Sept. 15, 1936. J. GOGAN 2,054,196

SPRING COILING MACHINE

Filed June 19, 1934 3 Sheets-Sheet 1

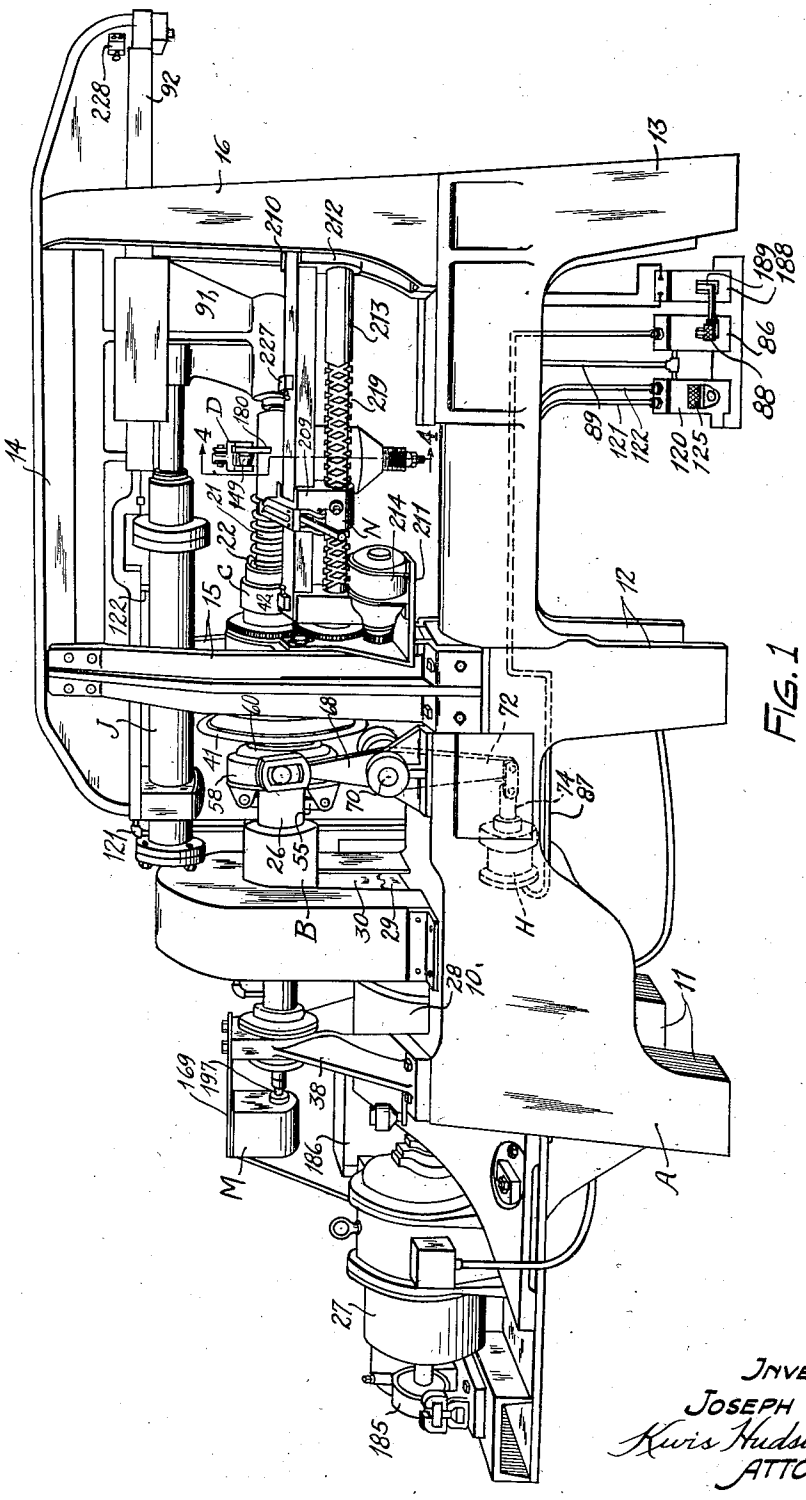


FIG. 1

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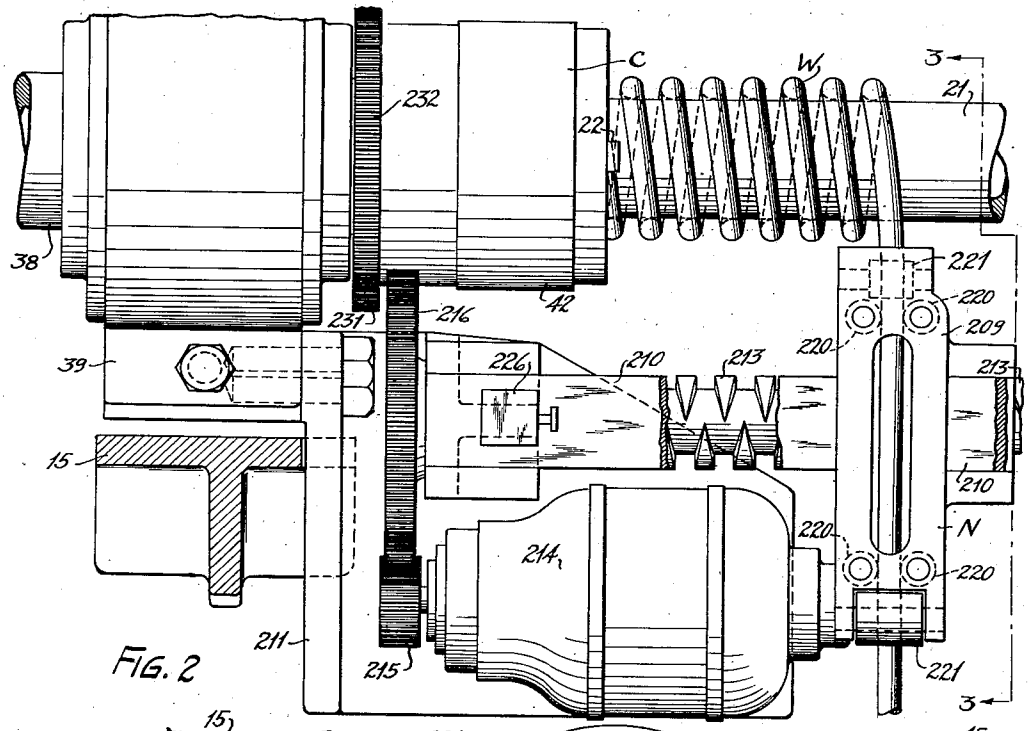


FIG. 2

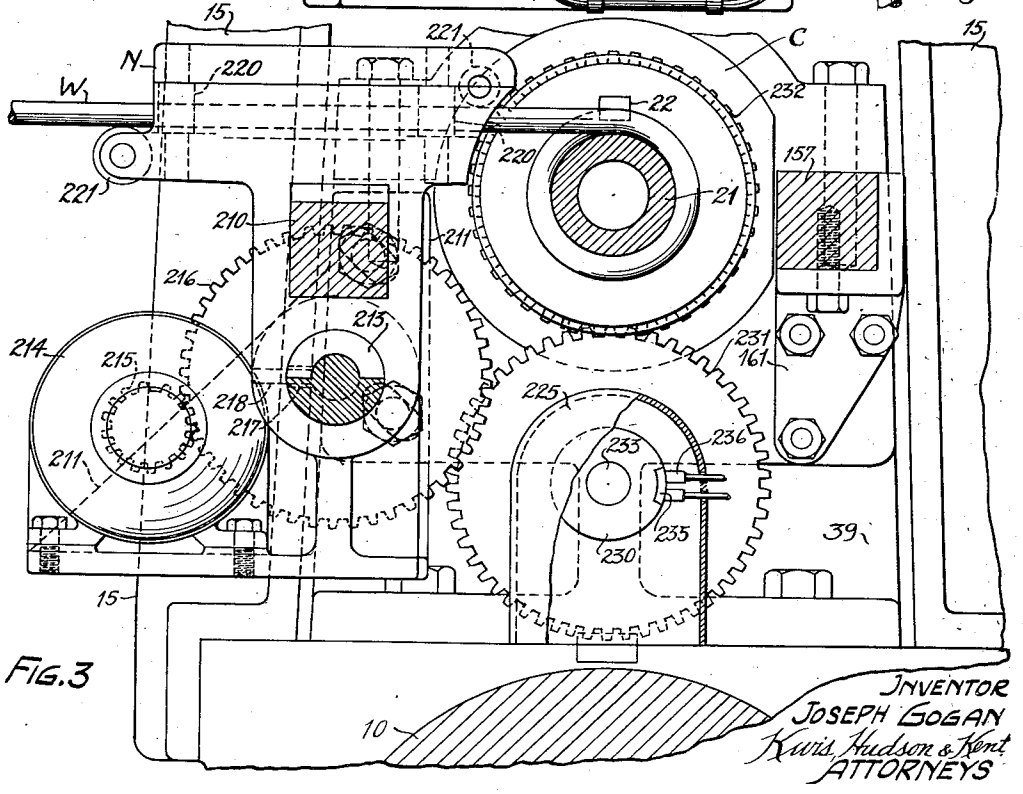


FIG. 3

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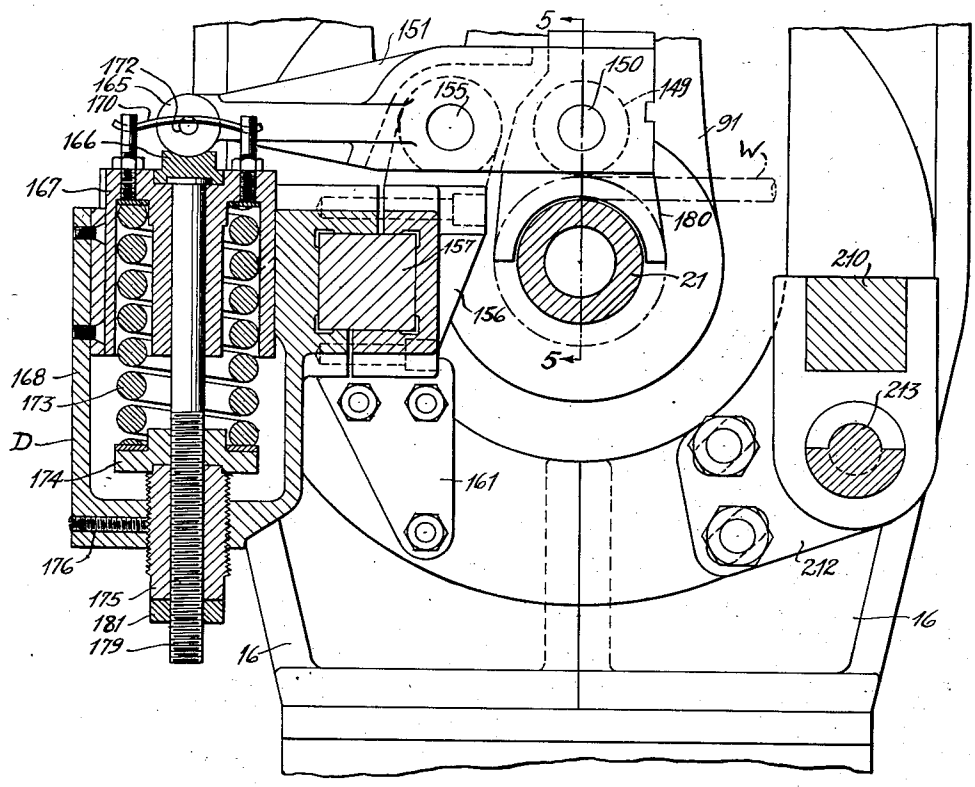


FIG. 4

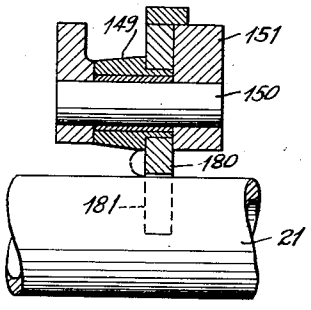


FIG. 5

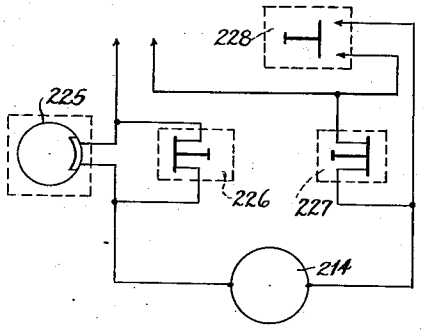


FIG. 6

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UNITED STATES PATENT OFFICE

2,054,196

SPRING COILING MACHINE

Joseph Gogan, Lakewood, Ohio

Application June 19, 1934, Serial No. 731,319

9 Claims. (Cl. 153—67)

The present invention relates to coiling machines, and more particularly to an improved spring coiling machine of the character described and illustrated in my copending application Serial No. 712,599, filed February 23, 1934, wherein a wire or rod is coiled about a rotatable mandrel to produce a relatively heavy helical spring. The invention is particularly applicable to and is described with reference to the manufacture of relatively heavy helical springs such as those employed in individual wheel suspension of automobiles.

An object of the present invention is the provision of a novel coiling machine particularly adapted for high production purposes, which will be rugged in construction, reliable in operation, and which will quickly produce accurately coiled springs with a minimum amount of attention and skill on the part of the operator.

In accordance with the provision of the present invention, wire or rod stock is fed to the machine or guided along a rotating mandrel in predetermined timed relation to the speed of rotation of the mandrel, and a further object of the invention is the provision of a novel feeding or guiding mechanism for a machine of the character referred to which will positively and accurately feed relatively heavy stock to the rotating mandrel in such a manner that the convolutions of the finished spring will be accurately spaced, etc.

Further objects and advantages of the invention will be apparent to those skilled in the art to which it pertains, and a more complete understanding thereof may be had from the following description of the preferred embodiments of the invention described with reference to the accompanying drawings, in which:

Fig. 1 is a front perspective of a spring coiling machine embodying the present invention;

Fig. 2 is an enlarged plan view of the wire or stock feeding mechanism illustrated in Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 1;

Fig. 5 is a section on the line 5—5 of Fig. 4; and

Fig. 6 is a wiring diagram of the electric control for the feed carriage motor.

The present invention is an improvement on the machine described and illustrated in my copending application, Serial No. 712,599, filed February 23, 1934, referred to above, and similar reference characters designate corresponding parts throughout the several views of the drawings of both applications.

The present invention has particular application to the manufacture of relatively heavy coil springs, such as those used in the front suspension of some automobiles, and the preferred embodiment thereof is illustrated as a machine for manufacturing such springs in quantity production. As previously stated, an object of the invention is the provision of a machine which will manufacture springs, of the type referred to, quickly and accurately as it is essential to have a high production of uniform springs the convolutions of which are properly spaced.

The machine is of the type wherein the springs are formed by coiling or wrapping bar or rod material about a rotary mandrel in a spiral manner.

Referring to the drawings, the form of the machine designated in general by the reference character A comprises a bed 10 supported on legs 11, 12 and 13 and an overhead member 14 supported on the bed 10 by brackets 15 and 16. The work, designated in general by the reference character W, is in the form of a predetermined length of preferably hot rod or wire stock, both ends of which are tapered, so that the end convolutions of the finished spring will present flat surfaces. In operation the rod is placed in the machine by an operator from the front by projecting one end of the stock through a stock feed carriage, designated in general by the reference character N, until it rests upon a mandrel 21 underneath a clamp bar 22 of a chuck, designated in general by the reference character C. With the work in this position, the chuck C is actuated to clamp the end of the work W between the clamp bar 22 and the mandrel 21.

The chuck C is carried by a shaft 26 which comprises part of the machine spindle, designated in general by the reference character B, which spindle includes the mandrel 21. After the work is clamped into position the spindle is rotated by mechanism, hereinafter referred to, to coil the stock about the mandrel. During the coiling operation the free part of the work is prevented from rotating with the spindle and fed longitudinally thereof by the stock feed carriage N, which will hereinafter be more fully described. As the free end of the work leaves the feed carriage it is squared and pressed down against the mandrel 21 in a manner hereinafter referred to, after which the mandrel is withdrawn and the completed spring allowed to drop through the bed of the machine.

The spindle shaft 26 is rotatably supported in brackets 38 and 39, bolted or otherwise secured to the bed 10, and is driven from an electric motor 27 through a gear reduction, designated in general by the reference character 28, and the

spur gears 29 and 30, the latter of which is operatively connected to the spindle shaft 26 by a friction or slip clutch of conventional construction to prevent injury to the motor in the event the machine becomes jammed, etc. A hand wheel 41 fixed to the spindle shaft 26 permits the same to be turned over manually in setting up the machine, etc. The clamp bar 22 is pivotally supported in the body member 42 of the chuck C, and carries a lever pivotally connected to the rear end thereof provided with a roller adapted to roll on a surface formed on the body member 42. The lower or free end of the lever referred to is cylindrical and fits into a rectangular opening in an enlarged end of a rod slidably supported in a centrally located longitudinal aperture in the spindle shaft 26. Longitudinal reciprocation of the rod moves the roller over the surface on the body member 42, thus causing the clamping bar 22 to engage or disengage the work depending upon the direction of reciprocation. The rod referred to is reciprocated through the medium of a bar 55 projecting through an aperture therein and elongated slots in the spindle shaft. The bar 55 is connected to lugs formed integral with an annular member 58 rotatably supported on the spindle shaft 26, and the annular member 58 is reciprocated longitudinally of the spindle shaft by a second annular member 60 held in assembled relationship therewith. The member 58 is adapted to rotate within the member 60 and anti-friction thrust bearings are interposed therebetween.

Projections on opposite sides of the member 60 carry rollers which engage in slots formed in the upper ends of levers 68 secured to a horizontal shaft 70 rotatably supported in bosses on the bed 10. A lever 72 secured to the shaft 70 midway between the levers 68 is operatively connected to the piston rod 74 of a fluid pressure operated motor, designated in general by the reference character H, the piston of which is continuously urged toward the left, as viewed in Fig. 1, by a compression spring enclosed within the cylinder. The piston is moved in the opposite direction to actuate the clutch C to clamp the work between the clutch bar 22 and mandrel 21 by fluid pressure, preferably air, admitted to the cylinder at the left of the piston by means of a pipe 87 communicating with the cylinder and a fluid operated valve 86, provided with a pedal 88 by means of which the supply and discharge of air to the motor are controlled. The valve 86 is of conventional construction and the fluid pressure supply line is designated by the numeral 89.

The mandrel 21 is secured to a member rotatably supported by anti-friction bearings in a bracket 91 slidably supported on ways 92 formed on the overhead member 14. The mandrel 21 is driven from the spindle shaft 26 through the chuck C by means of a squared end formed thereon adapted to extend through a rectangular aperture in the face plate of the clutch. The bracket 91 is reciprocated to engage and disengage the squared end of the mandrel with the chuck C by a double acting fluid pressure actuated motor, designated in general by the reference character J, the left hand end of which is provided with cushioned means for limiting the movement of the piston, etc. toward the left, as viewed in Fig. 1, and taking the impact thereof. The supply of fluid pressure, preferably air, to the motor J is controlled by a foot actuated pedal 125 connected to the motor through the medium of pipes 121 and 122. The valve 120 is provided with a foot pedal 125 which is depressed to connect the pipe 121 to the fluid pressure supply line 89 and the pipe 122 to exhaust and move the bracket 91, etc. to the right. When the pedal is released the direction of the flow of fluid in the pipes is reversed and the bracket 91, etc. moved to the left. The mandrel 21 is provided with a central longitudinal aperture through which air may be supplied for the purpose of cooling the same.

The end of the work W is rolled against the mandrel 21 by a roller 149 which is part of a breakdown assembly designated in general by the reference character D. The roller 149 is rotatably supported on a pin 150 fixed in a forked lever 151 pivotally supported on a pin 155 fixed in a bracket 156 adjustably secured to a rectangular bar 157 supported by brackets 161. The rear end 165 of the lever 151 is circular in shape and engages a recess in a bearing member 166 supported in a counterbore formed in a piston member 167, slidably keyed within a cylindrical or cup-shaped member 168, adjustably secured to the bar 157 along with the bracket 156. The end 165 of the lever 151 is continuously held in contact with the bearing member 166 by a spring member 170 supported by studs fixed in the member 167 and extending over a pin 172 secured in the lever 151.

The piston member 167 is continuously urged in an upward direction by a compression spring 173 compressed between the member 167 and a disc 174 supported on the upper end of an adjustable tubular member 175 threaded into the bottom of the member 168 and locked in any adjusted position by a screw 176. The upward movement of the piston member 167, and, in turn, the downward movement of the roller 149 are limited by a bolt 179, extending through the center of the member 167, the head of which overlies a portion of the member 167 underneath the bearing member 166. The lower end of the bolt 179 projects through the tubular member 175 and carries a nut 181 for adjusting the upper limit of the member 167.

The tapered end of the work is pressed against the adjacent convolution of the spring by a forked member 180 welded or otherwise secured to the lever 151, in such a manner that the flat side thereof is in a plane normal to the axis of the mandrel. The free ends of the member 181 project on either side of the mandrel 21 and strip the spring therefrom upon reciprocation of the bracket 91 in a rearward direction.

The breakdown assembly D is adjustable along the bar 157 as desired to accommodate different lengths of springs. The spring 173 is adjusted by means of the tubular member 175 to take care of stock of different thickness, and the distance of the roller 149 from the axis of the spindle B is adjusted by the nut 181 to accommodate both mandrels of different diameters and different size stock. While the breakdown member which forces the free end of the work against the mandrel is illustrated as a roller 149, a non-rotatable member may be substituted therefor if desired.

The motor 27 is a reversible three-phase alternating current motor, provided with an electrically controlled brake 185 applied to one end of the armature shaft. The control box 186, see Fig. 1, houses the solenoid operated control switch for the motor 27, the operating solenoid of which is in series with a foot operated switch 188, the operating pedal 189 of which extends underneath the foot pedal 88 and is operated simultaneously therewith. The operating solenoid for the brake 185 is also in series with the switch 188 and the

construction is such that the brake is released when the pedal 88 is depressed.

A limit switch M is provided for always bringing the spindle B to rest at a predetermined point in the rotation thereof. The limit switch M comprises a frame supported by a member 169 attached to the bracket 38, see Fig. 1, and an armature shaft 197 connected to the spindle shaft. A plurality of insulator discs or commutators adjustably connected to the shaft 197 carry contact segments on the circumference thereof embracing about ninety-five percent of the circumference. The contact segments are connected in series and contact is made therewith by spring pressed brushes slidably supported in insulating brush holders. The limit switch M is connected in shunt circuit with the switch 188 and maintains the circuit to the operating solenoids of the brake 185 and the switch 186, after the pedal 88 is released until a predetermined point in the rotation of the spindle B, thus always stopping the spindle in a predetermined position. The discs or commutators of the limit switch M are adjustable on the shaft 197 for the purpose of permitting the spindle to be stopped at different positions. A manually operated switch in series with the limit switch permits the machine to be placed under the sole control of the switch 188.

The machine thus far described with the exception of the stock feed carriage N is substantially a duplicate of that illustrated and described in the above mentioned copending application, to which reference is made for a more complete disclosure of the details of construction of the machine.

According to the present invention the wire or stock W is fed to the machine by the stock feeding carriage N comprising a frame 209 slidably supported on a square bar 210 supported by brackets 211 and 212 adjustably bolted or otherwise secured to the member 31 and the uprights 16, respectively. The frame 209 is reciprocated along the bar 210 through the medium of a lead screw 213 rotatably supported in suitable bearings in the brackets 211 and 212 and driven at a predetermined speed by a feed carriage motor 214 through a pinion 215 secured to the motor shaft and in mesh with a gear 216 keyed to one end of the lead screw 213. A roller 217 supported on a pin 218 fixed in the frame 209 engages within a continuous thread 219 on the lead screw 213, and the carriage N moves backward and forward along the bar 210 upon continued rotation of the lead screw 213 in the same direction. A plurality of vertical and horizontal rollers 220 and 221, respectively, rotatably supported in the frame 209 in any convenient manner, guide the wire or stock W in its passage to the mandrel. The feed carriage motor 214 is supported on an extension of the bracket 211 and the entire feed assembly may be bodily removed from the machine in order to accommodate mandrels of various sizes.

The feed carriage motor 214 is under the control of a commutator switch 225, limit switches 226 and 227 adjustably supported on the bar 210, and a limit switch 228 supported on the overhead member 14. The commutator 230 of the commutator switch 225 is operatively connected to the spindle B through the gears 231 and 232 secured to the commutator shaft 233 and the chuck C, respectively. The construction is such that after the mandrel 21 has turned over a sufficient distance to cause the first convolution to be close wound, the circuit to the motor 214 is closed through the medium of a contact bar 235 which bridges the brushes 236 supported in the switch 225 in any suitable manner. The limit switch 226 is of the two point break push button type and is connected in one of the motor lead lines in shunt circuit with the commutator switch 225. The limit switch 227 is of the same type as switch 226 and is connected in the other lead line of the motor in shunt circuit with the two point make push button switch 228. The location of the various switches in the circuit is shown in the wiring diagram, see Fig. 6.

It is believed that the operation of the machine will be apparent from the foregoing description thereof. With the machine at rest the work W, in the form of a predetermined length of rod stock tapered off at both ends, is inserted through the feed clutch N between the guide rollers 220 and 221, until the leading end thereof rests on the mandrel underneath the clamp bar 22 with the flat face adjacent the face plate of the clutch. The foot pedal 88 is then depressed, causing the motor M to actuate the clamp bar 22 and clamp the work to the mandrel 21. The pedal 189 is depressed simultaneously with the foot pedal 88, releasing the brake 185 and actuating the motor 27. After the mandrel has turned over a sufficient distance to cause the first convolution of the spring to be close wound, according to the specifications, the contact bar 235 bridges the brushes 236, closing the circuit to the feed carriage motor 214, causing the feed carriage N to move to the right at a predetermined speed. Before the commutator switch 225 breaks its contacts, the circuit to the motor 214 is closed through the two point break push button switch 226, the carriage N having moved away therefrom in the interim.

As the end of the spring is approached the feed carriage N engages the two point break push button switch 227, opening the circuit to the motor 214 and stopping the carriage. The work which continues to be wound over the mandrel engages underneath the roller 149, which presses the end thereof against the mandrel and the stationary plate 180 engages the flat side of the work and forces the same into a plane normal to the axis of rotation of the mandrel, gauging the length of the spring, etc. After the spring has been formed the foot pedals 88 and 189 are released and the spindle B comes to rest in a predetermined position, that is with the clamp bar 22 on top of the mandrel. The foot pedal 125 is then depressed to actuate the motor J to move the slide 91 and the mandrel 21 to the right, stripping the spring from the mandrel and allowing the same to drop through the bottom of the machine. When the slide 91 reaches the two point make push button switch 228 the circuit to motor 214 is again closed, returning the feed carriage N to its normal position, whereupon the circuit to the motor is opened by the engagement of the carriage against the push button on the switch 226. When the foot pedal 125 is released the slide 91 and the mandrel 21 are returned to their initial position and the machine is ready for the next operation.

The machine illustrated is adapted to the making of right hand springs, but it will be apparent to those skilled in the art that the invention is equally applicable to the manufacture of left hand springs, etc. From the foregoing description of the preferred embodiment of the invention it will be apparent that I have produced a new and improved machine for making springs, but I do not wish to be limited to the particular construction shown, which may be varied within

the scope of this invention, and I particularly point out and claim as my invention the following:

1. In a spring coiling machine of the character described, the combination of a frame, a member adapted to have rod or wire stock coiled thereabout rotatably supported by said frame, means for rotating said member, an electric motor for feeding the stock longitudinally of said member, and a second electrical motor for actuating said means.

2. In a spring coiling machine of the character described, the combination of a frame, a member adapted to have rod or wire stock coiled thereabout rotatably supported by said frame, an electric motor for rotating said member, a feed carriage slidably supported by said frame for feeding the stock longitudinally of said mandrel, and a second electric motor for reciprocating said carriage.

3. In a spring coiling machine of the character described, the combination of a frame, a mandrel adapted to have rod or wire stock coiled thereabout rotatably supported by said frame, an electric motor for rotating said mandrel, a feed carriage for feeding the stock to said mandrel, a second electric motor for moving said feed carriage longitudinally of said mandrel, and means for automatically controlling the actuation of said motor.

4. In a spring coiling machine of the character described, the combination of a frame, a mandrel rotatably supported by said frame, an electric motor for rotating said mandrel, a feed carriage slidably supported by said frame, a lead screw for moving said carriage longitudinally of said mandrel, and a second electric motor for rotating said lead screw.

5. In a spring coiling machine of the character described, the combination of a frame, a mandrel rotatably supported by said frame, an electric motor for rotating said mandrel, a feed carriage slidably supported by said frame, a lead screw for reciprocating said carriage longitudinally of said mandrel, a second electric motor for rotating said lead screw, and means for automatically controlling the actuation of said motor.

6. In a spring coiling machine of the character described, the combination of a frame, a mandrel adapted to have rod or wire stock coiled thereabout rotatably supported by said frame, means for rotating said mandrel, and stationary means for engaging the end of the stock and squaring the end of the spring.

7. In a spring coiling machine of the character described, the combination of a frame, a mandrel adapted to have rod or wire stock coiled thereabout rotatably supported by said frame, means for rotating said mandrel, a roller for coiling the end of the stock about said mandrel, and a stationary member for engaging the stock and squaring the end of the spring.

8. In a spring coiling machine of the character described, the combination of a frame, a mandrel adapted to have rod or wire stock coiled thereabout rotatably supported by said frame, means for rotating said mandrel, a feed carriage slidably supported by said frame adapted to feed the stock longitudinally of said mandrel, and means permitting angular displacement of said carriage about said mandrel.

9. In a spring coiling machine of the character described, the combination of a frame, a mandrel adapted to have spring stock coiled thereabout rotatably supported by said frame, means for rotating said mandrel, means for feeding the stock longitudinally of the mandrel and means including a stationary member encircling a part of said mandrel adapted to engage the end of the stock for finishing the end of the coil.

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