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J. GOGAN

2,038,488

SPRING COILING MACHINE

Filed April 27, 1934

3 Sheets-Sheet 1

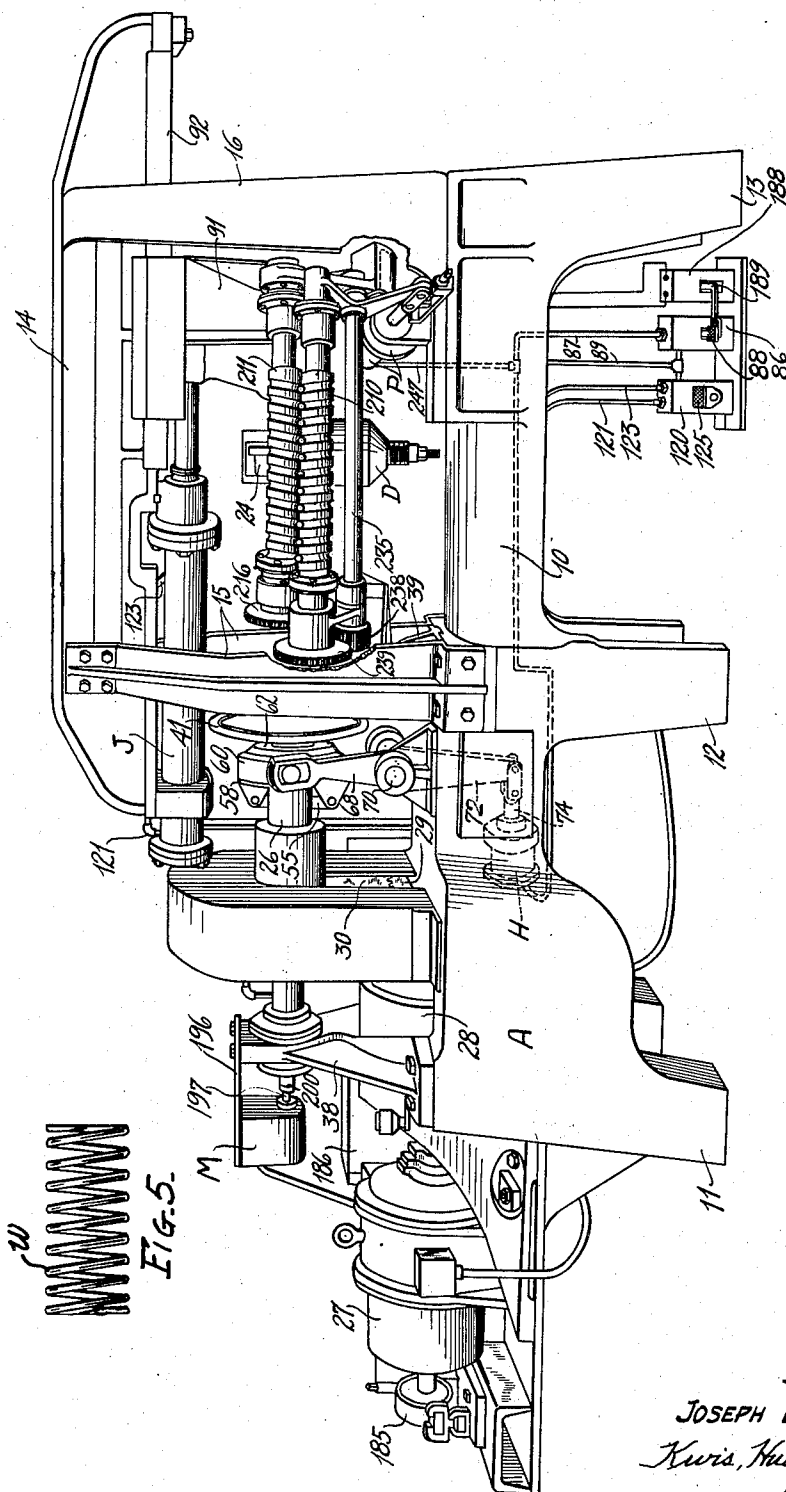


FIG. 1

FIG. 5

INVENTOR
JOSEPH GOGAN
Kerr, Hudson & Kent
ATTORNEYS

April 21, 1936.

J. GOGAN

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3 Sheets-Sheet 2

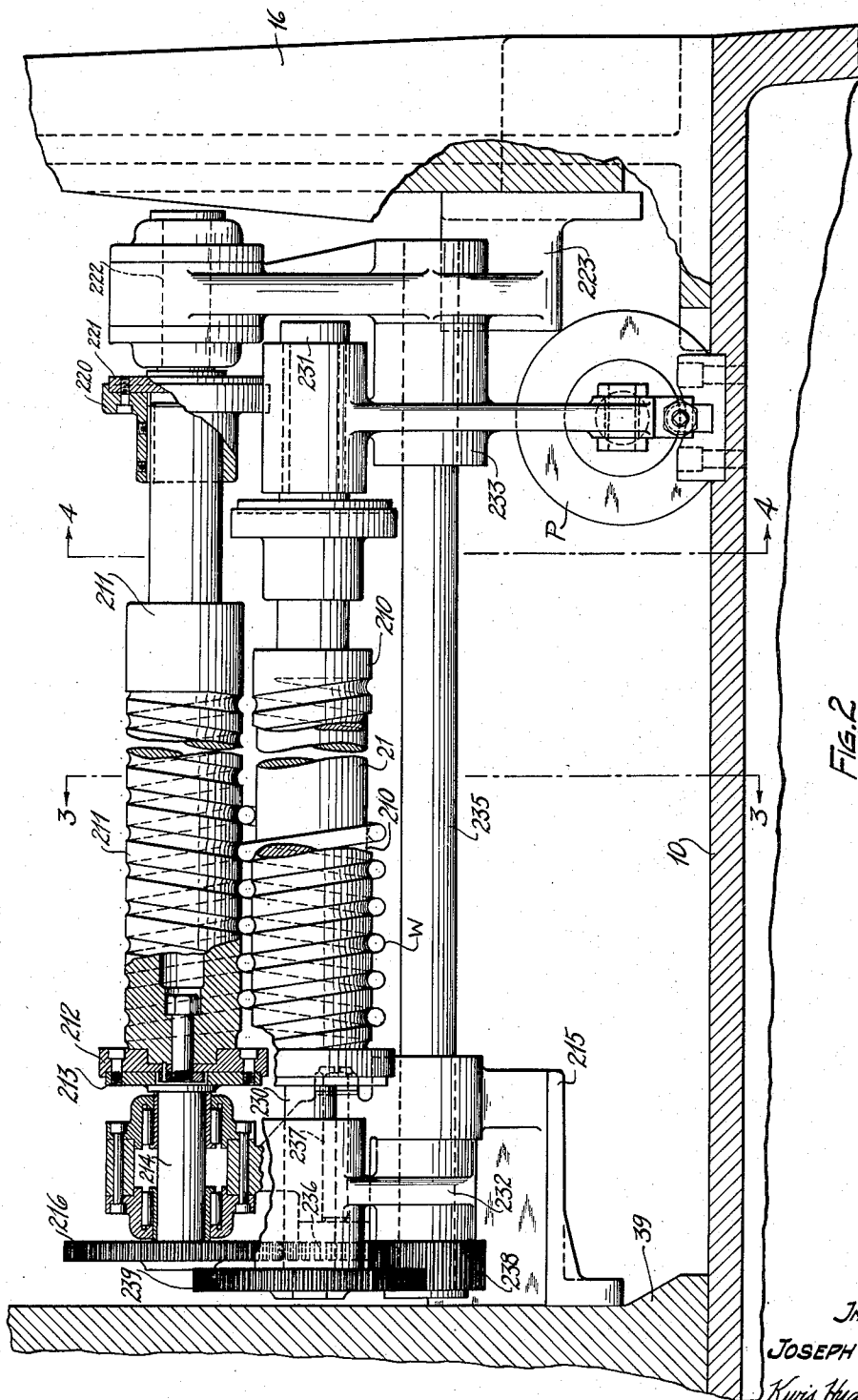


Fig. 2

INVENTOR
JOSEPH GOGAN
Kuris, Hudson & Kent
ATTORNEYS

J. GOGAN

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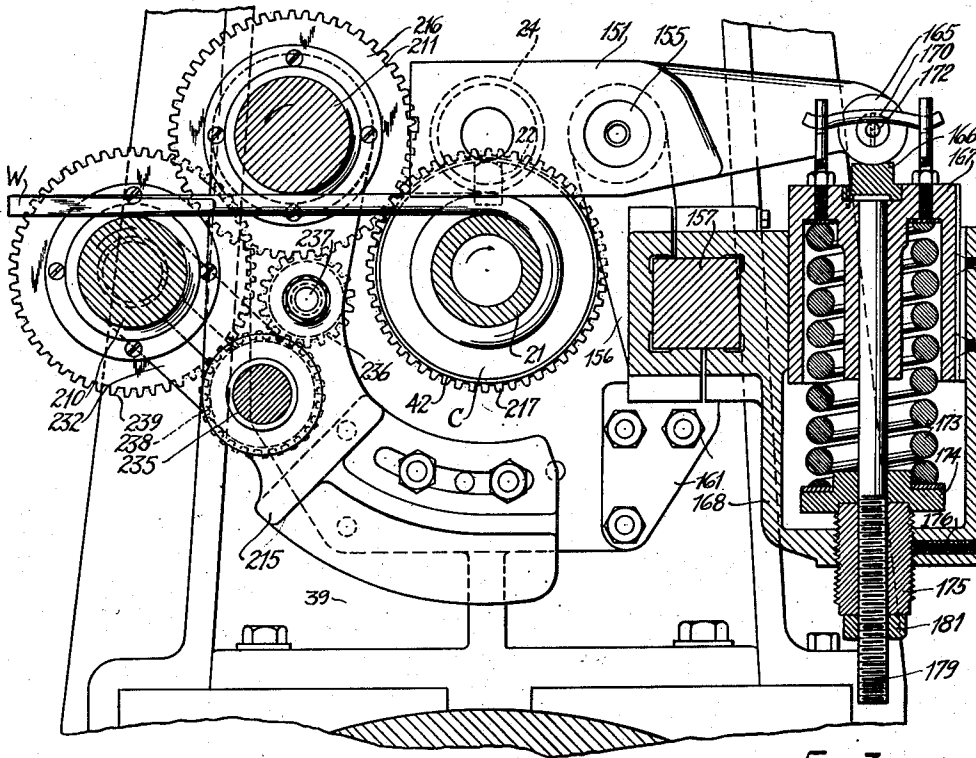


FIG. 3

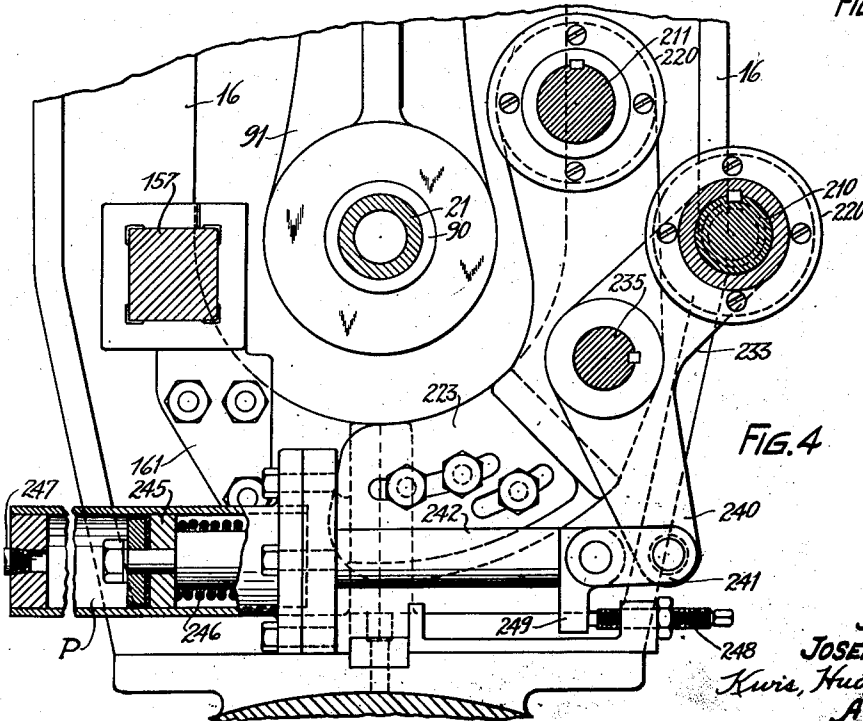


FIG. 4

INVENTOR
248 JOSEPH GOGAN
Kuris, Hudson & Kent
ATTORNEYS

UNITED STATES PATENT OFFICE

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SPRING COILING MACHINE

Joseph Gogan, Lakewood, Ohio

Application April 27, 1934, Serial No. 722,698

6 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 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 prospective of a spring coiling machine embodying the present invention.

Fig. 2 is an enlarged front elevation 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. 2, and

Fig. 5 is a front elevation of a spring produced on the machine illustrated in Figs. 1 to 4 inclusive.

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 the springs uniform and the convolutions thereof properly spaced.

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 hot rod or wire stock, both ends of which are tapered, see Fig. 3, so that the end convolutions of the finished spring will present flat surfaces. In operation the hot rod is placed in the machine by an operator from the front by projecting one end of the stock between right and left hand lead screws 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 end of the work is prevented from rotating with the spindle and is fed longitudinally of the mandrel by the lead screws, which are rotated in predetermined timed relation to the rotation of the spindle. As the free end of the work leaves the lead screws it is rolled down against the mandrel 21 by a roller 24 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 55

41 fixed to the spindle shaft 26 permits the same to be turned over manually in setting up the machine etc. The chuck C comprises a body portion 42 keyed to the spindle shaft 26 to prevent rotation therebetween. The clamp bar 22 is pivotally supported in the body portion 42 and carries a lever pivotally connected to the rear end thereof provided with a roller secured to the lower free end adapted to roll on a surface formed on the body portion 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 portion 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. The annular member 58 is reciprocated longitudinally of the spindle shaft by a second annular member 60 held in assembled relationship therewith by a disc 62 bolted to the member 58. The member 58 is adapted to rotate within the member 60 and antifriction 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 chuck C to clamp the work between the clamp 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 is 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 91 rotatably supported by antifriction 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 valve 120 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 123 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 roller 24 which rolls the end of the work W against the mandrel and presses the same against the adjacent convolutions of the spring is a part of a roller assembly designated in general by the reference character D. The roller 24 is supported 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 counter-bore formed in a piston member 167, slidably keyed within a cylindrical or cup-shaped member 20 168, 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 25 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 24 35 is 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 40 175 and carries a nut 181 for adjusting the upper limit of the member 167. The roller 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 24 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 member which forces the free end of the work against the mandrel is illustrated as a roller 24, 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 60 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 65 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 196 attached to the bracket 38, see Fig. 1, and an armature shaft 197 connected to the spindle shaft 26 by a coupling 200. A plurality of insulator discs or commutators adjustably connected to the shaft 75

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 there-
 5 with 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 sole-
 10 noids 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
 15 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 excep-
 20 tion of the lead screws referred to, is 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.

In the illustrated embodiment of the present
 25 invention the wire or stock W is fed to the machine by or between right and left hand lead screws 210 and 211, respectively, rotated in pre-
 30 determined timed relation to the rotation of the spindle B, in the direction indicated, see Fig. 3. The left hand end of the feed screw 211 is bolted to a disc 212 detachably keyed to a disc member 213 fixed to one end of a stud shaft 214. The
 35 shaft 214 is rotatably supported by a bracket 215 secured to the member 39 and carries a gear 216 in mesh with a gear 217 on the chuck C, by means of which the lead screw is driven. The right
 40 hand end of the lead screw 211 is slidably keyed to an annular member 220 detachably keyed to a disc member 221 fixed to one end of a stud
 45 shaft 222 rotatably supported by a bracket 223. Sufficient clearance is provided to permit replacement of the lead screw 211 and the members 212 and 220 as a unit without disturbing the bearings or brackets 215 and 223.

The lead screw 210 is detachably connected to stud shafts 230 and 231 in a manner similar to that in which the lead screw 211 is connected to the stud shafts 214 and 222. The stud shafts 230
 50 and 231 are rotatably supported in brackets 232 and 233, respectively, keyed to a shaft 235 rotatably supported in the brackets 215 and 223. The lead screw 210 is driven from the gear 216 previously referred to through the medium of an idler
 55 gear 236 or a stud shaft 237 fixed in the bracket 215, a double faced idler gear 238 rotatably supported on the shaft 235, and a gear 239 fixed to the end of the stud shaft 230. The bracket 233 is in the form of a bell crank lever and the lower
 60 end 240 thereof is operatively connected, by means of a link 241, to a piston rod 242 of a fluid pressure motor designated in general by the reference character P.

The piston 245 of the motor P is continuously
 65 urged toward the left, as viewed in Fig. 4, by a compression spring 246, and the movement of the piston in the opposite direction under the influence of fluid pressure admitted by a pipe 247 is limited by an adjustable stop 248 which engages
 70 a downwardly extending projection 249 on the piston rod 242. The pipe 247 is connected to the pipes 87 and the supply of fluid pressure to and from the motor P is under the control of the foot
 75 operated valve 86. Actuation of the motor P produces rotation or oscillation of the shaft 235

which in turn moves the lead screw 211 to and from the lead screw 210. When the motor P is unenergized the parts are in the position shown in dotted line in Fig. 4, with the lead screw 210
 5 in its lower position to facilitate inserting the work in the machine.

It is believed that the operation of the machine will be apparent from the foregoing description thereof, suffice it to say that with the machine at rest the work W in the form of a predetermined
 10 length of rod stock tapered off at both ends, is inserted over the lead screw 210 and underneath the lead screw 211 until the end is positioned on the mandrel underneath the clamp bar 22, with the flat face adjacent the face plate of the clutch.
 15 The foot pedal 88 is depressed to actuate the motor H to clamp the end of the work between the clamp bar 22 and the mandrel 21 and the motor P is actuated to move the lead screw 210 into its upper or closed position. As the foot pedal 88
 20 is depressed the pedal 189 is depressed simultaneously therewith, releasing the brake 185 and starting the motor 27.

As the wire is coiled about the mandrel 21 the same is guided and fed lengthwise thereof by the
 25 feed screws 210 and 211 in such a manner that there will be no variation in the finished spring. As the end of the coil is approached the work engages underneath the roller 24 which rolls the free end of the work against the mandrel and
 30 presses the last convolution against the one adjacent thereto, thus gauging the length of the spring etc. After the coil has been formed the foot pedals 88 and 189 are released, the spindle B comes to stop in a predetermined position, which
 35 in the present illustration is with the clamp bar 22 on top, and the lead screw 210 drops down to its lower position under the action of the spring 246. The foot pedal 125 is then depressed actu-
 40 ating the motor J to move the slide 91 and the mandrel 21 to the right, stripping the spring from the mandrel and allowing it to drop through the bottom of the machine. When the foot pedal 125 is released the slide 91 and mandrel 21 are re-
 45 turned to their initial position and the machine is ready for the next operation.

The machine shown is set up for making right hand springs, but is capable of making left hand springs by merely reversing the direction of ro-
 50 tation of the motor 27, moving the brackets 215 and 223 until the top of the lead screw 210 is approximately even with the bottom of the mandrel 21, and adjusting the limit switch M so that the spindle will stop with the clamp bar 22 un-
 55 derneath the mandrel.

From the foregoing it will be apparent that applicant has produced a new and improved ma-
 60 chine for making springs, etc. While the preferred embodiment of the invention has been illustrated and described, I do not wish to be limited to the construction shown, which may be varied within the scope of the invention, and I particu-
 65 larly point out and claim as my invention the following.

I claim:

1. In a machine of the character described, the combination of a frame, a member adapted to have stock coiled thereabout to form a helical coil rotatably supported by said member, means for rotating said member, and a plurality of lead
 70 screws spaced radially of said member for feeding the stock longitudinally of said member.

2. In a machine of the character described, the combination of a frame, a member adapted to have stock coiled thereabout to form a helical
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coil rotatably supported by said member, means for rotating said member, and a plurality of lead screws provided with helical grooves within which the stock is adapted to engage spaced radially of said member and on opposite sides of the stock for feeding the stock longitudinally of said member.

3. In a coiling machine of the character described, the combination of a frame, a mandrel rotatably supported by said frame, means for rotating said mandrel, a plurality of lead screws rotatably supported by said frame adapted to have work fed therebetween, said lead screws being spaced radially of the axis of rotation of said mandrel, and means for rotating said lead screws.

4. In a coiling machine of the character described, the combination of a frame, a mandrel rotatably supported by said frame, means for rotating said mandrel, a plurality of lead screws rotatably supported by said frame adapted to have work fed therebetween, said lead screws being spaced radially of the axis of rotation of said mandrel, means for producing relative movement between said lead screws to facilitate the positioning of work therebetween, and means for rotating said lead screws in predetermined timed relation to the rotation of said mandrel.

5. In a coiling machine of the character described, the combination of a frame, a mandrel rotatably supported by said frame, means for rotating said mandrel, a plurality of lead screws

rotatably supported by said frame adapted to have work fed therebetween, said lead screws being spaced radially of the axis of rotation of said mandrel and provided with right and left hand helical grooves adapted to engage the work, and means for rotating said lead screws in predetermined timed relation to the rotation of said mandrel and in opposite directions to each other.

6. In a coiling machine of the character described, the combination of a frame, a mandrel rotatably supported by said frame, means for rotating said mandrel, a lead screw rotatably supported by said frame parallel with said mandrel, said lead screw being provided with a right hand helical groove adapted to engage one side of the work as it is fed to the machine, means for rotating said lead screw in a direction opposite to the direction of rotation of the mandrel, a second lead screw rotatably supported by said frame parallel with said mandrel and spaced from the first mentioned lead screw radially with reference to said mandrel, said second lead screw being provided with a left hand helical groove adapted to engage the side of the work opposite to that engaged by the first mentioned lead screw, means for rotating said second lead screw in the same direction as the rotation of said mandrel, and means for moving said second lead screw bodily towards and from the first mentioned lead screw.

JOSEPH GOGAN.