May 16, 1933. G. C. BURD ET AL 1,908,884

SPRING COILING DEVICE

Filed Aug. 27, 1931 3 Sheets-Sheet 1

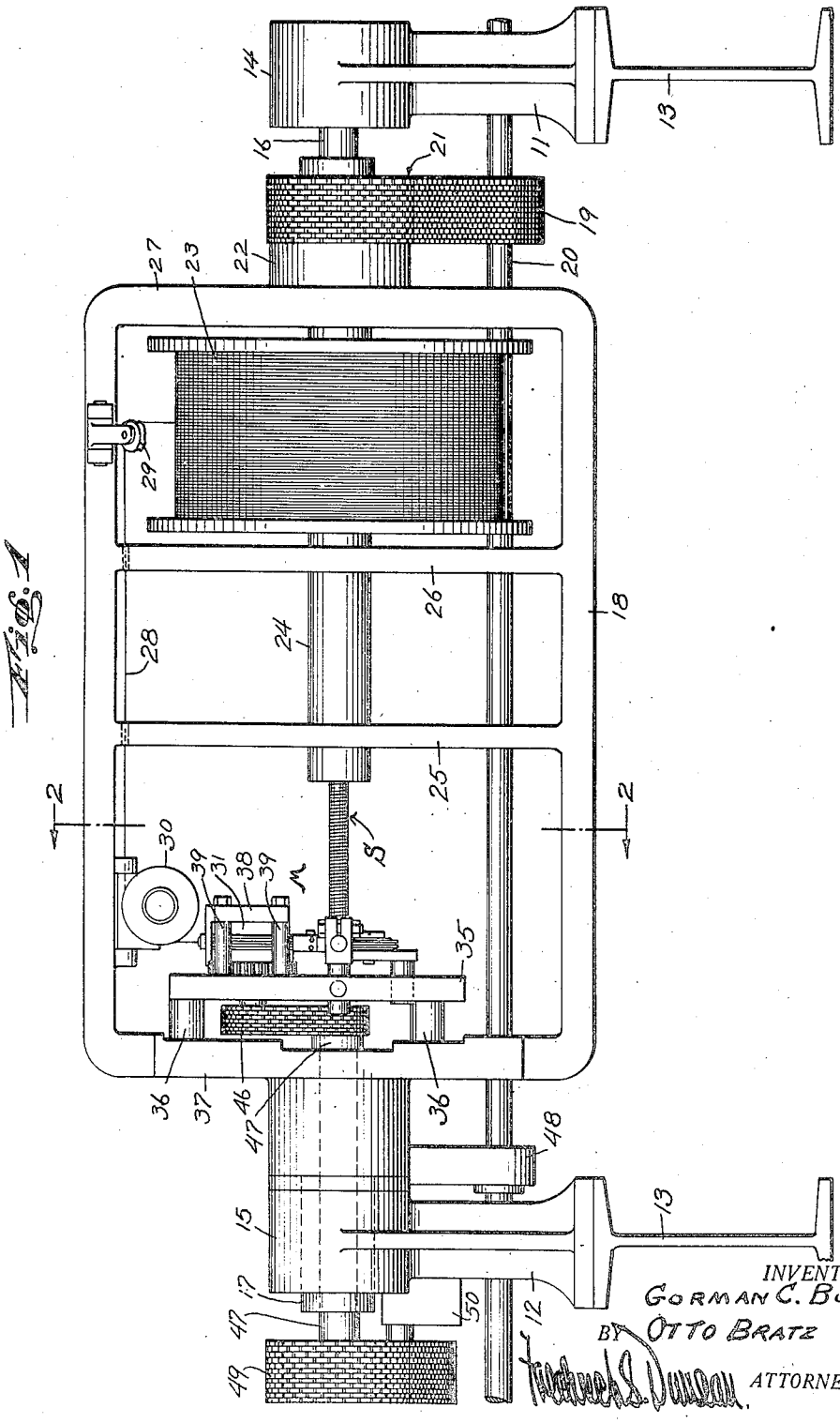

Fig. 1

INVENTOR.
GORMAN C. BURD,
BY OTTO BRATZ
Frederick S. Duncan ATTORNEY.

May 16, 1933. G. C. BURD ET AL 1,908,884

SPRING COILING DEVICE

Filed Aug. 27, 1931 3 Sheets-Sheet 2

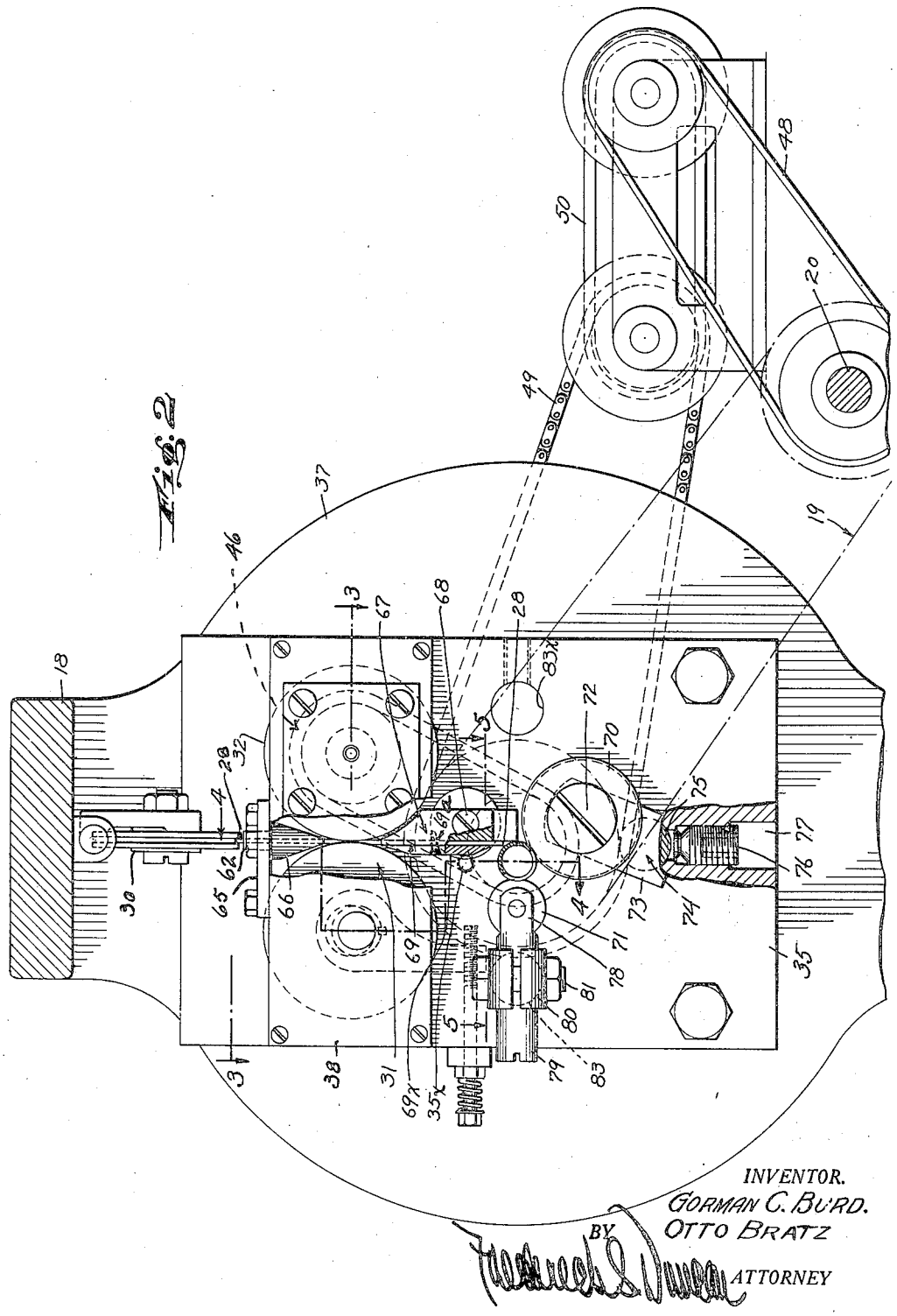

Fig. 2

INVENTOR.
GORMAN C. BURD.
OTTO BRATZ
BY
ATTORNEY

May 16, 1933. G. C. BURD ET AL 1,908,884

SPRING COILING DEVICE

Filed Aug. 27, 1931 3 Sheets-Sheet 3

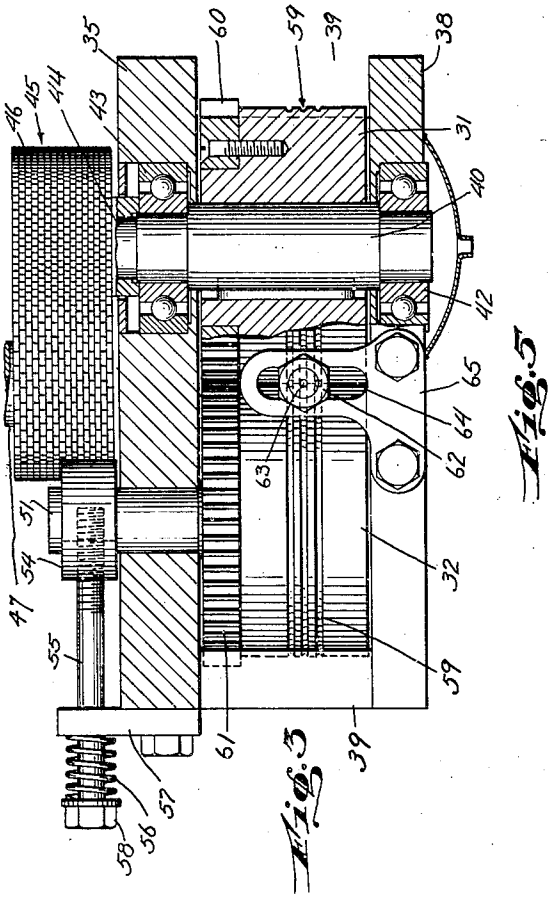

Fig. 3

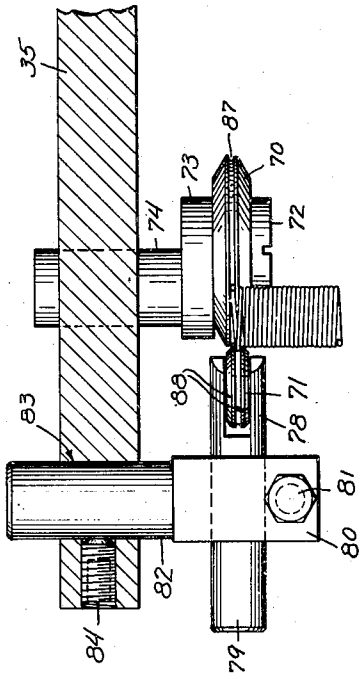

Fig. 5

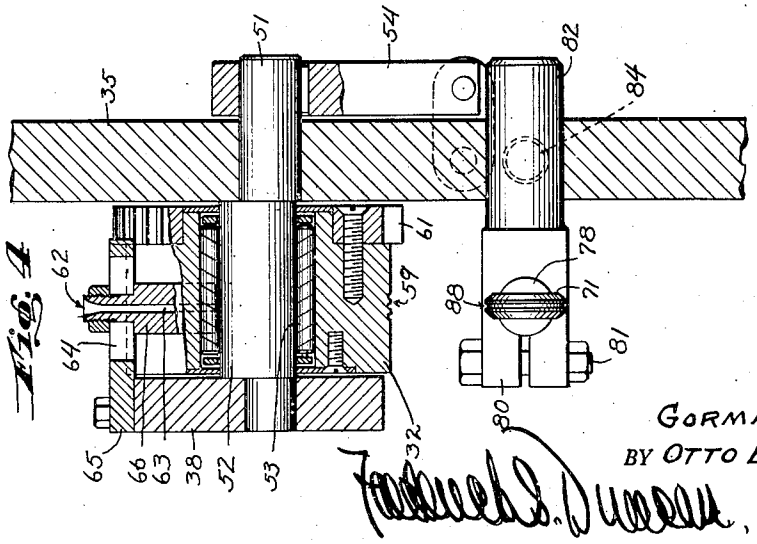

Fig. 4

INVENTOR.
GORMAN C. BURD,
BY OTTO BRATZ
ATTORNEY

Patented May 16, 1933 1,908,884

UNITED STATES PATENT OFFICE

GORMAN C. BURD AND OTTO BRATZ, OF ADRIAN, MICHIGAN, ASSIGNORS TO AMERICAN CABLE COMPANY, INC., A CORPORATION OF DELAWARE

SPRING COILING DEVICE

Application filed August 27, 1931. Serial No. 559,706.

This invention relates to the production of coil springs, and has for an object the provision of an improved method of forming such a helical product continuously and also to provide for this purpose an improved machine which is adapted to operate rapidly and is equipped to produce coil springs of various types and sizes with a minimum of adjustment and with operating parts so organized as to permit the necessary changes to be easily and quickly made by operators of average skill.

An important object of the invention is to provide a method of forming the helical springs by feeding a supply of stock wire continuously subject to the action of a force applied by means revolving around the axis of the helix being formed and in a fixed plane normal to said axis, whereby the helical product is delivered non-rotatively and progressively along the axis of formation, solely by the co-action of the feeding and deforming forces, and without requiring the use of a mandrel.

Another object is to provide improved means for so feeding, guiding and supporting the wire stock being operated upon that it does not tend to twist, loop and snarl, and thereby necessitate stopping the operation of the machine.

Still another object of the invention is to provide a machine with feeding and forming rolls which have working and guiding surfaces so designed and arranged that as one set of surfaces becomes worn, another set may be brought into action without dismantling the machine or removing and substituting working parts.

Another object is to provide a machine of improved construction adapted to operate without use of a mandrel and to produce coiled springs of accurate and uniform structure comparable with the product of a mandrel type machine.

The above and other features of the invention are illustrated and described in the accompanying drawings and specifications, and are pointed out in the claims.

In the drawings,

Fig. 1 is a view in side elevation of a machine in the construction of which the invention has been embodied;

Fig. 2 is a sectional view thereof on the line 2—2 of Fig. 1, with parts broken away to reveal interior details of structure;

Fig. 3 is a fragmentary horizontal section on the line 3—3 of Fig. 2 on a larger scale;

Fig. 4 is a fragmentary vertical section on the line 4—4 of Fig. 2 also on a larger scale; and

Fig. 5 is a similar fragmentary section on the line 5—5 of Fig. 2.

In the now-preferred embodiment of the invention selected for illustration and description, the parts designated by the reference characters 11 and 12 are standards mounted on suitable foundations 13 and serving to support bearings 14 and 15 in which rotate the journals 16 and 17 of a flier 18, the latter being actuated rotatively by a silent or sprocket chain 19 running from the main actuating shaft 20 to a pinion 21 on the hub 22 of the flier.

The spring-coiling mechanism or coil-forming head is supported within the flier at the left-hand end thereof and is designated generally by the reference character M, while the supply of spring wire stock upon which this forming mechanism operates is carried by the flier on a reel 23 mounted rotatably upon a hollow shaft 24 journaled in bearings supported by the cross members 25 and 26 of the flier and by the end member 27 thereof. The supply of wire 28 is led from the reel 23 over guide rollers 29 and 30 to the operating mechanism M. In pursuance of the invention, the coil-forming head comprises a couple of feed rolls 31 and 32 between which the wire 28 is drawn and by which it is fed to forming rolls, the number and arrangement of which may vary according to the type of spring to be formed, two forming rolls being shown in the instance illustrated, the one designated 70 being relatively large and the other, designated 71, being smaller.

The feed rolls and forming rolls are mounted upon a common base plate 35 which in turn is supported by posts 36 extending from the end member 37 of the flier, with which the forming head rotates bodily. Between

the base plate 35 and an auxiliary support plate 38, mounted in spaced parallel relation thereupon by posts 39, are journaled the feed rolls 31 and 32, (see Fig. 3) the shaft 40 of the power transmitting roll of this feed couple being mounted in ball-bearings 42 and 43, and having an extension 44 provided with a pinion 45 driven by a silent or sprocket chain 46 which derives its power from a shaft 47 running out through the hollow journal 17 of the flier 18 and driven from the main shaft 20 by silent chains or belts 48 and 49 operating through the medium of a "Reeves" 50, this constituting one convenient and well known form of speed-changing mechanism by which the speed of the drive rolls 31 and 32 may be varied independently of the speed of the flier 18. The position of the feed roll 31 is fixed in the instance illustrated but that of the feed roll 32 preferably may be varied by suitable means, of which one convenient form is shown in Fig. 4, comprising a journal pin 51 having an eccentric portion 52 supporting a roller bearing 53 on which is mounted the feed roll 32, the angular position of the eccentric 52 controlling the spacing between the peripheries of the feed rolls 31 and 32. A lever 54 fixed to the end of journal pin 51 may be swung to cause rotation of the pin and its eccentric, and a bolt 55 (see Fig. 3) with spring 56, bearing against an abutment 57, operates, through the lever 54, to hold the roll 32 yieldingly toward the roll 31, so as to grip the wire being fed therebetween. The tension of spring 56 may be adjusted by the nut 58.

The peripheries of the feed rolls preferably have opposed grooves 59 operating to embrace the wire. Any of the series of grooves may be used as needed and the grooves may be of different sizes to accommodate different sizes of wire or may be of the same size so that as one becomes worn another can be used.

Feed roll 32 is driven by gearing 60 and 61 from feed roll 31 and the wire 28 is drawn into the feeding couple through a guide 62 which has a series of apertures 63 through any of which the wire 28 may be led to the selected groove 59. The guide 62 is held adjustably in a slot 64 of the guide plate 65 so that any selected hole 63 may be brought opposite any of the grooves 59 and thus desirable adjustments may be made in the event of wear on any of these operating parts, or if use is to be made of a size of stock wire which requires a particular size of groove to accommodate it.

Below the plate 65 the guide 62 is preferably provided with a nozzle or extension 66 leading into the bite of the feed rolls to insure accurate delivery of the wire 28 into the selected groove of the series 59, and at the lower side of the bite means are preferably provided to receive the wire being fed and support it against lateral displacement as it passes to the forming rolls.

For this purpose provision is made of what may be termed a "form-roll guide" 67, to distinguish it from the above described "feed-roll guide" 62 and it is preferably of considerably greater length than the feed roll guide and is mounted on a screw 68 passing through the guide at one side of the channel 69 for the wire, it being noted that this channel coincides with the axial line of the flier, while the peripheries of rolls 70 and 71 are displaced from the axis of the helix by a distance equal to the radius of the coil being formed. (See Fig. 2.) By this arrangement the wire is fed tangentially with respect to the helix into which it is to be formed.

The post 68 which supports the form-roll guide 67 is screwed into one of two threaded sockets $35x$ in the base plate 35, these sockets being symmetrically disposed, one on each side of the line of feed, and when it is desired to form a right-hand spring, a form-roll guide similar to the guide 67, but facing in the opposite direction, is screwed into the left-hand socket $35x$ shown in Fig. 2.

Each of these guides comprises a body-plate 67, having the face groove or channel 69 at its side, as already mentioned, to receive the wire, and a face plate or closure $69x$ which prevents escape of the wire from the channel 69. This closure is removable, to give access to the channel and is held in place by suitable fastening means $69a$.

Coiling mechanism

In pursuance of the invention, provision is made of bending means comprising one, two or three bending devices adapted to apply a bending force to the wire component and thereby effect its helical deformation in the formation of a coil spring having the desired characteristics for any particular application and, as already indicated briefly, two forming rolls are utilized as bending forces in the instance illustrated, viz.: the large or primary forming roll 70, to which the wire 28 is delivered by the form-roll guide 67 and which serves to initiate the bending of the wire, which then passes in partially coiled form to have the coil completed by a secondary, smaller roll 71 occupying an offset position at one side or the other of the main axis of the flier, according to whether a right-hand spring or left-hand spring is to be produced, suitable means being provided to support the rolls 70 and 71 in appropriate relative positions to produce the right-hand or left-hand spring as may be desired.

As a convenient form of support for the larger forming roll 70, the latter is shown as journaled at 72 in a swinging block 73 mounted on a pivot pin or shank 74 carried by the plate 35 and having a portion 75 against which is set a screw 76 mounted in a

socket 77 formed in the plate 35 as shown in Fig. 2, and by which set-screw the block 73 is held firmly in adjusted position. In the instance illustrated a left-hand spring is being coiled and accordingly the roll 70 occupies a position at the right-hand side of the axis of formation while the roll 71 occupies a position at the left-hand side thereof, and to support the roll 71 in this position and in its other possible positions any suitable supporting means may be utilized.

As a now-preferred means for this purpose the roll 71 is illustrated as journaled in a fork 78 having a round shank 79 extending through a split clamp 80 provided with a tightening bolt 81, the clamp having a shank 82 set into a socket 83 in the main base plate 35 where it is secured by a set-screw 84 (see Fig. 5). By this arrangement the roll 71 is capable of substantially universal adjustment including an angular adjustment relatively to the plane of operation of the larger roll 70, this being effected by rotating the shank 79 around its longitudinal axis.

By this adjustment the lead imparted to the spring coil is controlled, and by adjusting the shank 79 longitudinally its distance from the forming roll 70 may be changed to vary the size of the helix being formed.

When a right-hand spring is to be produced the post 82 is withdrawn from the socket 83 and is inserted in a similar socket 83*x* disposed symmetrically at the other side of the base plate 35, the roll 71 being presented in the opposite direction, and the roll 70 is correspondingly adjusted by swinging its block 73 over toward the left from the position shown in Fig. 2. It is to be noted that the set-screw 76 can be used to fix the block 73 in any desired angular position relatively to the line of feed of the wire 28 for the production of a spring having the desired diameter of helix.

Each of the forming rolls is preferably provided with peripheral grooves 87, 88, to prevent escape of the wire as it is coiled, and by having a plurality of such grooves on each roll, as one wears another may be shifted into position to receive the wire. This is accomplished by adjusting the shanks 82 and 74 longitudinally.

By proper control (such as cam action) of the forming rolls, tapered springs with varying leads may be produced. This includes close-wound springs, space-wound springs, and springs with initial tension.

When the speed of the feed rolls is in proper relationship to the speed of rotation of the flier there will be no torsion in the spring coming from the machine, i. e., no tendency to twist, loop and snarl.

The completed spring S, as it is continuously formed, advances toward the right along the axis of the flier, passing into and through the hollow journal 24 of the reel 23 and out through the bearing 14 at the right-hand end. It does not rotate and may be cut off in desired lengths for use or may be accumulated in any desired manner and stored or transported.

We claim:

1. In a machine for making coil springs, a support, a flier mounted rotatably thereon and provided with a supply of spring wire stock and a coil-forming head, said coil-forming head being adapted to withdraw wire from said supply and having bending means arranged to operate upon the wire to bend it helically around the axis of the spring, without the use of a mandrel, and to deliver the completed helical product non-rotatively, said head having also means to permit adjustment of said bending means radially and longitudinally with respect to the longitudinal axis of said helix.

2. In a machine for making coil springs, a support, a flier mounted rotatably thereon and provided with a supply of spring wire stock and a coil-forming head, said coil-forming head being adapted to withdraw wire from said supply and having bending means arranged to operate upon the wire to bend it helically around the axis of the spring, without the use of a mandrel, and to deliver the completed helical product non-rotatively, said head having also means to permit adjustment of said bending means angularly and longitudinally with respect to the longitudinal axis of said helix.

3. In a machine for making coil springs, a support, a flier mounted rotatably thereon and provided with a supply of spring wire stock and a coil-forming head, said coil-forming head being adapted to withdraw wire from said supply and having bending means arranged to operate upon the wire to bend it helically around the axis of the spring, without the use of a mandrel, and to deliver the completed helical product non-rotatively, said head having also means to permit adjustment of said bending means radially and angularly with respect to the longitudinal axis of said helix.

4. In a machine characterized as in claim 1, feeding means adapted to force said spring wire stock against said bending means and thereby deform said wire into a helical shape, said machine being further characterized by a mounting for said bending means comprising a member having a shank set in a socket in said coil-forming head, and adjustable longitudinally and rotatively in said socket upon an axis in substantial parallelism with the axis of the helix to be formed, and means to secure said shank in various positions of longitudinal and rotative adjustment.

5. In a machine characterized as in claim 1, feeding means adapted to force said spring wire stock against bending means and thereby

deform said wire into a helical shape, said machine being further characterized by the fact that said bending means comprises a plurality of bending devices, including a primary bending device and a secondary bending device, each of said bending devices having a shank mounted in a socket in said coil-forming head and adapted for rotative and lengthwise adjustment in said socket, and means to hold each of said shanks in adjusted position in its socket.

6. In a machine characterized as in claim 1, feeding means adapted to force said spring wire stock against bending means and thereby deform said wire into a helical shape, said machine being further characterized by the fact that said bending means comprises a plurality of bending devices, including a primary bending device and a secondary bending device, each of said bending devices having a shank mounted in a socket in said coil-forming head and adapted for rotative and lengthwise adjustment in said socket, and means to hold each of said shanks in adjusted position in its socket, and at least one of said bending devices having its shank provided with an auxiliary shank mounted therein and adapted for rotative and longitudinal adjustment at an angle to the axis of the supporting shank, said auxiliary shank carrying the bending device.

7. In a machine characterized as in claim 1, feeding means adapted to force said spring wire stock against bending means and thereby deform said wire into a helical shape, said machine being further characterized by the fact that said bending means comprises a plurality of bending devices, including a primary bending device and a secondary bending device, each of said bending devices having a shank mounted in a socket in said coil-forming head and adapted for rotative and lengthwise adjustment in said socket, and means to hold each of said shanks in adjusted position in its socket, and said secondary bending device having its shank provided with an auxiliary shank adapted for rotative and longitudinal adjustment in said secondary shank and carrying said secondary bending device, whereby said secondary bending device may be adjusted angularly with respect to said primary bending device.

8. In a machine characterized as in claim 1, feeding means adapted to feed said spring wire stock in a predetermined direction, a primary bending device carried by said coil-forming head in a mount adapted to be swung to one side or the other of the line of feed, to form a right-hand or a left-hand spring selectively, and a secondary bending device adapted to be moved bodily to one side or to the other side of said line of feed to receive and operate upon said wire stock as it passes from said primary bending device in a right-hand or left-hand direction, said coil-forming head having a plurality of seats to receive and support said secondary device in one or the other position, selectively, and means to hold said secondary device in selected position.

9. In a machine for making helical springs and the like, a feeding-roll couple comprising a pair of rolls each having a series of grooves, the grooves on one roll of said pair registering with the grooves on the other pair, a bending device adapted to receive a supply of stock wire from selected co-operating grooves of said feeding rolls, and deform the same helically, a feed-roll guide adjustable to direct said supply of wire stock to any selected co-operating grooves of said series upon said feeding rolls, and a forming device guide adapted to receive stock-wire so fed and deliver the same to said bending device.

10. In a machine for making helical springs and the like, a feeding-roll couple comprising a pair of rolls each having a series of grooves, the grooves on one roll of said pair registering with the grooves on the other pair, a bending device adapted to receive a supply of stock wire from selected co-operating grooves of said feeding rolls, and deform the same helically, a feed-roll guide adjustable to direct said supply of wire stock to any selected co-operating grooves of said series upon said feeding rolls, and a forming device guide adapted to receive stock-wire so fed and deliver the same to said bending device, said bending device comprising a roll having grooves in a parallel series extending around the periphery thereof, said bending roll being adapted for adjustment co-axially to bring a selected groove into position to receive wire stock from any selected pair of co-operating grooves in said feeding rolls.

11. In a machine for making helical springs and the like, a feeding-roll couple comprising a pair of rolls each having a series of grooves, the grooves on one roll of said pair registering with the grooves on the other pair, a bending device adapted to receive a supply of stock wire from selected co-operating grooves of said feeding rolls, and deform the same helically, a feed-roll guide adjustable to direct said supply of wire stock to any selected co-operating grooves of said series upon said feeding rolls, and a forming device guide adapted to receive stock-wire so fed and deliver the same to said bending device, said bending device comprising a roll having grooves in a parallel series extending around the periphery thereof, said bending roll being adapted for adjustment co-axially to bring a selected groove into position to receive wire stock from any selected pair of co-operating grooves in said feeding rolls, certain of said grooves in said feeding roll series and in said bending roll series respec-

tively being of a different size from other grooves in said respective series, to permit said machine to operate upon different sizes of stock-wire.

In testimony whereof, we have signed this specification.

GORMAN C. BURD.
OTTO BRATZ.