

June 20, 1933.

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1,914,976

MACHINE FOR COILING HELICAL FORMS

Filed Aug. 27, 1930

4 Sheets-Sheet 1

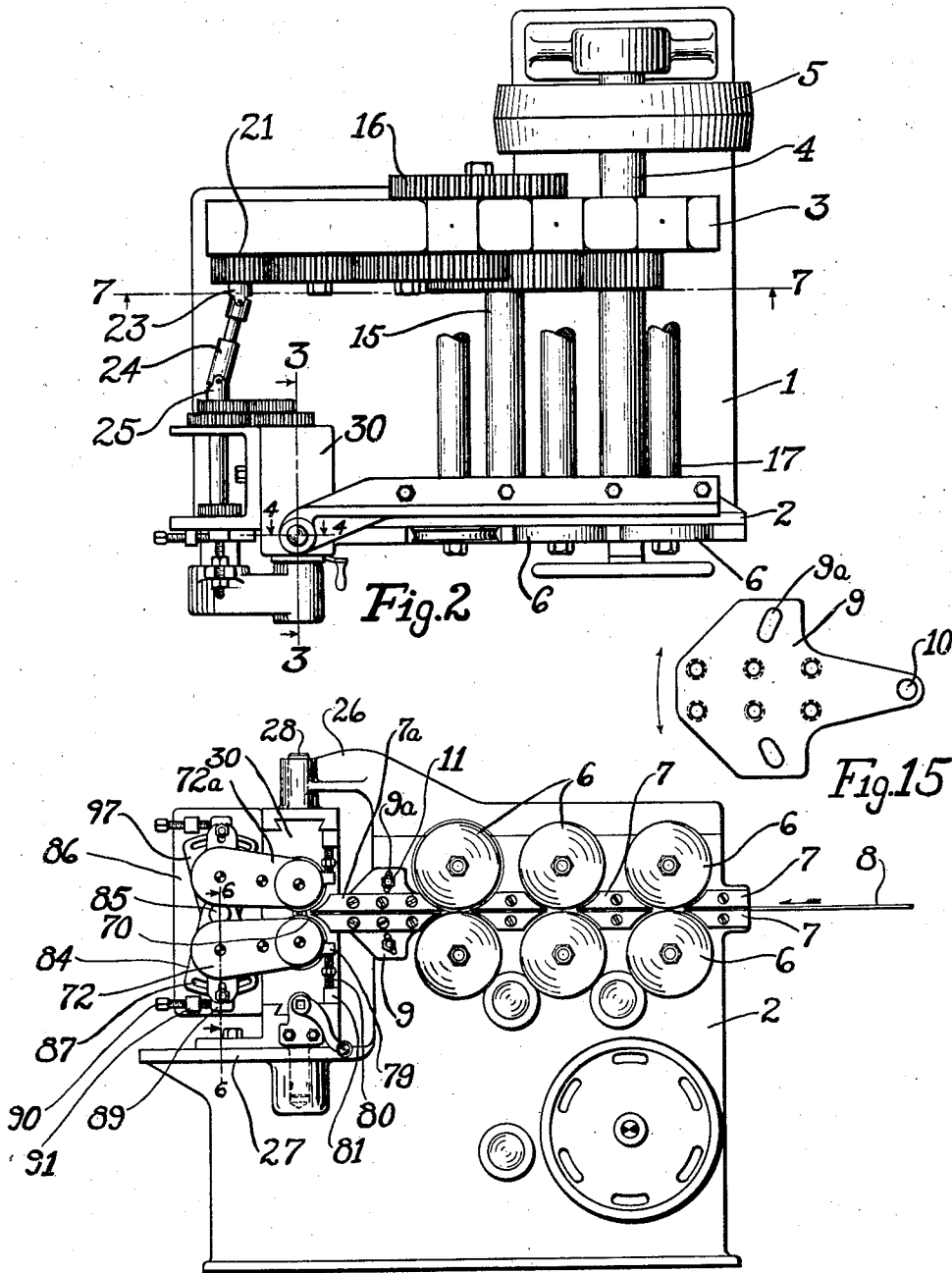


Fig. 1

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4 Sheets-Sheet 2

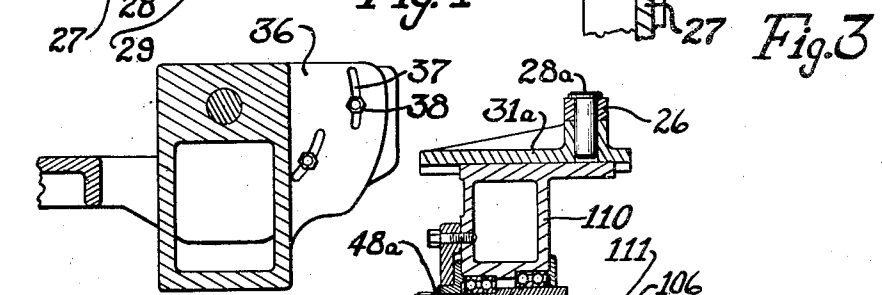
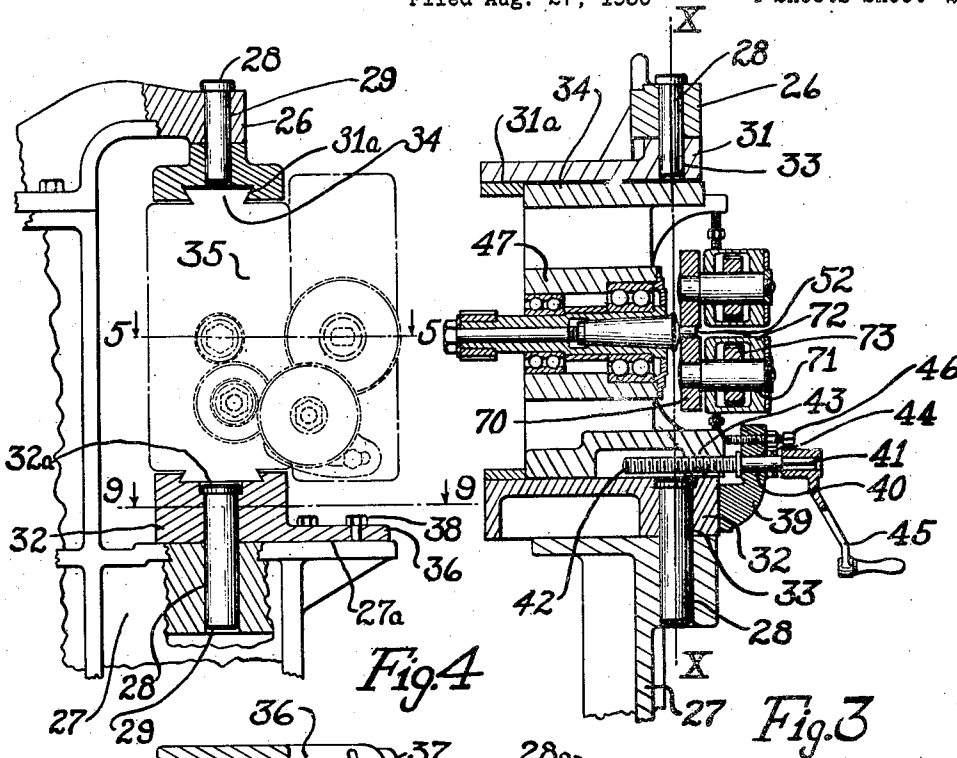


Fig. 9

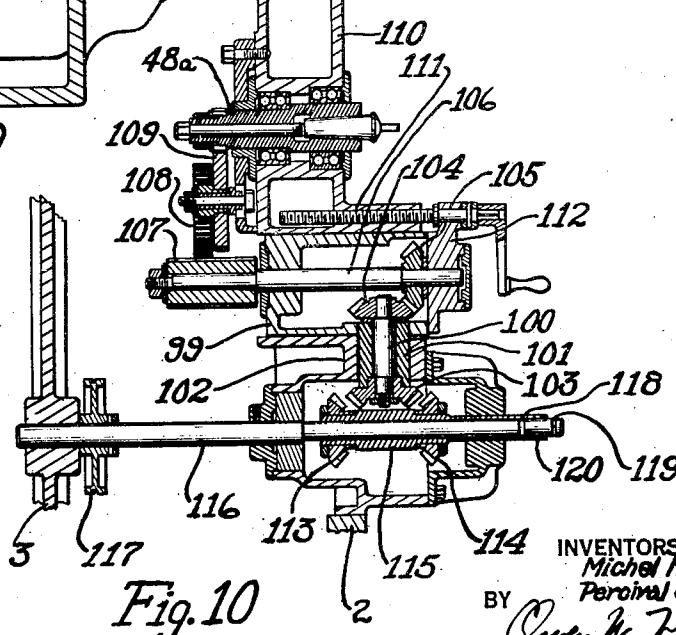


Fig. 10

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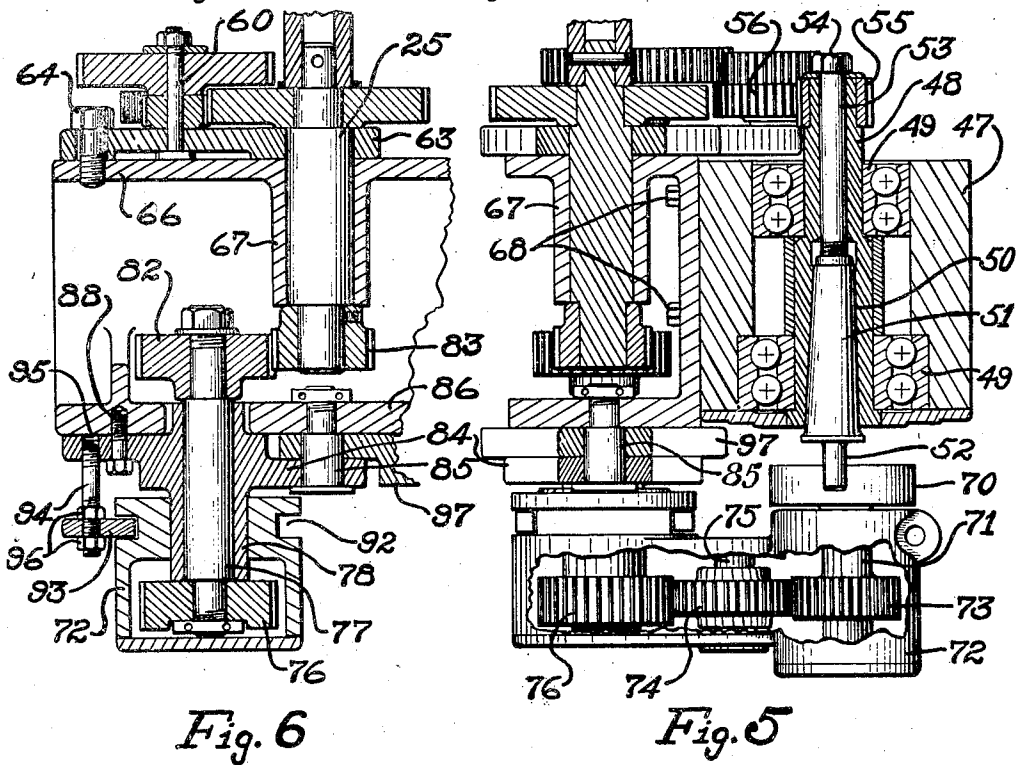
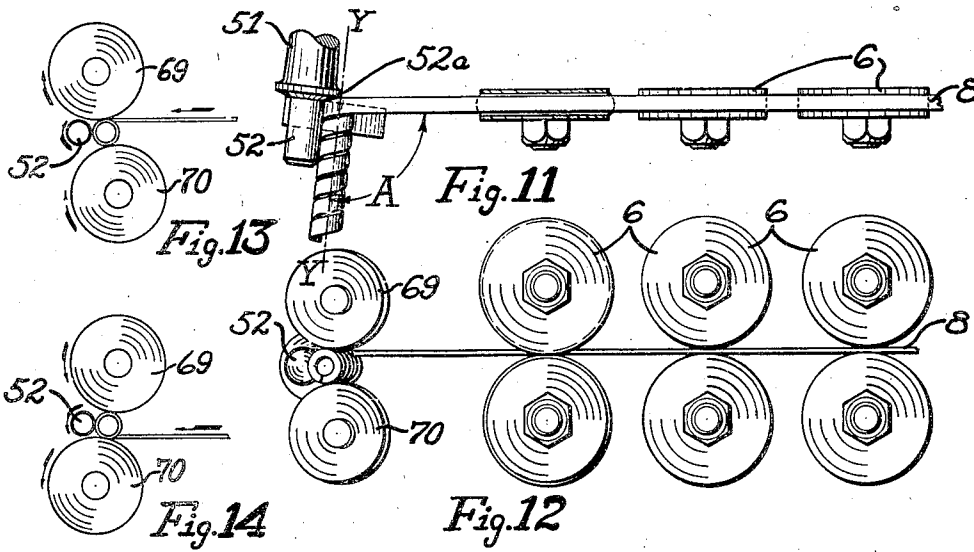
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MACHINE FOR COILING HELICAL FORMS

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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

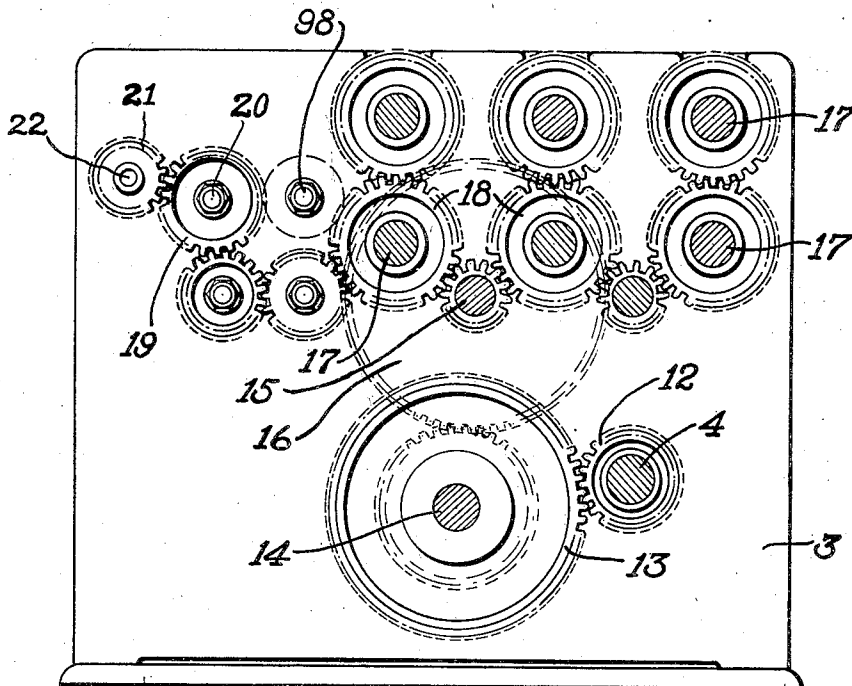


Fig. 7

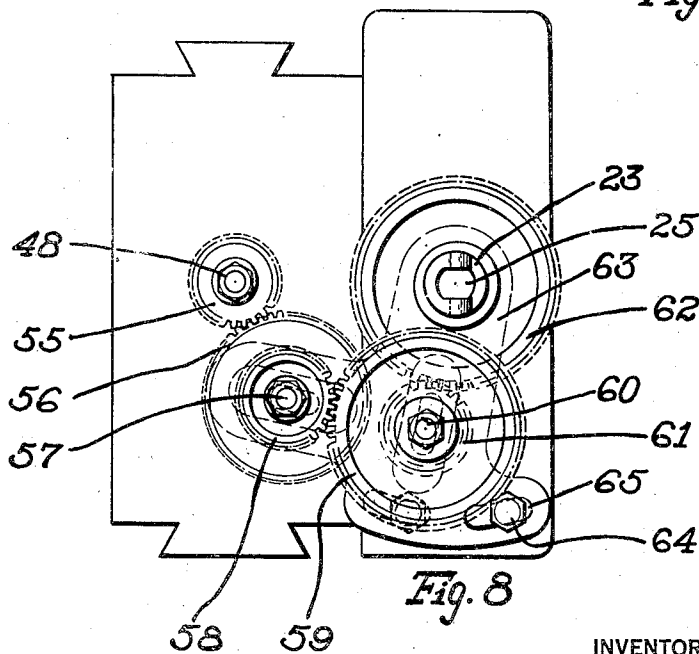


Fig. 8

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MACHINE FOR COILING HELICAL FORMS

Application filed August 27, 1930. Serial No. 478,004.

The present invention relates to an improved machine particularly adapted to coil rectangular stock, flatwise, into helical forms such as are used for roller bearings and the like.

In the operation of prior machines for coiling of helical forms by forcibly feeding metal stock to a group of coiling tools, difficulties have been encountered in properly setting the tools to produce a helical coil of the desired pitch, since a change in the width, or diameter, of the stock, or even a change in the diameter of the helical coil produced, results in a different pitch angle in the finished helical coil. As a result, individual adjustments of all the coiling tools are necessary to meet each alteration in the cross section of the material and diameter of the coil. Furthermore, when coiling relatively stiff heavy stock, difficulties have heretofore been encountered in maintaining the adjustment of the coiling tools under the heavy stresses imposed upon the tools by the deformation of the stock.

The present invention contemplates a machine for coiling helical forms of different pitch and diameter from different sizes of stock in which individual adjustment of the coiling tools is substantially eliminated. Instead of providing for the individual adjustment of the coiling tools to secure variations in the coiled product, the machine of the present invention is characterized by the carrying of all of the coiling tools on a head mounted on a pivotal axis passing through one of the tools substantially at the point of coiling, or stock deflection, by this tool, so that angular adjustment of the head carrying the coiling tools in fixed relation brings about a variation in the pitch angle of the helical form produced. In fact the provision of the pivoted tool carrying head makes it possible to vary the pitch angle even while the machine is in operation, so that laborious adjustments of the coiling tools found neces-

sary in prior machines are entirely eliminated. The above and other advantageous features of the invention will hereinafter more fully appear with reference to the accompanying drawings in which—

Fig. 1 is a view in front elevation of a machine embodying the present invention.

Fig. 2 is a plan view of the parts shown in Fig. 1.

Fig. 3 is a vertical sectional view along the line 3—3 of Fig. 2, looking in the direction of the arrows.

Fig. 4 is a vertical sectional view along the line 4—4 of Fig. 2, looking in the direction of the arrows.

Fig. 5 is a fragmentary view in longitudinal section along the line 5—5 of Fig. 4, the parts being shown on an enlarged scale.

Fig. 6 is a vertical sectional view along the line 6—6 of Fig. 1, the parts being shown on an enlarged scale.

Fig. 7 is a vertical sectional view along the line 7—7 of Fig. 2, looking in the direction of the arrows.

Fig. 8 is a fragmentary view illustrating the arrangement of gearing for driving the coiling abutment.

Fig. 9 is a fragmentary view in horizontal section taken along the line 9—9 of Fig. 4, looking in the direction of the arrows.

Fig. 10 is a vertical sectional view similar to Fig. 3 showing a modification in the arrangement of gearing for driving the coiling tools.

Fig. 11 is a fragmentary plan view illustrating the operation of the feeding and coiling tools in the formation of a helical coil.

Fig. 12 is a view in side elevation of the parts shown in Fig. 11.

Fig. 13 is a fragmentary view illustrating diagrammatically the formation of a right hand coil.

Fig. 14 is a diagrammatic view similar to

Fig. 13 illustrating the formation of a left hand coil.

Fig. 15 is a fragmentary view illustrating the adjustment of the forward stock guide.

5 Like reference characters refer to like parts in the different figures.

Referring first to Figs. 1 and 2, the machine comprises a base 1 providing spaced vertical frame members 2 and 3 between which is jour-
 10 nalled a power shaft 4 adapted to be rotatably driven from any suitable source of power, as by means of a pulley 5. The front frame member 2 carries a number of pairs of feed rolls 6, 6 with cooperating guides 7, 7
 15 mounted therebetween, rotation of the rolls 6 being adapted to forcibly feed flexible metal stock 8 to the coiling tools, as indicated by the arrow. The foremost pair of guides 7a are adjustable vertically so as to vary the line
 20 of stock feed up and down with respect to the coiling tools hereinafter described. One way of effecting this adjustment is by means of a plate 9 carrying the guides 7a, the plate 9 being angularly adjustable about a pivot pin
 25 10 on the frame member 2 by means of bolts 11 received in curved slots 9a in the plate 9, see Fig. 15.

As best shown in Fig. 7, the drive shaft 4 carries a pinion 12 in mesh with a gear 13 on a countershaft 14 extending through the rear
 30 frame member 3 and the shaft 14 is adapted to drive a second countershaft 15 by reduction gearing 16, carried by the shafts 14 and 15 on the outer face of the frame member 3, as shown in Fig. 2. The shaft 15 is adapted
 35 to drive in unison the several pairs of feed roll shafts 17, 17 which extend between the frame members 2 and 3 by a train of intermeshing gears 18. One of the feed roll driving gears 18 serves to also drive a train of
 40 gears 19 mounted on stub shafts 20, with the last gear 19 of the train in mesh with a gear 21 carried on a shaft 22. The shaft 22 is connected by universal joints 23 and telescoping intermediate shaft 24 to a shaft 25 which
 45 serves to drive the coiling tools in a manner to be hereinafter described.

As best shown in Figs. 1 and 4, the front frame member 2 extends beyond the feed roll
 50 6 to provide a projecting lug 26 which overhangs and is spaced from a foot 27. Pivot pins 28 are received in alined openings 29 provided in the lug 26 and foot 27, respectively, and these pins 28 serve to pivotally
 55 support between them, on a vertical axis, a coiling head generally designated by the reference character 30 in Figs. 1 and 2. As best shown in Figs. 3 and 4, the swiveled head 30 comprises a pair of parallel slides 31 and 32
 60 extending rearwardly into the space between the pivoted lug 26 and foot 27 and providing alined openings 33 for receiving the pivot pins 28. The slides 31 and 32 provide parallel dovetailed guideways 31a and 32a which
 65 are adapted to receive dovetailed tongues 34

extending along the top and bottom of a housing, generally designated by the reference character 35 in Fig. 4, which housing 35 serves to support the coiling tools and the driving
 70 gearing associated therewith. However, before entering into a detailed description of the coiling tools and the manner of driving the same, there will first be pointed out the manner in which the entire head 30 may be
 75 adjusted about a vertical axis passing through the pins 28, and the manner in which the housing 35 may be adjusted longitudinally within the space between the slides 31 and 32.

As best shown in Figs. 4 and 9, the lower pivoted slide 32 provides a forwardly extending flange 36 which is in contact with
 80 the upper face 27a of the foot 27, the entire weight of the head assembly 30 being borne on this face 27a. The flange 36 provides curved slots 37, 37 for receiving bolts 38 threaded into the foot 27, the slots 37 being
 85 concentric about the axis of the pivot pins 28, so that when the bolts 38 are loosened, the entire coiling head assembly may be swung about a vertical axis passing through the pins 28. The slots 37 serve to control this swinging movement, after which the
 90 head 30 may be locked in its adjusted position by turning the bolts 38 into the foot 27 to bring the bolt heads into clamping engagement with the flange 36. As best shown in Fig. 3, the lower slide 32 carries a forwardly extending bracket 39 providing an
 95 opening 40 for freely receiving a shaft 41 providing a portion 42 in threaded engagement with a lug 43 provided by the housing 35. Since the shaft 41 is locked against axial movement in the bracket 39 by collars 44, turning of the shaft 41 as by means of a suitable
 100 handle 45 will cause the housing 35 and all its associated mechanism to be shifted longitudinally between the pivoted slides 31 and 32. At this point it should be noted that the threaded portion 42 of the shaft 41 is long enough to move the housing 35 a considerable distance inwardly from the front of the machine, in which position the coiling
 105 tools will be out of the line of stock feed by the rolls 6, for a purpose which will hereinafter appear. In order to prevent the housing 35 from being moved too far forward by the shaft 41, a stop bolt 46 is carried by the bracket 39, the inner end of which can be set to limit forward movement of the
 110 housing 35.

As best shown in Figs. 3 and 5, the housing 35 provides a cylindrical portion 47 within which is rotatably mounted a sleeve 48 supported in anti-friction bearings 49, 49 seated
 115 within the housing portion 47. The sleeve 48 provides a tapered opening 50 within which is received the tapered body portion of a coiling abutment 51 providing a reduced cylindrical nose portion 52 projecting be-
 120

yond the end of the housing portion 47. The abutment 51 is removably secured within the sleeve 48 by means of a draw bolt 53 with one end threaded into the abutment and with its head 54 engaging the end of the sleeve 48 which projects beyond the housing portion 47 opposite to the nose 52. The projecting end of the sleeve 48 carries a pinion 55 which, as best shown in Fig. 8, is in mesh with a gear 56 mounted on a shaft 57. The shaft 57 also carries a pinion 58 in mesh with a gear 59 on a shaft 60. The shaft 60 in turn carries a pinion 61 in mesh with a gear 62 mounted on the shaft 25, which, as previously described, is positively driven from the power shaft 4 through the universal joints 23 and the train of gearing shown in Fig. 7.

The shafts 57 and 60 which carry the gear train between the power driven shaft 25 and the abutment carrying sleeve 48 are adjustably mounted on a bracket 63 which, as best shown in Fig. 8, is pivotally supported about the axis of the shaft 25. The bracket 63 with its train of gearing is adapted to be adjusted about the axis of the shaft 25 by means of bolts 64 received in curved slots 65 in the bracket 63, whereby the bracket 63 may be clamped in an adjusted position. The bolts 64 are threaded into a flange 66 forming part of a bearing 67 for the shaft 25, the entire bearing structure 67 being rigidly secured to the housing portion 47 by a bolt 68, as shown in Fig. 5. The adjustable mounting of the gear train between the shaft 25 and the abutment carrying spindle 48 provides convenient means for varying the speed of the spindle 48 by changing the various gears in the train. With the gearing shown in Fig. 8 obviously the speed of the spindle 48 is very much greater than the speed of the shaft 25 and this drive will be maintained irrespective of pivotal adjustment of the head 30 or longitudinal adjustment of the housing 35 by reason of the provision of the universal joints 23 and telescopic shaft 24 between the shaft 25 and the shaft 22 which is driven from the power shaft 4.

As best shown in Figs. 3 and 12, the rotatably driven nose 52 of the coiling abutment is disposed between coiling rolls 69 and 70 so arranged that either one may receive the stock 8 tangentially thereto as it is fed by the roll 6 so as to deflect it to the nose of the abutment and coil it in helical form, as indicated in Figs. 13 and 14. Since both the rolls 69 and 70 are adjustably mounted on the housing 35 and rotatably driven from the shaft 25 in the same manner, only the mounting of the lower roll 70 will be described in detail, with like parts associated with the upper roll 69 being designated with the same reference characters.

As best shown in Figs. 3 and 5, the roll 70 is mounted on a shaft 71 journalled between

the sides of a hollow bracket 72 with a gear 73 mounted on the shaft 71 within the bracket 72. The gear 73 is in mesh with an idler gear 74 mounted on a stub shaft 75 carried by the bracket 72, and the gear 74 in turn meshes with a gear 76. As best shown in Fig. 6, the gear 76 is carried at the end of a shaft 77 rotatably mounted within a sleeve 78 and the entire roll bracket 72 with the gears 73 and 74 and the roll 70 is pivotally mounted on the bearing sleeve 78. As best shown in Fig. 1, the free end of the roll bracket 72 provides a lug 79 which is engaged by an adjusting stud 80 cooperating with a lug 81 forming part of the housing 35. The function of this stud 80 is to support the free end of the bracket 72 so as to position the roll 70 in proper relation to the abutment 51 for forming a helical coil of a given diameter.

Referring again to Fig. 6, shaft 77 carrying the gear 76 extends beyond the bearing sleeve 78 and carries a gear 82 in mesh with a pinion 83 mounted on the end of the shaft 25, so that the shaft 77 is driven in unison with the abutment sleeve 48 and the driving connection between the shaft 77 and the coiling roll 70 is maintained for different adjustments of the roll 70, since roll bracket 72 swings on the axis of the shaft 77. The bearing sleeve 78 for supporting the shaft 77 is part of an arm 84 which is pivotally supported on a pin 85 rigidly carried by a flange 86 of the bearing 67 which forms part of the housing structure 35. It will be noted that the axis of the pivoted pin 85 is in alignment with driven shaft 25 so that swinging movement of the arm 84 about the pin 85 will in no way disturb the driving connection between the shafts 25 and 77 through the gears 82 and 83.

As best shown in Fig. 1, the arm 84 provides a curved slot 87 concentric about the axis of the pin 85, which slot receives a bolt 88, see Fig. 6, threaded into the flange 86 for locking the arm 84 in position. For the purpose of conveniently adjusting the arm 84 about the pivot pin 85, the arm provides a projection 89 beyond the slot 87 against which abuts the end of a bolt 90 threaded into a lug 91 projecting from the flange 86. By turning the bolt 90 after the locking bolt 88 has been loosened, the arm 84 carrying with it the entire roll housing assembly can be swung about the axis of the pivot pin 85 so as to shift the roll 70 from the position shown in Fig. 13 to the position shown in Fig. 14. The purpose of this adjustment is to permit the coiling of either a right hand or a left hand helix, proper provision being made for reversing the direction of rotation of both rolls 69 and 70, as will hereinafter appear.

In addition to the above described adjustment of the roll 70, first about the axis of the shaft 77 and then about the axis of the pin 85, the roll 70 is also capable of adjustment back

and forth with respect to the axis of the coil being formed. For this purpose the bracket 72 provides a groove 92 surrounding the bearing sleeve 78 in which is received a fork 93 with its lower end providing an opening for receiving an adjusting stud 94 having one end threaded into an opening 95 provided at the lower end of the arm 84. Nuts 96 provided on the stud 94 on opposite sides of the fork 93 provide means for shifting the entire bracket 72 longitudinally on the bearing sleeve 78, thus permitting relative adjustment between the cylindrical surfaces of the abutment nose 52 and the roll 70. It is evident from Fig. 5 that when the roll bracket 72 is laterally shifted by means of the fork 93, idler gear 74 will remain in mesh with the gear 76 which is fast on the shaft 77, since the teeth of the gear 76 are wider than the teeth of the idler gear 74.

As previously pointed out, the upper roll 69 is supported by an upper pivotally mounted bracket 72a in exactly the same manner as the lower roll 70 and the upper bracket 72a is capable of both angular and lateral adjustment on an arm 97 mounted on the same pivot pin 85 which supports the bracket carrying arm 84. In order to provide for pivotal movement of the arms 84 and 97 independently of each other, the arms are cut away so that they are mounted on the pin 85 in overlapping relation.

With the above described individual adjustments of the rolls 69 and 70, it is obvious that the rolls can be initially positioned with respect to the abutment 51 so as to produce a helical coil of the desired diameter, such a setting of the rolls 69 and 70 being indicated in Fig. 12. When the rolls 69 and 70 have been initially set, it is possible to adjust the entire head 30 carrying all of the coiling tools about a vertical axis passing through the pins 28, and it is evident from Figs. 3 and 4 that this vertical axis, designated X—X passes substantially through the center of the coiling nose 52 of the abutment 51. As clearly shown in Fig. 11, the shoulder 52a between the nose 52 and the body of the abutment 51 is slightly beveled so that when the stock 8 fed by the rolls 69 is deflected downwardly by the under surface of the roll 69 to the nose 52 it will be readily guided by the shoulder 52a into contact with the cylindrical surface of the nose 52. It is also evident from Fig. 11 that the initial angular setting of the head 30 about the axis X—X is such that the axis Y—Y of the helical coil formed by cooperation of the rolls 69 and 70 with the nose 52 makes an obtuse angle with the line of feed of the stock 8.

This angle, designated A in Fig. 11, varies with the pitch of the helix being coiled, for, as previously pointed out, a change in the width or diameter of the stock 8 results in a different pitch angle in the finished helical

coil. In other words, in forming stock of a given cross section into a helical coil of a given diameter, there is a definite pitch angle at which the stock will coil most readily and the present machine is particularly characterized by the manner in which it may be set for this pitch angle, without laborious adjustment of the coiling tools. For example, assuming that the rolls 69 and 70 have been initially set with respect to the nose 52 to produce a helical coil of a given diameter, it is an easy matter to angularly adjust the head 30 about the axis X—X so as to obtain the exact angle A between the axis Y—Y of the coil and the line of stock feed at which the stock 8 will coil most readily. The great advantage of such an adjustment, as compared to individual adjustments of all the coiling tools to vary the pitch, will be readily apparent when it is considered that the present machine permits of very minute variations of the pitch angle such as would be caused by a variation in the cross section of different lengths of stock. As a result with a given initial setting of the rolls 69 and 70 with respect to the abutment 51 to produce a helical coil of a given diameter, almost any kind of stock can be handled without disturbing the initial setting of tools by merely carrying out the necessary angular adjustment of the head 30, and it is obvious that such adjustments can be made without interrupting the formation of the coil.

As previously pointed out, the machine is capable of producing either right hand or left hand coils by swinging the roll housings 72 and 72a through movement of the arms 84 and 97. The relation of the coiling rolls 69 and 70 with respect to the abutment 51, when forming either a right hand or a left hand coil, is illustrated diagrammatically in Figs. 13 and 14. Thus when forming a right hand coil, the upper roll 69 first receives the stock in contact with its lower surface, the roll 69 being vertically adjusted so that its periphery is very close to the nose 52 with the center of the roll lying between the axis of the abutment 51 and the axis of the coil. On the other hand, the roll 70 is set with its axis on the opposite side of the coil axis, so that its periphery is considerably farther removed from the surface of the nose 52. When forming a left hand coil, the positions of the rolls 69 and 70 with respect to the nose 52 are reversed. Furthermore, the extreme left hand stock guide 7a is so adjusted as to direct the stock 8 to the upper surface of the lower roll 70, as clearly indicated in Fig. 14.

When changing from the formation of a right hand coil to the formation of a left hand coil, it is also necessary to reverse the direction of rotation of both the coiling rolls 69 and 70 and of the abutment 51. Thus in Fig. 13, all three of the coiling tools are rotating in a clockwise direction, as indicated

by the arrows, whereas in Fig. 14 all three of the coiling tools are rotating in the opposite, or counter-clockwise, direction. In order to obtain this reversal in the direction of rotation the machine provides an extra shaft 98 mounted in the rear frame member 3. As clearly shown in Fig. 7, the shaft 98 is interposed between the feed roll shaft 17 that is driven directly from the power shaft and the stub shaft 20 carrying a gear 19 in mesh with the gear 21 on the shaft 22. In the train of gearing shown in Fig. 7, three intermediate shafts 20 are employed, but when it is desired to reverse the direction of rotation of the shaft 22, the gears 19 are removed from two of these shafts and a gear of the same diameter is mounted on the shaft 98, as indicated by the dotted circle. Therefore, all that is necessary in order to change from a right hand coil of a given diameter to a left hand coil of the same diameter, is to shift the arms 84 and 97 and to mount a gear on the shaft 98, while removing the gear 19 from one of the shafts 20. In other words, no adjustments whatsoever of the coiling tools or even of the coiling head 30 are required to effect the change-over.

When it is desired to start the coiling of the forward end of a new bundle of stock 8, it is possible to withdraw the coiling tools from the line of stock delivery so that the stock can be fed by hand and wound on a suitable hand fixture. As previously pointed out, the threaded portion 42 of the shaft 41, shown in Fig. 3, is long enough to cause the entire housing 35 to be moved on the slides 31 and 32 far enough to clear the coiling tools from the line of stock fed. Upon starting the coil by hand, the housing 35 can be moved back into place to receive the coil, whereupon the machine can be started in operation. Obviously, this retraction of the housing 35 with all of the coiling tools in no way affects the adjustment of the tools.

Referring now to Fig. 10, there is shown a modification in the manner of driving the coiling tools without employing a universal joint between the shaft in the housing and the shaft on the rear frame member. In this modified arrangement a lug 26 of the front frame member supports a pivot pin 28a received in a slide 31a in the same manner as shown in Fig. 3. The lower slide 99 is of different construction from the slide 32, being pivoted on the shaft 100 journaled in a bearing 101 received in the slide 99 and a hollow foot portion 102 carried by the frame. The shaft 100 carries at its lower end a bevel gear 103, while its upper end carries the gear 104 in mesh with the bevel gear 105 mounted on a shaft 106 journaled in the slide 99. The other end of the shaft 106 carries a pinion 107 with elongated teeth in mesh with a gear 108 forming part of a gear train 109, whereby rotation of the shaft 106 is impart-

ed to an abutment carrying sleeve 48a rotatably supported in a housing 110 which also carries coiling rolls mounted in the same manner as described with reference to Fig. 3, the rolls being omitted for the sake of simplifying the drawing.

The housing 110 is capable of longitudinal adjustment between the slides 31a and 99 by means of a shaft 111 in threaded engagement with the housing 110 and rotatably supported by a bracket 112 secured to the slide 99. The provision of the elongated teeth on the pinion 107 insures that the train of gears for driving the abutment carrying sleeve 48a will remain in mesh irrespective of longitudinal adjustment of the housing 110 between the slides 31a and 99. The bevel gear 103 mounted on the lower end of the pivot shaft 100 is adapted to be engaged with one or the other of bevel gears 113 and 114 carried on a sleeve 115 slidable on a shaft 116. The shaft 116 is supported at its ends between the rear frame member 3 and the hollow foot portion 102 which is supported by the front frame member 2. The shaft 116 carries a gear 117 adapted to be driven from the power gear train shown in Fig. 7 and rotation of the shaft 116 is adapted to be imparted to the pivot shaft 100 by shifting the gear sleeve 115 to bring either a bevel gear 113 or the bevel gear 114 into mesh with the bevel gear 103. Thus the sleeve 115 provides means whereby the direction of rotation of the abutment carrying sleeve 48a may be reversed. In order to provide for locking either the gear 113 or the gear 114 in mesh with gear 103, the shaft 116 provides spaced tapered openings 118 and 119 adapted to register with alined openings 120 in the end of the sleeve 115 to receive a pin which causes the sleeve 115 to rotate with the shaft 116. With the modified driving arrangement shown in Fig. 10, obviously the entire head including the slides 31a and 99 with the housing 110 supported therebetween can be swung about an axis passing through the pivot 28a and the shaft 100, without affecting the driving connection between the driving shaft 116 and the coiling tools.

From the foregoing, it is apparent that by the present invention there is provided an improved machine which is adapted to coil stock into helical forms with a facility of operation not heretofore obtained in prior machines for the same purpose. With the machine of the present invention, it is possible to set the coiling tools for forming a helical coil of a given diameter and with this setting, vary at will the pitch angle of the helix being coiled without in any way altering the initial setting of the tools. As a result, the machine is adapted to handle stock having considerable variation in its form and to coil the same at the proper

pitch angle by merely adjusting the head the desired amount.

We claim:

1. In a machine of the class described, the combination with means for forcibly feeding relatively stiff metal stock, of a head pivotally mounted about an axis extending at right angles to the line of stock feed, and a set of rotatably driven coiling tools carried by said head for forming the stock into a helical coil as it is fed, said head being turnable bodily about its pivotal axis to vary the pitch angle of the helix being coiled, and said tools being adjustable relatively with respect to the coiling axis to permit the formation of either a right hand or left hand coil.

2. In a machine of the class described, the combination with means for forcibly feeding relatively stiff metal stock, and an axially rotatable head carrying a group of coiling tools for coiling said stock into helical form as it is fed, of means for moving said tools as a unit on said head to withdraw the same from the line of stock feed.

3. In a machine of the class described, the combination with means for forcibly feeding relatively stiff metal stock, and a head carrying a group of coiling tools for coiling said stock into helical form as it is fed, of means for angularly adjusting said head about a pivotal axis at right angles to the line of stock feed to determine the pitch angle of the helix being coiled, and means for moving said tools bodily on said head to withdraw them from the line of stock feed, without altering the angular adjustment of said head, or the relative adjustment of the tools, one to another.

4. In a machine of the class described, the combination with a frame, a rotatably driven shaft mounted thereon and a pair of rolls connected to said shaft adapted by their rotation to forcibly feed relatively stiff metal stock, of a coiling head pivotally supported by said frame about an axis extending at right angles to the line of stock feed, a group of coiling tools mounted on said head for forming the stock into a helical coil as it is fed, means for adjusting said head about its pivotal axis to vary the pitch angle of the helix being coiled, and means for rotatably driving said coiling tools from said shaft in any angular position of said head.

5. In a machine of the class described, the combination with a frame, a rotatably driven shaft mounted thereon and a pair of rolls connected to said shaft adapted by their rotation to forcibly feed relatively stiff metal stock, of a coiling head pivotally supported by said frame about an axis extending at right angles to the line of stock feed, a group of coiling tools mounted on said head for forming the stock into a helical coil as it is fed, means for adjusting said head about its pivotal axis to vary the pitch angle of the

helix being coiled, means for shifting said tools as a group on said head to withdraw them from the line of stock feed, and means for rotatably driving all of said tools from said shaft in any angular position of said head, and in any position of said tools with respect to the line of stock feed.

6. In a machine of the class described, a frame, a coiling head pivotally mounted on said frame about a vertical axis, a housing slidably mounted on said head at right angles to its pivotal axis, and a group of rotatably driven coiling tools mounted in said housing.

7. In a machine of the class described, a frame, a coiling head pivotally mounted on said frame about a vertical axis, a housing slidably mounted on said head at right angles to its pivotal axis, a coiling abutment rotatably mounted in said housing, a pair of rotatable coiling rolls pivotally mounted on said housing above and below said abutment, and means for adjusting said rolls about their pivotal axes to determine the diameter of the coil formed by the cooperation of said rolls and abutment.

8. In a machine of the class described, a frame, a coiling head pivotally mounted on said frame about a vertical axis, a housing slidably mounted on said head at right angles to its pivotal axis, a coiling abutment rotatably mounted on said housing, a pair of coiling rolls pivotally mounted on said housing above and below said abutment, and means for shifting the pivotal axes of said rolls with respect to said abutment to cause the formation of either a right hand, or a left hand, coil by the cooperation of said rolls with said abutment.

9. In a machine of the class described, the combination with means for forcibly feeding relatively stiff metal stock, of a head carrying a group of rotatively driven coiling tools to form the stock into a helical coil as it is fed, said head being pivoted about an axis extending at right angles to the line of stock feed and through one of said tools substantially at the point of coiling.

10. In a machine of the class described, the combination with means for forcibly feeding relatively stiff metal stock, of a head carrying a group of rotatively driven coiling tools to form the stock into a helical coil as it is fed, said head being turnable at will about a fixed axis passing substantially through the point of coiling to vary the pitch of the coil being formed.

11. In a machine of the class described, the combination with means for forcibly feeding relatively stiff metal stock, of a head carrying a group of rotatively driven coiling tools to form the stock into a helical coil as it is fed, said head being turnable about a fixed axis passing substantially through the coiling point to vary the pitch of the coil being

formed, the setting of the coiling tools carried by said head remaining unchanged for coiling helices of different pitch.

12. In a machine of the class described, the
5 combination with means for forcibly feeding relatively stiff metal stock, of a head carrying a group of rotatively driven coiling tools to form the stock into a helical coil as it is fed, said head being turnable at will about a
10 fixed axis passing through one of the coiling tools substantially at the point of stock deflection by this tool to vary the pitch of the coil being formed.

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PERCIVAL S. THOMAS.

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