Nov. 20, 1934. M. NIGRO 1,981,566

MACHINE FOR COILING METAL STRIP

Filed May 4, 1931 5 Sheets-Sheet 1

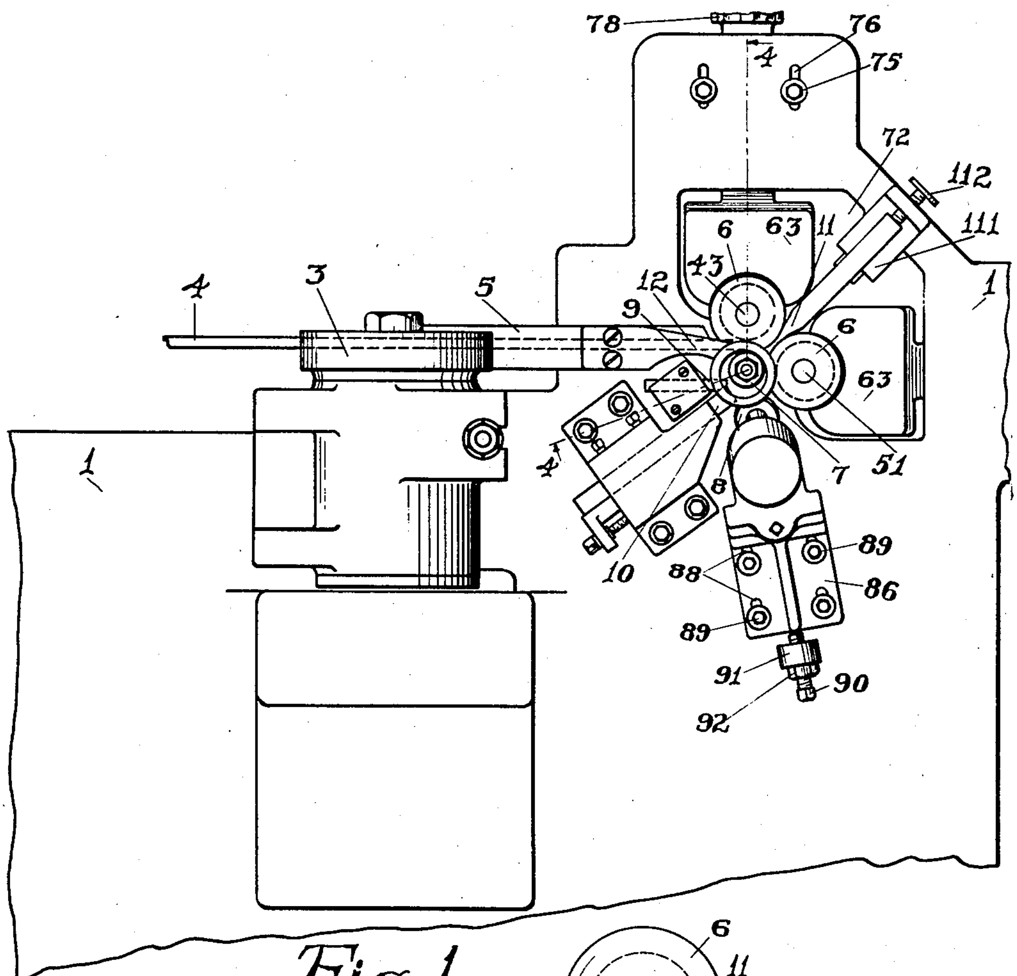

Fig. 1.

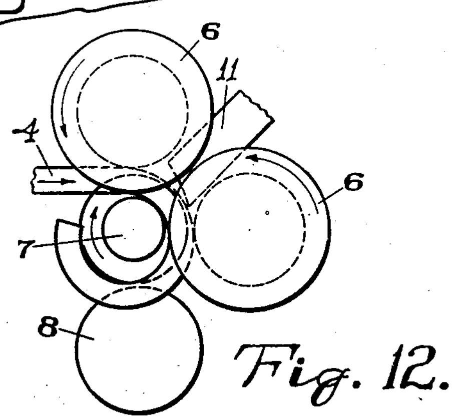

Fig. 12.

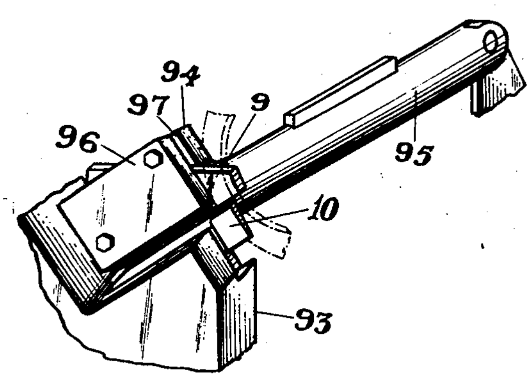

Fig. 10.

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MACHINE FOR COILING METAL STRIP

Filed May 4, 1931 5 Sheets-Sheet 2

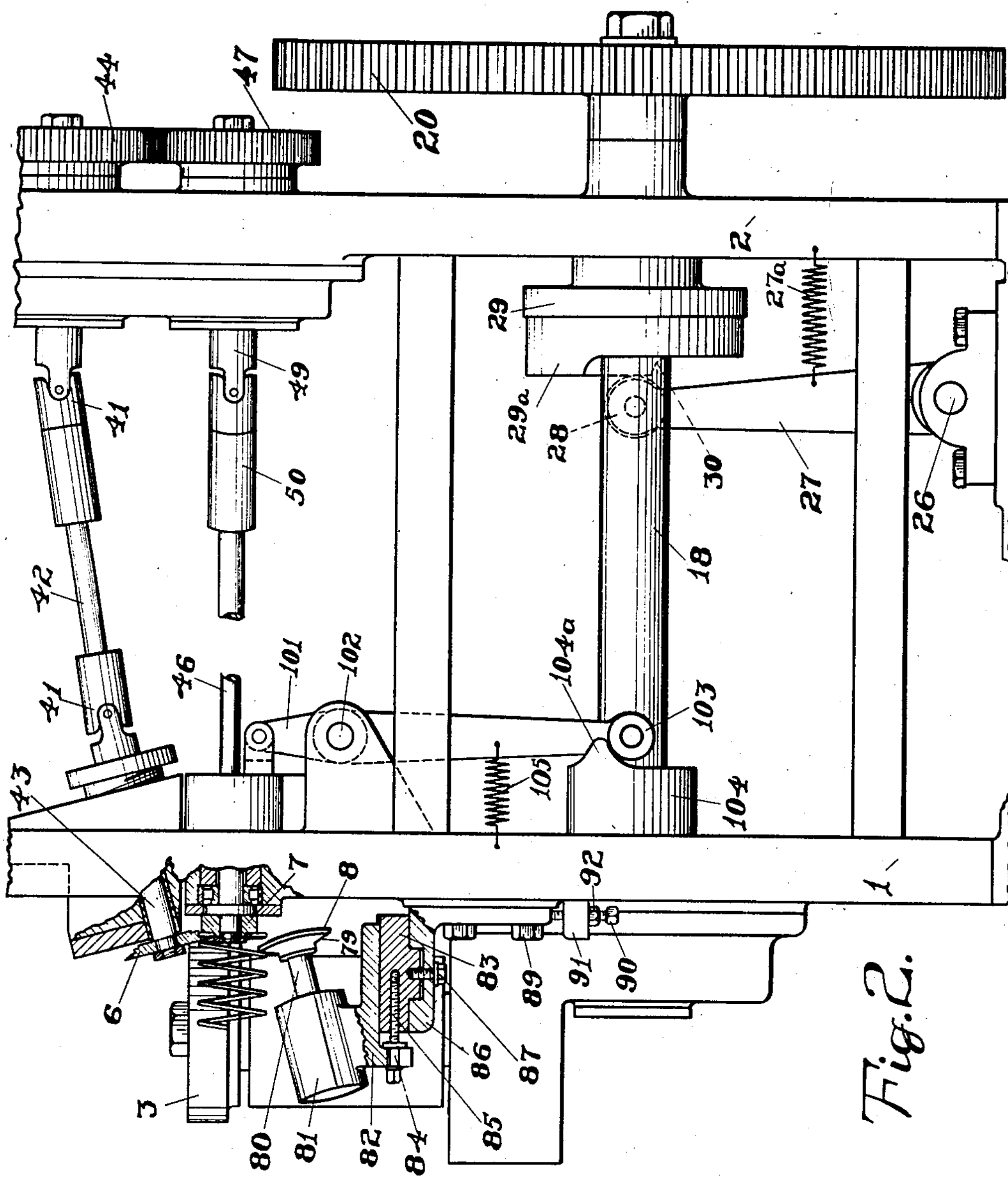

Fig. 2.

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MACHINE FOR COILING METAL STRIP

Filed May 4, 1931 5 Sheets-Sheet 3

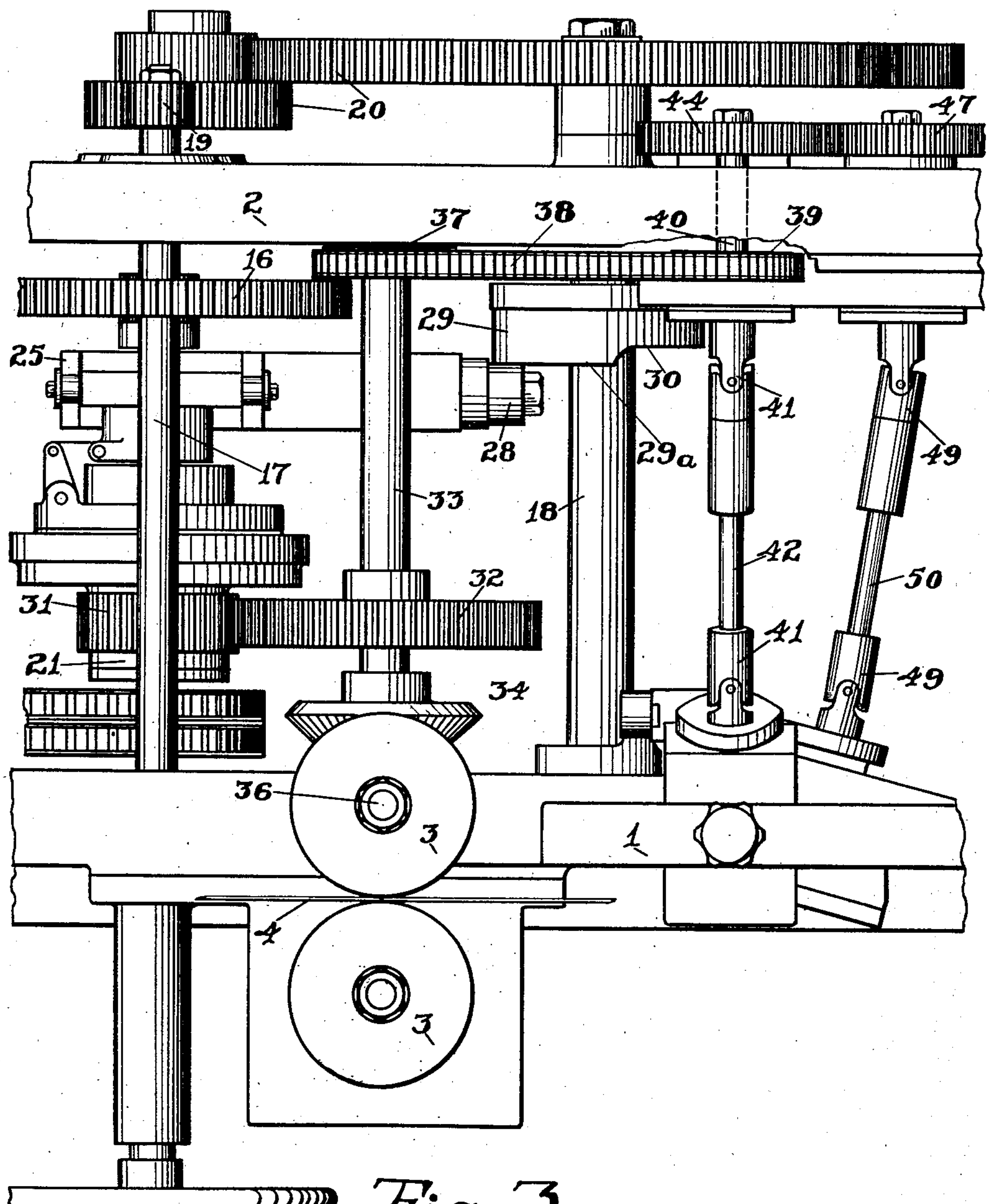

Fig. 3.

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MACHINE FOR COILING METAL STRIP

Filed May 4, 1931 5 Sheets-Sheet 4

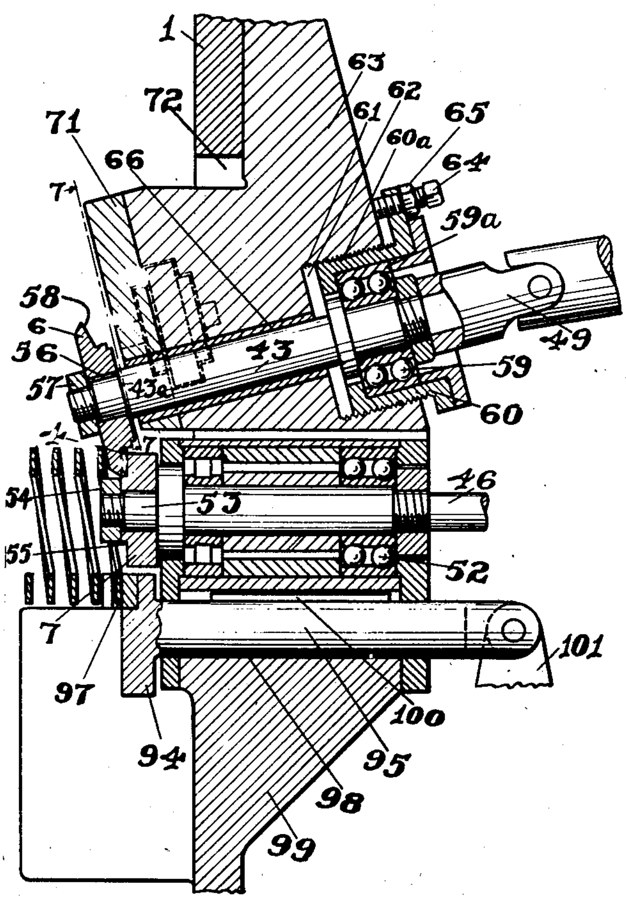

Fig. 4.

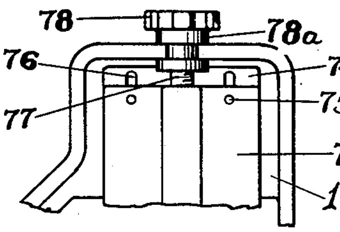

Fig. 11.

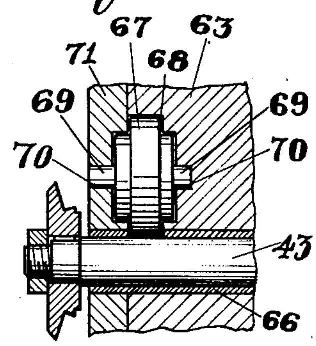

Fig. 8.

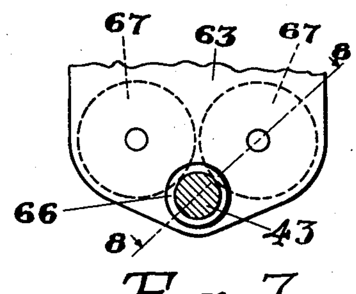

Fig. 7.

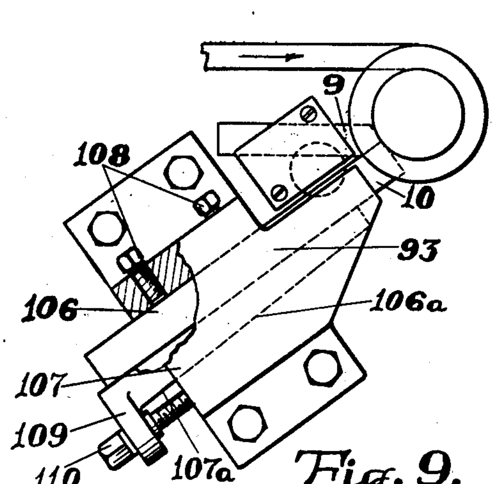

Fig. 9.

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Nov. 20, 1934. M. NIGRO 1,981,566

MACHINE FOR COILING METAL STRIP

Filed May 4, 1931 5 Sheets-Sheet 5

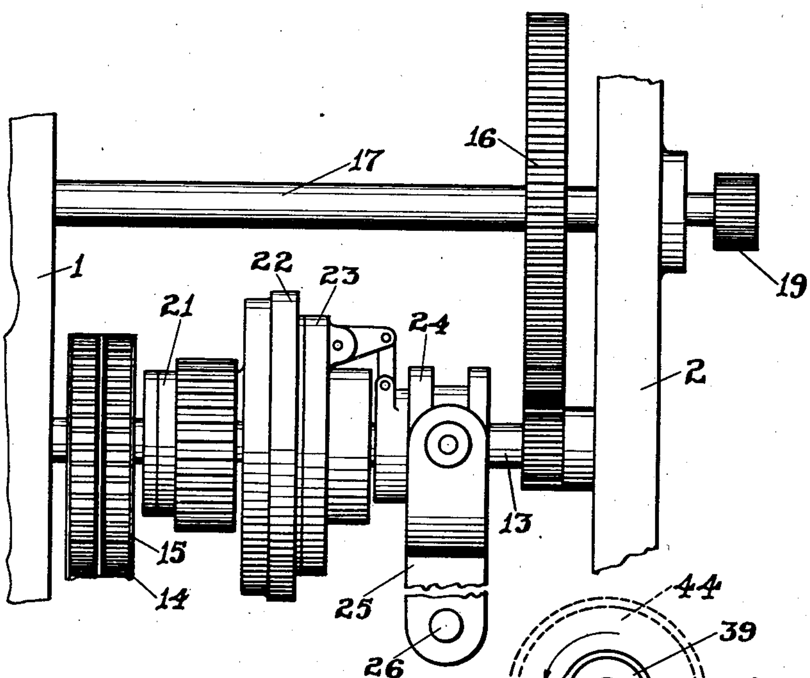

Fig. 6.

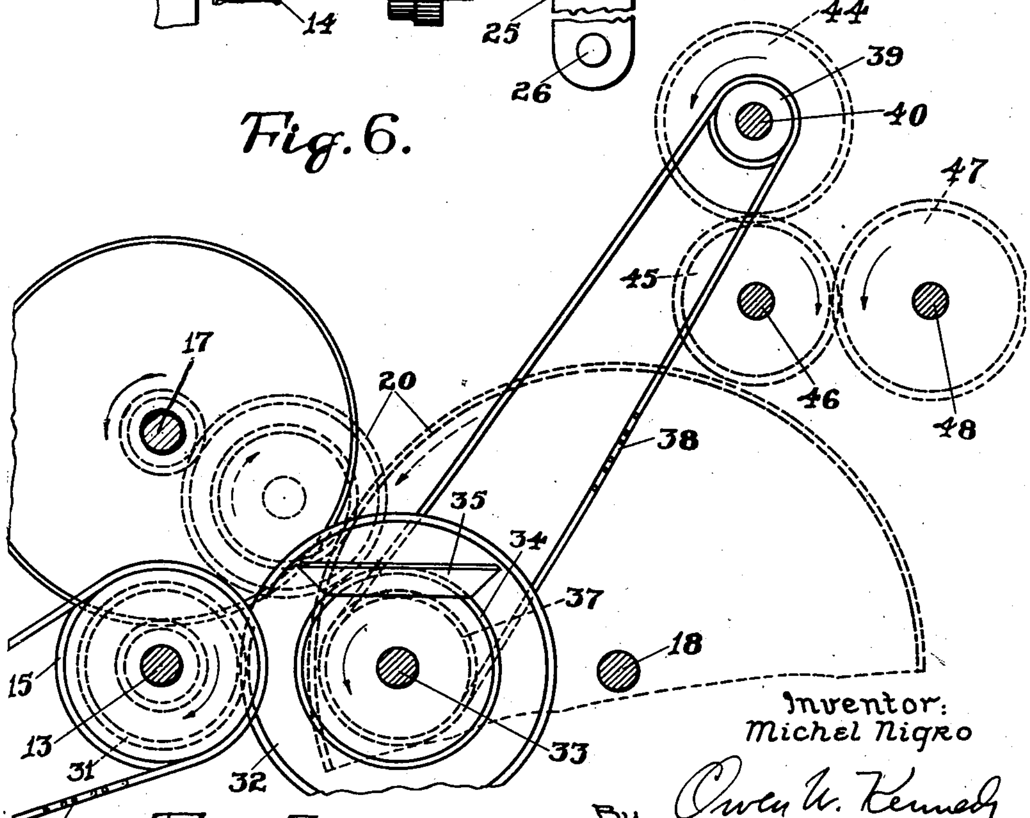

Fig. 5.

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UNITED STATES PATENT OFFICE

1,981,566

MACHINE FOR COILING METAL STRIP

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Application May 4, 1931, Serial No. 534,945

7 Claims. (Cl. 153—64.5)

The present invention relates to a machine for coiling flat metal strip on edge to form coils of the type that are utilized for electrical resistance units and other purposes, and has for its object to provide a machine of the above indicated character that is adapted to coil the stock smoothly and easily into coils of the desired pitch and diameter.

In operation, the machine of the present invention is particularly characterized by its automatic production of coils of uniform character, each containing the same amount of stock, and its ability to handle stock of different sizes through convenient adjustments of the coiling tools. The above and other advantages features of the invention will hereinafter more fully appear from the following description with reference to the accompanying drawings, in which:—

Fig. 1 is a view in front elevation of that portion of the machine which carries the stock feeding, coiling and cutting tools.

Fig. 2 is a view in side elevation of the machine shown in Fig. 1, certain parts being shown in section.

Fig. 3 is a plan view of the machine shown in Fig. 1.

Fig. 4 is a vertical sectional view along the line 4—4 of Fig. 1, showing the parts on an enlarged scale.

Fig. 5 is a diagrammatic view illustrating the gearing for driving the various elements of the machine.

Fig. 6 is a fragmentary view of a portion of the gearing shown in Fig. 5.

Fig. 7 is a fragmentary sectional view along the line 7—7 of Fig. 4, looking in the direction of the arrows.

Fig. 8 is a fragmentary sectional view along the line 8—8 of Fig. 7 looking in the direction of the arrows.

Fig. 9 is a fragmentary view illustrating, on an enlarged scale, details of the cut-off mechanism shown in Fig. 1.

Fig. 10 is a perspective view of the parts shown in Fig. 9.

Fig. 11 is a detail of a coiling roll adjustment.

Fig. 12 is a diagrammatic view illustrating the coiling operation.

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

Referring first to Figs. 1 and 2, the machine comprises spaced frame members 1 and 2, with the front member 1 carrying a pair of rotatably driven rolls 3 geared together for feeding metal strip stock 4 edgewise through a suitable guide 5. As the stock 4 emerges from the guide 5 it is operated upon by a group of coiling tools comprising rotatably driven rolls 6, 6 cooperating with a rotatably driven mandrel 7 to grip and deflect the strip 4 in the form of an open coil, the pitch of which is determined by a pitch tool or roll 8, best shown in Fig. 2. At intervals, the coiling operation is interrupted to permit the severance of separate coils of predetermined length through the operation of a cut-off mechanism comprising relatively movable knives 9 and 10. The coiling mechanism also comprises a preliminary stock deflector 11 between the rolls 6 and a clearing tool 12 which cooperate with the other coiling tools in a manner which will hereinafter more fully appear. However, before describing the detailed construction of the coiling tools generally referred to above, there will be first described the manner in which the various parts are driven in unison from a common source of power to cause the deflection of the stock 4 into helical form and its cutting into coils of predetermined length.

As best shown in Figs. 3, 5 and 6, a shaft 13 is rotatably mounted between the frame members 1 and 2 and is adapted to be driven from any suitable source of power, not shown, by means of a chain 14 passing around a toothed wheel 15. The drive shaft 13 is connected through reduction gearing 16 to a counter shaft 17, which is adapted to continuously drive a cam shaft 18 through a pinion 19 in mesh with change gears 20, as best shown in Fig. 3. The counter shaft pinion 19 is carried beyond the rear frame member 2 so that the change gears 20 for driving the cam shaft 18 are readily accessible for the purpose of varying the speed of the cam shaft 18 as desired. It will also be apparent that the ratio of the reduction gearing 16 and change gearing 20 is such that the drive shaft 13 will make a relatively large number of revolutions in driving the cam shaft 18 through one revolution.

As best shown in Fig. 6, the drive shaft 13 carries a sleeve 21 that is adapted to be connected to the shaft 13 through the functioning of cooperating clutch elements 22 and 23, of any desired type. The clutch elements 22 and 23 are adapted to be thrown into engagement so as to transmit rotation of the shaft 13 to the sleeve 21 by means of an operating collar 24 movable axially on the shaft 13 by means of a forked lever 25 mounted on a rock shaft 26 extending at right angles to the drive shaft 13 to a point below the cam shaft 18. As best shown in Fig. 2, the other end of the shaft 26 carries a lever arm 27 provided at its upper end with a roller 28 maintained in engagement with the face of a cam 29 mounted on the cam shaft 18 by a spring 27*a*. From a consideration of Figs. 2 and 3, it is obvious that rotation of the cam shaft 18 at a speed less than that of the drive shaft 13, will cause the cam 29 to turn the rock shaft 26 and thereby move the collar 24 to bring the clutch elements 22 and 23 into engagement. Therefore, the sleeve 21 will be driven in unison with the drive shaft 13 for a predetermined number of revolutions during each complete revolution of the cam shaft 18, as determined by the length of the raised portion 29*a* of the cam 29 and the ratio of the change gearing 20. However, when the roller 28 reaches the depression 30 of the cam 29, the clutch elements 22 and 23 will be disengaged, with the result that the sleeve 21 has an intermittent rotative movement imparted thereto from the drive shaft 13.

As best shown in Fig. 3, the sleeve 21 carries a pinion 31 in mesh with a gear 32 carried by a shaft 33 extending between the frame members 1 and 2 between and parallel to the drive shaft 13 and cam shaft 18. The shaft 33 carries a bevel gear 34 in mesh with a bevel gear 35, see Fig. 5, mounted on a shaft 36 carrying one of the strip feeding rolls 3, so that the rolls 3 are adapted to intermittently feed the stock 4 toward the coiling rolls 6 which are driven in unison with the rolls 3, as will now be described.

The other end of the shaft 33 carries a sprocket 37 around which passes a chain 38 to a gear 39 carried by a shaft 40 rotatably mounted in the rear frame member 2, see Fig. 3. The shaft 40 is connected by universal joints 41 and an intermediate telescoping shaft 42 to a shaft 43, Fig. 4, carrying the first coiling roll 6, as indicated in section in Fig. 2. The shaft 40 also carries a gear 44 beyond the frame member 2 which, as best shown in Fig. 5, is in mesh with a gear 45 on a shaft 46, with the gear 45, in turn, meshing with a gear 47 on a shaft 48. The shaft 46 shown broken away in Fig. 2 extends between the frame members 1 and 2 and carries at its end the coiling mandrel 7, while the shaft 48 is connected by universal joints 49 and the intermediate telescoping shaft 50 to a shaft 51, Fig. 1, carrying the second coiling roll 6. With the above described gearing and shaft connections, it is evident that the coiling rolls 6 and mandrel 7 will be driven intermittently, in unison with the feed rolls 3, the ratio of the gears 44, 45 and 47 being such that the speed of rotation of the coiling roll shafts 43 and 51 will be slightly less than the speed of rotation of the mandrel shaft 46. It will also be evident from Fig. 12 that while the coiling rolls 6 are driven in the same direction of rotation, the mandrel 7 will be driven in the opposite direction of rotation, as indicated by the arrows.

Referring now to Fig. 4, it will be seen that the front end of the mandrel shaft 46 is supported by the frame member 1 in anti-friction bearings 52, with the shaft 46 projecting beyond the bearings 52 to provide a reduced portion 53 for receiving the mandrel 7. The mandrel 7 is secured on the reduced shaft portion 53 by means of a nut 54, so that the mandrel 7 can be readily removed as desired. The face of the mandrel 7 provides a shoulder 55 which is adapted to receive the stock 4 as fed by the rolls 3, the stock being forced in engagement with the shoulder 55 by the rotatably driven coiling rolls 6. As previously pointed out, the coiling rolls 6 are driven at the same speed and in the same direction of rotation, and since both rolls 6 are mounted and adjusted in exactly the same manner, the detail construction and mounting of only the first roll 6 will be described in detail with reference to Fig. 4.

The coiling roll 6 is secured by a key 56 to rotate with the shaft 43 and is held by a nut 57 against a shoulder 43*a* on the shaft 43. The inner face of the roll 6 provides a groove 58 which overhangs the shoulder 55 on the mandrel 7 so as to completely enclose a portion of the stock 4 where the peripheries of the roll and mandrel overlap each other, as viewed in Fig. 12. The roll 6 is adapted to engage the stock 4 and force it into engagement with the shoulder 55 on the mandrel 7 through axial adjustment of the roll shaft 43 which permits the roll 6 to be set to grip stock of different thicknesses. To this end, the coiling roll shaft 43 is supported at the end adjacent the universal joint 49 in an anti-friction bearing 59 which is capable of adjustment with the shaft 43 in the direction of its longitudinal axis. The outer race 59*a* of the bearing 59 is received in a sleeve 60 provided around its outer surface with threads 60*a* in engagement with threads 61 provided in a recess 62 of the bearing bracket 63. By turning the sleeve 60 the entire roll shaft assembly, including the bearing 59, the shaft 43 and the roll 6, can be shifted along the longitudinal axis of the shaft 43 to very closely control the width of the space between the shoulder 55 of the mandrel 7 and the groove 58 of the roll 6. In other words, the roll 6 can be set so as to force the stock 4 against the mandrel 7 with just the desired degree of frictional engagement to forcibly grip and deflect the stock 4 when the mandrel and roll are rotatably driven in unison in opposite directions of rotation, as indicated in Fig. 11. For the purpose of locking the bearing sleeve 60 after setting the roll 6, a stud 64 is threaded into a flange of the sleeve 60 having a lock nut 65 cooperating therewith to secure the stud 64 in position.

That portion of the roll shaft 43 extending through the bearing bracket 63 beyond the bearing 59 is received in a sleeve bearing 66, and in order to prevent the radial thrust on the shaft 43, when coiling, from rapidly wearing out this sleeve bearing 66, there is shown in Figs. 7 and 8 an improved arrangement for absorbing this radial thrust without substantial wear on the bearing 66. This arrangement comprises a pair of hardened rollers 67 mounted in the bearing bracket 63 with their axes of rotation disposed above and on opposite sides of the axis of the shaft 43, see Fig. 7. The rollers 67 are arranged symmetrically with respect to the shaft 43 with their peripheries extending through a slot 68 provided in the sleeve bearing 66, so that any radial thrust on the shaft 43 due to the forces set up during the coiling operation is borne entirely by the rollers 67. As best shown in Fig. 8, each roller 67 provides opposed trunnion portions 69 which are received in alined seats 70 provided in the bearing bracket 63 and in a plate 71 secured to the front of the bracket 63, so that the rollers 67 can be readily assembled in the machine.

As previously pointed out, both coiling rolls 6 are mounted in exactly the same manner as described above with reference to Figs. 4, 7 and 8, and obviously, axial adjustment of the respective roll shafts is permitted, by reason of the intermediate telescopic shafts 42 and 50 respectively, which extend between the roll driving shafts 38 and 48 and the roll carrying shafts 43. In addition to the axial adjustment of each roll shaft 43, further provision is made for independent adjustment of each of the roll shaft bearing brackets 63, with reference to the axis of coiling so as to permit the roll 6 to form coils of different diameters.

As best shown in Fig. 1, the bearing brackets 63 are mounted in an opening 72 provided in the front frame member 1, and as best shown in Fig. 11, each bracket 63 provides an upwardly extending boss 73 having a flat surface thereof in engagement with a seat 74 provided by the frame member 1. The boss 73 is clamped in engagement with the seat 74 by means of bolts 75 threaded into the boss 73 and passing through elongated slots 76 in the frame 1 so as to permit adjustment of the whole bearing bracket assembly within the frame opening 72. In making such an adjustment, the bolts 75 are loosened enough to permit the bearing assembly to be shifted on the seat 74 by means of an adjusting screw 77 threaded into the boss 73. The adjusting screw 77 provides a suitable hand wheel 78 by means of which it may be turned, the hand wheel 78 providing a hub 78*a* bearing on the end face of the frame. Obviously, by turning the hand wheel 78, the screw 77 may be caused to shift the entire coiling roll shaft assembly within the frame opening 72 to vary the position of a coiling roll 6 radially with respect to the axis of the coiling mandrel 7. Such adjustment of a bearing bracket 63 is permitted by the elongated slots 76 through which the clamping bolts 75 pass, and after an adjustment has been made the bolts 75 are tightened to firmly lock the boss 73 of the bracket in engagement with its seat 74. In making adjustments of the bearing brackets 63 as described above, the universal joints 41 and 49 and the intermediate telescoping shafts 42 and 50 permit bodily movement of the brackets 63 without interfering with the drive from the shafts 40 and 48 respectively.

As previously pointed out, the coiling mechanism also comprises a pitch tool 8, the construction of which is best illustrated in Fig. 2. The function of the pitch tool 8 is to engage the deflected stock as it is gripped and coiled into helical form by the cooperation of the coiling rolls 6 and mandrel 7, and impart the desired angular pitch to the convolutions of the helix as it moves away from the mandrel 7, as indicated in Fig. 2. The coiling tool 8 is preferably in the form of a disk providing a shoulder 79 which engages the stock just below the mandrel 7, the disk being carried at the end of a shaft 80 which is rotatably mounted in a bearing 81 with its axis inclined with respect to the axis of coiling. The tool 8 is, therefore, freely rotatable so that it imparts no frictional resistance to the movement of the coiled stock, although at the same time the angle of the plane of the disk determines the pitch of the helix and the separation of the convolutions thereof.

In order to adjust the pitch tool 8 to cause the formation of helices of different pitch and diameter, the bearing 81 which rotatably supports the pitch tool shaft 80 provides a foot portion 82 that is adjustable on a slide 83 by means of a stud 84 turnable in the foot portion 82 with its threaded portion received in a threaded opening 85 provided in the slide 83. Obviously, turning of the stud 84 will cause the pitch tool to be shifted with respect to the axis of coiling to thereby vary the pitch of the helix being coiled. The slide 83 is in turn adjustable on a bracket 86, so that it may be shifted at right angles to the axis of coiling, a bolt 87 threaded into the slide 83 serving to clamp the slide 83 in position on the bracket 86. As best shown in Fig. 1, the bracket 86 carrying the pitch tool assembly is also adjustable radially with respect to the axis of coiling through the provision of elongated slots 88 for receiving clamping bolts 89 threaded into the frame member 1. When the bolts 89 are loosened, close adjustment of the radial position of the bracket 86 can be obtained by means of a set screw 90 threaded into a lug 91 projecting from the frame 1 with its end bearing on the lower face of the bracket 86. A lock nut 92 is adapted to secure the set screw 90 in position following an adjustment of the bracket 86, after which the bolts 89 are tightened to clamp the bracket 86 securely to the frame 1.

As previously pointed out, continuous rotation of the drive shaft 13 is adapted to cause intermittent rotation of both the feed rolls 3 and the coiling rolls 6, the cam 29 on the cam shaft 18 functioning through the clutch elements 22 and 23 to cause all the rolls to remain stationary for a predetermined period during each complete revolution of the cam shaft 18. And since the ratio of the change gearing 20 driving the cam shaft 18 from the shaft 13 is such that the shaft 18 rotates at a reduced speed, it follows that the roll driving shaft 33 will make a number of revolutions for each revolution of the cam shaft 18. As a result, the rolls 6 will operate to coil one or more convolutions of the helix during each complete revolution of the cam shaft 18, and as will next be described, each dwell in the coiling operation is utilized to bring the knives 9 and 10 into operation to cause the severance of separate coils from the helix, each having a predetermined number of convolutions.

As best shown in Fig. 9, the stationary cutter blade 10 is carried by a holder 93, the inner end of the blade 10 projecting beyond the holder 93 so that it is positioned between the first and second convolutions of the helix at a point beyond the pitch tool 8. As best shown in Fig. 10, the movable blade 9 is carried by a holder which comprises a head 94 formed on the end of a shaft 95, a clamping plate 96 serving to hold the blade 9 within a slot 97 provided by the head 94. In its normal or retracted position, the blade 9 has its cutting edge in alinement with the cutting edge of the stationary blade 10, with the cutting edges displaced enough to permit the coiled stock 4 to pass between them.

As best shown in Fig. 4, the shaft 95 carrying the blade head 94 is slidably received in an opening 98 extending through the frame portion 99 which supports the mandrel shaft 46, a key 100 preventing turning of the shaft 95 without interfering with its axial movement in the opening 98. The shaft 95 projects rearwardly beyond the bracket 99 and is pivotally connected to the upper end of a lever 101 pivotally mounted intermediate its ends on a pin 102 supported by the frame 1, see Fig. 2. The lower end of the lever 101 carries a roller 103 which cooperates with a cam 104 mounted on the cam shaft 18. The cam 104 is so timed with relation to the cam 29 that when the cam roller 28 passes off of the raised portion 29*a* into the depression 30 to disengage the clutch elements 22 and 23, a projection 104*a* on the cam 104 will turn the lever 101 in a counterclockwise direction, as viewed in Fig. 2. This turning of the lever 101 moves the shaft 95 to the left, as viewed in Fig. 4, thereby causing the blade 9 to sever the stock 4 where it is held by the blade 10, as will be evident from a consideration of Fig. 10. When this occurs, a coil containing a predetermined number of convolutions will be delivered by the machine, leaving a portion of a complete convolution coiled on the mandrel, as will be evident from a consideration of Fig. 9.

After the operation of the cut-off mechanism as just described, continued rotation of the cam shaft 18 will release the roller 103 from the cam projection 104a, whereupon the lever 101 will be turned by the spring 105 to withdraw the shaft 95 and its blade 9 to the position shown in Fig. 4. After this occurs, the roller 28 on the lever arm 27 rides out of the cam depression 30, thereby reengaging the clutch elements 22 and 23, and causing the rolls 6 to resume coiling of the stock into helical form. Upon resumption of coiling, the end of the stock which has just been severed passes freely between the separated blades 9 and 10, the coiling continuing until the rolls 6 again come to rest, whereupon the cutter blade 9 will again be operated to cut another coil from the helix having the same number of convolutions as the coil previously severed.

Referring again to Fig. 9, it will be seen that the holder 93 for the stationary cutting blade 10 provides for adjustment of the blade 10, both with respect to the movable blade 9 and the convolutions of the helix being coiled. The blade 10 is received in a slot 106 provided in the holder, the slot 106 being wider than the blade 10, in one dimension, to receive a wedge 107 extending along one side of the blade 10. The face 107a of the wedge 107 opposite to the blade 10 is beveled and coacts with a similarly beveled face 106a of the slot 106, and set screws 108 threaded through the opposite wall of the slot 106 serve to hold the blade against the wedge 107.

When it is desired to set the blade 10 with respect to the movable blade 9, so that the cutting edges are in proper relation for severing the stock therebetween, it is possible to shift the blade 10 bodily within the slot 106 by moving the wedge 107 longitudinally. For this purpose, the wedge 107 provides a laterally projecting lug 109 beyond the holder 93, and a stud 110 turnable in the lug 109 is threaded into the holder 93. By turning the stud 110, it is possible to shift the wedge 107 longitudinally in the slot 106, and the cooperation between the engaged beveled faces 106a and 107a causes the blade 10 to be shifted bodily to bring its cutting edge in proper alinement with the cutting edge of the movable blade 9. Before making such an adjustment, the set screws 108 are loosened slightly, and with the set screws loosened it is also possible to move the blade longitudinally so that its cutting end will project the proper amount between the coils of the helix. After such an adjustment, the blade 10 is securely clamped by the set screws 108 in engagement with the wedge 107.

Having described the construction and function of the various parts of the machine, the general mode of operation thereof is briefly, as follows. Before starting the coiling, a mandrel 7 of the desired diameter is mounted on the shaft 46 by means of the nut 54 and the bearing blocks 63 carrying the coiling roll assemblies are adjusted within the frame opening 72 by means of the hand wheels 78 to position the coiling rolls 6 with their peripheries substantially tangent to the shoulder 55 on the mandrel 7. The machine is then turned over by hand to cause the rolls 3 to project the strip 4 on edge through the guide 5 which delivers it into the space between the mandrel 7 and the groove 58 of the first coiling roll 6. As the stock is fed, its advancing end strikes the deflector 11 positioned between the rolls 6, see Fig. 12, which serves to deflect the stock between the second roll 6 and the mandrel 7, thereby initiating the formation of the helix. As best shown in Fig. 1, the deflector 11 is loosely mounted in a holder 111 and is capable of radial adjustment with respect to the axis of coiling by means of a stud 112.

The coiling of the stock into a helix having been initiated by hand as described above, the next step resides in adjusting the rolls 6 to give the desired amount of gripping, in cooperation with the mandrel 7. As previously described in detail, the coiling roll shafts 43 and 51 are capable of axial adjustment to cause the stock to be gripped flatwise between the roll grooves 58 and the shoulder 55 of the mandrel 7, and when this adjustment has been made, the machine is ready for automatic operation. Upon rotation of the drive shaft 13 and operation of the clutch, the rolls 6 and mandrel 7 will be driven in unison, thereby causing one or more convolutions of the helix to be coiled as the stock is fed and deflected around the mandrel by the gripping action of the rolls 6. As the coiled stock passes from between the lower roll 6 and the mandrel 7, the pitch tool 8 engaging the stock at an angle to the axis of coiling serves to impart the desired pitch to the coil, as clearly shown in Fig. 2. As the coiling continues, the clearing tool 12 carried by the guide 5, as shown in Fig. 1, serves to deflect the convolutions of the helix away from the upper coiling roll.

After one or more convolutions of the helix have been coiled, operation of the cam 29 disengages the clutching elements 22 and 23 on the drive shaft 13, whereupon the coiling rolls and mandrel come to rest. The cam 104 thereupon operates the lever 101 to move the shaft 95 and cause the blade 9 to sever the helix in cooperation with the stationary blade 10. Continued rotation of the drive shaft from this point causes the spring 105 acting on the lever 101 to withdraw the blade 9 and coiling is resumed when the cam 29 reengages the clutch elements. Therefore, as long as the drive shaft 13 is rotating, the machine will automatically coil and cut helices of exactly the same length and pitch, the number of convolutions in each helix being dependent upon the speed of the cam shaft 18, as determined by the change gearing 20 between the shafts 13 and 18. Obviously, the greater the difference between the speeds of rotation of the shafts 13 and 18, the greater the number of revolutions that the coiling rolls 6 will make while the cam shaft is making one complete revolution.

I claim:

1. In a machine of the class described, the combination with a rotatable mandrel and a rotatable coiling roll, said mandrel and roll providing overlapping annular faces, and means for delivering metal strip on edge between the overlapping faces of said mandrel and roll, of a thrust bearing assembly for rotatably supporting said roll against axial movement, and means for moving said bearing assembly bodily to procure axial shifting of said roll for the purpose of varying the spacing between said overlapping annular faces and thereby cause said strip to be gripped flatwise between said roll and mandrel with a predetermined pressure.

2. In a machine of the class described, the combination with a rotatable mandrel, a shaft carrying a roll having an annular face in overlapping

relation to an annular face on said mandrel and a bearing bracket for rotatably supporting said shaft, of a thrust bearing for rotatably supporting said roll shaft against axial movement and a sleeve surrounding said thrust bearing in threaded engagement with said bearing bracket, turning of said sleeve serving to shift the roll, shaft and bearing assembly bodily to vary the distance between the overlying faces of said roll and mandrel.

3. In a machine of the class described, the combination with a rotatable mandrel and a shaft carrying a roll having an annular face in overlapping relation to an annular face on said mandrel, of a thrust bearing for rotatably supporting said roll shaft against axial movement, and rollers mounted on the fixed axes spaced from the axis of said roll shaft and engaging the surface thereof above and on opposite sides of the roll shaft axis for receiving the radial thrust of said roll.

4. In a machine of the class described, the combination with a rotatable mandrel and a shaft carrying a roll having an annular face in overlapping relation to an annular face on said mandrel, of a thrust bearing for rotatably supporting said roll shaft against axial movement, a sleeve bearing surrounding said shaft and hardened rollers mounted on fixed axes spaced from the axis of said roll shaft and engaging the surface of said shaft above and on opposite sides of its axis for receiving the radial thrust of said roll without substantial wear on said sleeve bearing.

5. In a machine of the class described, the combination with a rotatable mandrel and a shaft carrying a roll having an annular face in overlapping relation to an annular face on said mandrel, of a bracket carrying a sleeve bearing for rotatably supporting said roll shaft, a thrust bearing assembly adjustable in said bracket for shifting said roll and shaft axially, rollers mounted on fixed axes in said bracket with their peripheries in engagement with the surface of the roll shaft for receiving the axial thrust of said roll, and means for adjusting said bracket radially with respect to the axis of said mandrel for varying the distance between said mandrel and said roll shaft.

6. In a machine of the class described, the combination with a rotatable mandrel and rotatable coiling rolls, said mandrel and rolls providing overlapping annular faces, means for delivering metal strip on edge between the overlapping faces of said mandrel and rolls, and means for driving said mandrel and rolls in unison to cause them to grip said strip flatwise and coil it in helical form, of a disk carried by a shaft freely rotatable about an axis inclined with respect to the axis of the helix being coiled, a bearing carrying said shaft, means for adjusting said bearing axially with respect to the helix being coiled for determining the pitch of said helix, and means providing for adjustment of the angular relation between the axis of said shaft and the axis of the helix being coiled to cause said disk to engage said strip flatwise between adjacent coils of the helix.

7. In a machine of the class described, the combination with a rotatable mandrel and rotatable coiling rolls, said mandrel and rolls providing overlapping annular faces, means for delivering metal strip on edge between the overlapping faces of said mandrel and rolls, and means for intermittently driving said mandrel and rolls to cause them to grip said strip flatwise and coil it in helical form, of a stationary cutter blade projecting between the endmost coils of the helix, a reciprocatory head carrying a second blade, and means for moving said head parallel to the axis of the helix, between coiling operations, to engage the second blade with the endmost coil just beyond the coiling rolls and sever it in cooperation with said first-named blade.

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