Feb. 14, 1933.

M. NIGRO

1,897,855

SPRING COILING MACHINE

Filed May 31, 1930

5 Sheets-Sheet 1

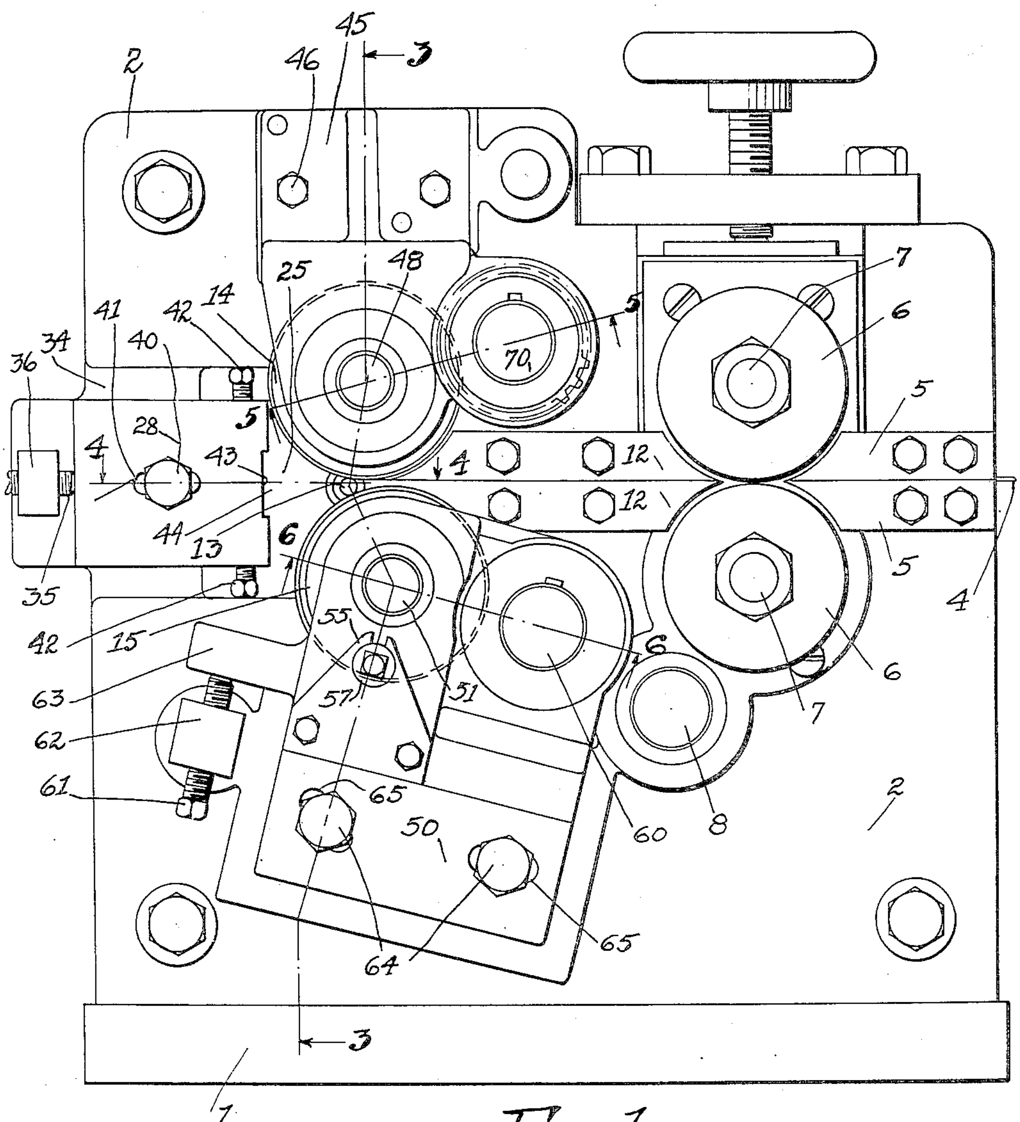

Fig. 1.

Inventor:
Michel Nigro
By Owen W. Kennedy
Attorney

Feb. 14, 1933. M. NIGRO 1,897,855

SPRING COILING MACHINE

Filed May 31, 1930 5 Sheets-Sheet 2

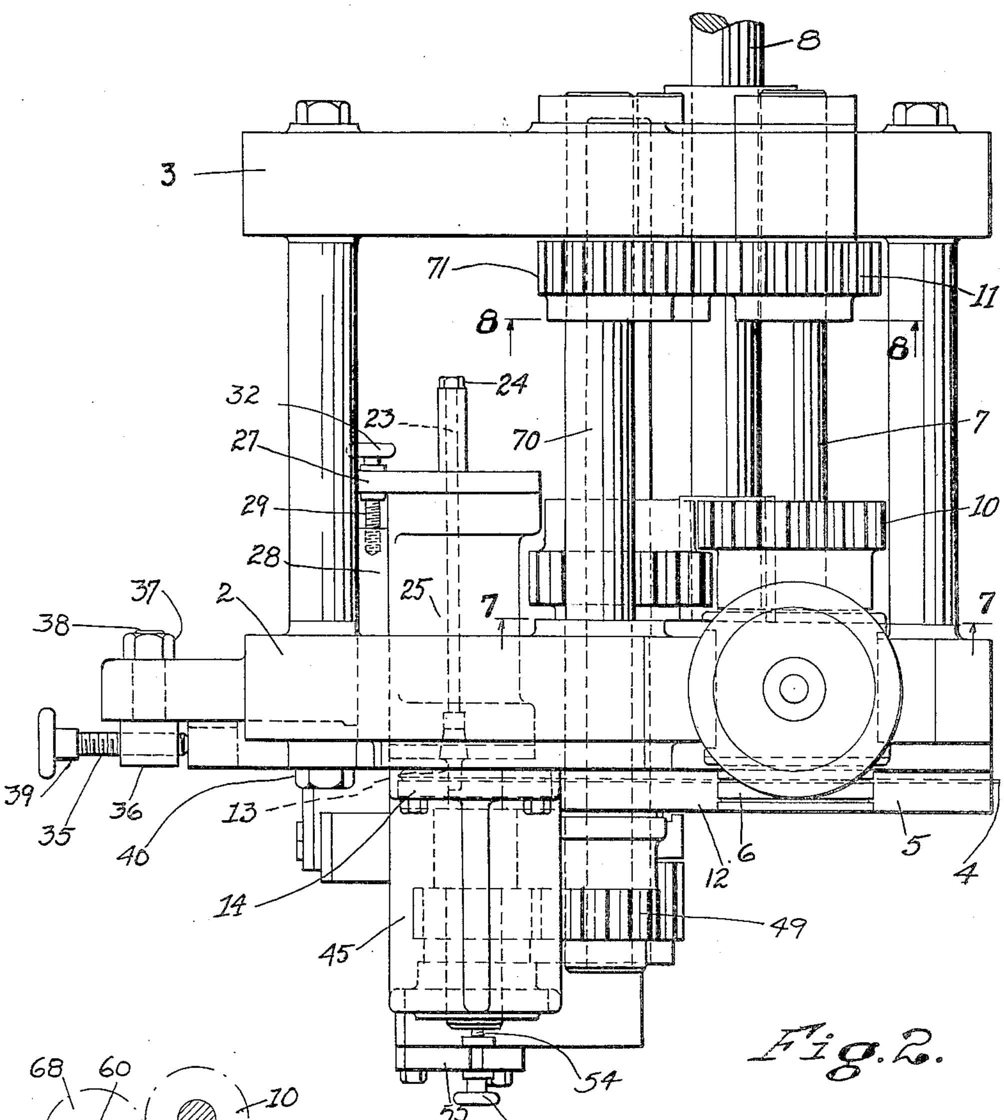

Fig. 2.

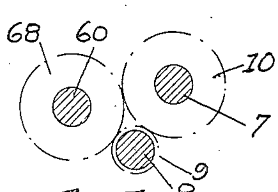

Fig. 7.

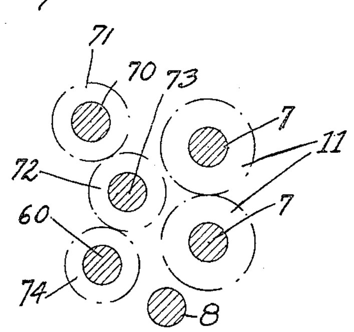

Fig. 8.

Inventor
Michel Nigro
By
Owen W. Kennedy
Attorney

Feb. 14, 1933. M. NIGRO 1,897,855

SPRING COILING MACHINE

Filed May 31, 1930 5 Sheets-Sheet 3

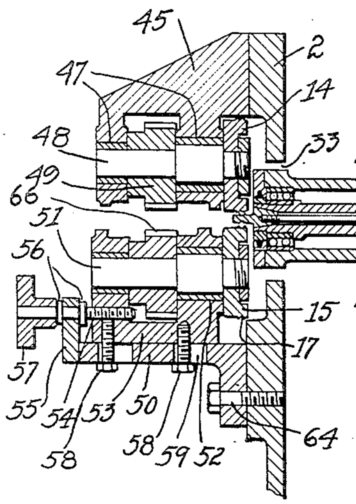

Fig. 3.

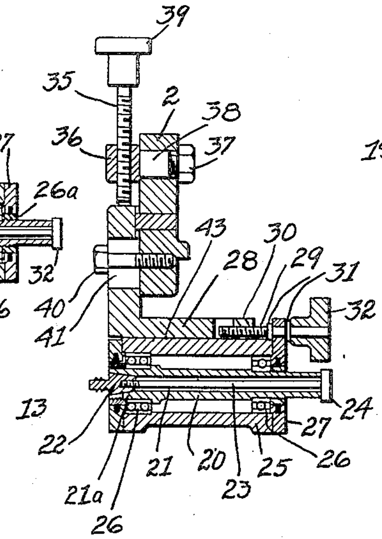

Fig. 4

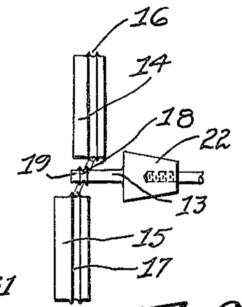

Fig. 9.

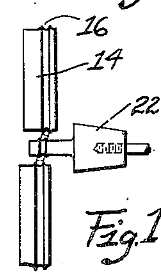

Fig. 10.

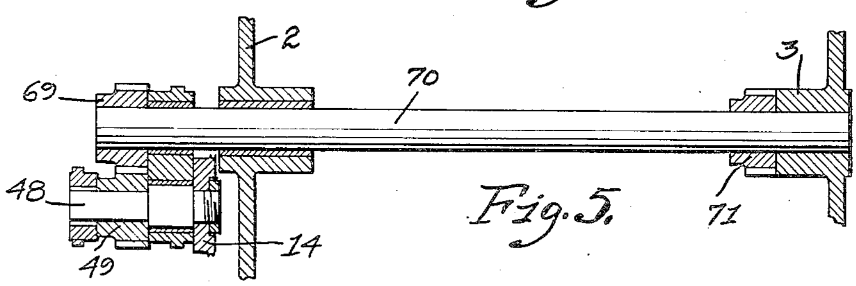

Fig. 5.

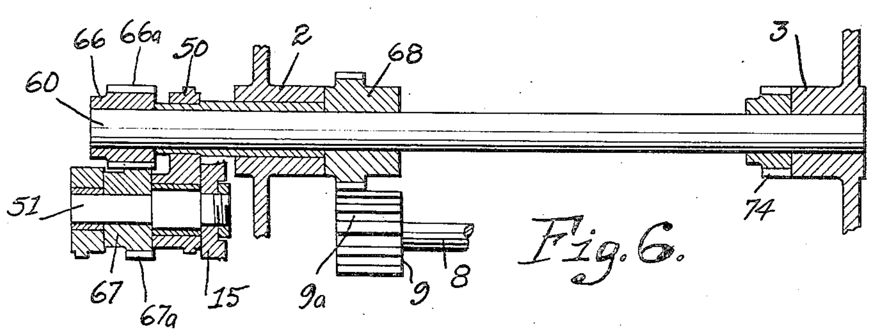

Fig. 6.

Inventor:
Michel Nigro
By Chas. W. Kennedy
Attorney

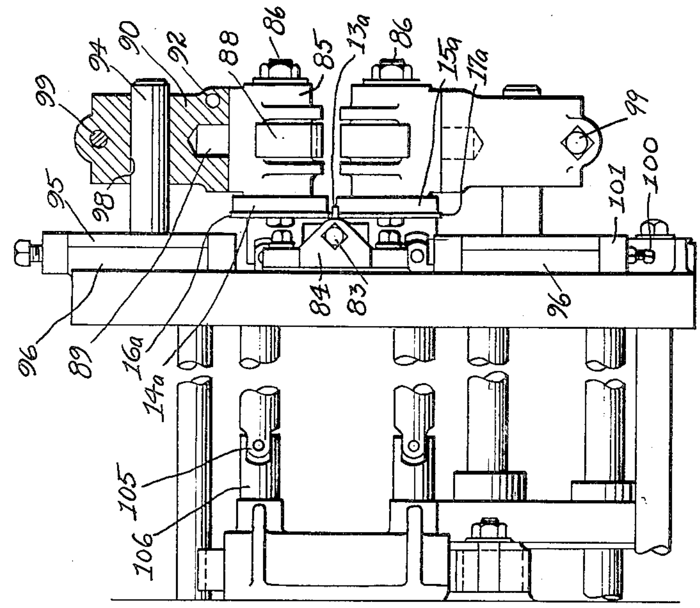

Fig. 13.

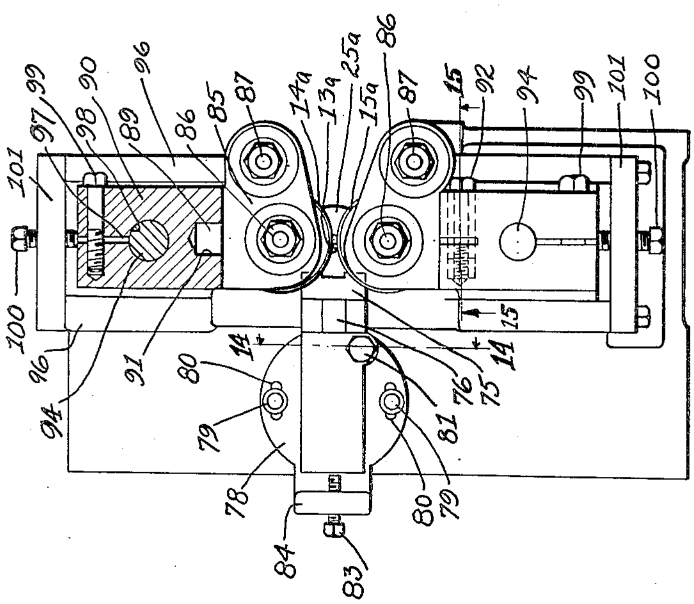

Fig. 11

Inventor
Michel Nigro
By Owen W. Kennedy
Attorney

Feb. 14, 1933. M. NIGRO 1,897,855

SPRING COILING MACHINE

Filed May 31, 1930 5 Sheets-Sheet 5

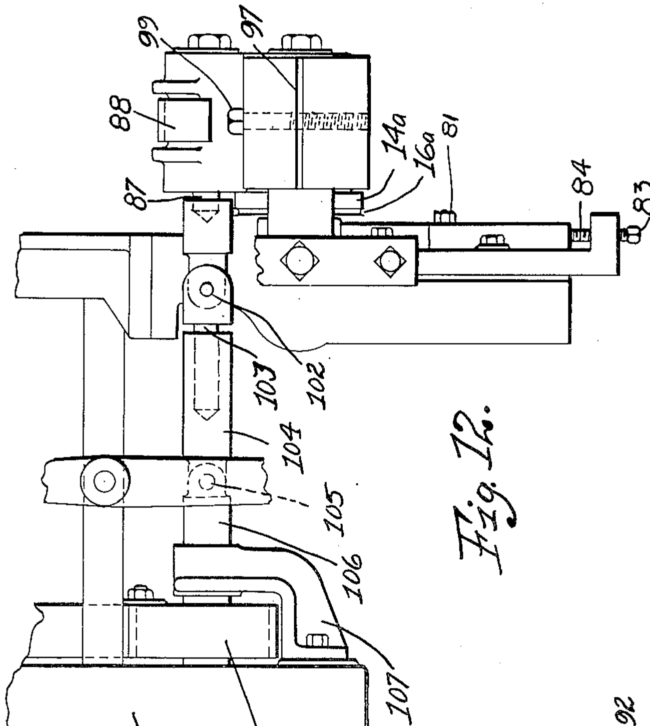

Fig. 12.

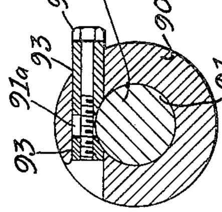

Fig. 15.

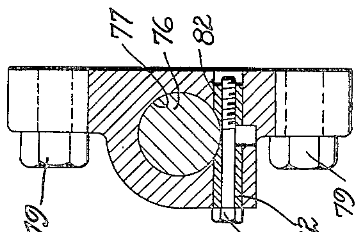

Fig. 14.

Inventor
Michel Nigro
By Owen W. Kennedy
Attorney

Patented Feb. 14, 1933

1,897,855

UNITED STATES PATENT OFFICE

MICHEL NIGRO, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO SLEEPER & HARTLEY, INC., OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

SPRING COILING MACHINE

Application filed May 31, 1930. Serial No. 458,333.

The present invention relates to spring coiling machines and has for its object to provide a spring coiling machine particularly characterized by its ability to coil springs of different diameter and pitch with an ease of adjustment not heretofore obtainable in machines of this type.

Generally stated, the machine of the present invention contemplates the formation of the springs by means of a rotatable abutment cooperating with rotatably driven coiling rolls, with both the abutment and rolls adjustable with respect to the longitudinal axis of coiling, as well as radially with respect to the coiling surfaces of revolution. By reason of the above mentioned means of adjustment, it is possible to set the machine for the formation of coils of different pitch and diameter. 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 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. 1 looking in the direction of the arrows.

Fig. 4 is a horizontal sectional view along the line 4—4 of Fig. 1 looking in the direction of the arrows.

Fig. 5 is a fragmentary sectional view along the line 5—5 of Fig. 1 looking in the direction of the arrows.

Fig. 6 is a fragmentary sectional view along the line 6—6 of Fig. 1 looking in the direction of the arrows.

Fig. 7 is a fragmentary vertical sectional view along the line 7—7 of Fig. 2 looking in the direction of the arrows and illustrating the gearing at the front end of the machine.

Fig. 8 is a fragmentary sectional view along the line 8—8 of Fig. 2 looking in the direction of the arrows and illustrating the gearing at the rear end of the machine.

Fig. 9 is a fragmentary view based on Fig. 3 illustrating the relation between the coiling tools.

Fig. 10 is a fragmentary view similar to Fig. 9, illustrating the formation of a spring of different diameter and pitch from the spring being coiled in Fig. 9.

Fig. 11 is a view in front elevation of a portion of the machine, showing a modification in the manner of mounting the coiling tools.

Fig. 12 is a plan view of the parts shown in Fig. 11, certain portions being shown in section.

Fig. 13 is a view in side elevation of the parts shown in Fig. 11.

Fig. 14 is a fragmentary sectional view along line 14—14 of Fig. 11, looking in the direction of the arrows.

Fig. 15 is an enlarged detail section on the line 15—15 of Fig. 11, looking in the direction of the arrows.

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

Referring first to Figs. 1 and 2, the machine comprises a base 1 from which extend spaced vertical frame members 2 and 3. Wire stock 4 is led into the right hand side of the machine, as viewed in Fig. 1, through a pair of cooperating guides 5, 5 which deliver the stock 4 to a pair of feed rolls 6, 6 disposed above and below the line of feed. The feed rolls 6, 6 are mounted on shafts 7, 7 that are adapted to be rotatably driven in unison from a main drive shaft 8 journalled in the frame members 2 and 3 adapted to be rotatably driven from any suitable source of power, not shown.

As best shown in Figs. 7 and 8 the lower feed roll shaft 7 is driven directly from the power shaft 8 from a pinion 9 and gear 10 adjacent the front frame member 2, while the parallel shafts 7, 7 are driven in unison and at the same speed, although in opposite directions, by intermeshing gears 11 adjacent the rear frame member 3, portions of this gearing appearing in Fig. 2. As a result of the above described gearing rotation of the power shaft 8 causes the feed rolls 6 to be driven at the same speed in opposite directions to feed the wire stock 4 into a second pair of guides 12, 12 which serve to deliver the stock to a coiling abutment 13 and coiling rolls 14 and 15, which cooperate to form the wire stock into a coil in a manner which will be hereinafter described.

As best shown in Figs. 3 and 9, the coiling rolls 14 and 15 are provided with peripheral grooves 16 and 17, respectively, which cooperate with a groove 18 provided on a reduced nose portion 19 of the abutment 13 to form the wire stock 4 fed from the guides 12 into a helical coil which will move away from the front of the machine as it is coiled. It is obvious from a consideration of Fig. 9 that the diameter of the helix being coiled will depend upon the radial spacing of the grooves 16, 17 and 18 from the axis of coiling, while the pitch of the helix will depend upon the relation of the grooves 16, 17 and 18 with respect to the longitudinal axis of coiling and, as previously pointed out, one of the objects of the present invention is to provide means whereby these relations may be readily varied to cause the machine to form helical coils of different diameter and pitch. At this point, also, it should be pointed out that, as clearly shown in Fig. 3, the mounting of the abutment 13 and of the coiling rolls 14 and 15 on opposite sides of the front frame member 2 permits the adjustments of the coiling tools to be carried out in an extremely convenient manner without interference between the several tools, it being possible to shift both the abutment and the roll 15 with respect to the coiling axis either radially, or longitudinally, without making it necessary to remove any of the tools.

As best shown in Figs. 1, 3 and 4, the coiling abutment 13 is carried by a sleeve 20 providing a longitudinal opening 21, the end of which provides a tapered seat 21*a* for receiving a correspondingly tapered portion 22 of the abutment 13. The abutment is held in the seat 21*a* by means of a rod 23 threaded into the tapered portion 22 at one end with a head 24 bearing on the end of the sleeve 20, turning of the head 24 being adapted to lock the abutment in position in engagement with the seat 21*a*. The above arrangement provides means whereby the abutment may be readily removed from the sleeve 20, or centered therein, when placing the abutment in position on the sleeve.

The abutment carrying sleeve 20 is rotatably supported within an outer sleeve 25 by anti-friction bearings 26 held in posititon on the sleeve 20 by means of lock nuts 26*a* threaded on the sleeve 20 with end plates 27 holding the inner sleeve 20 in position within the outer sleeve 25. The sleeve 25 carrying the abutment assembly is mounted for longitudinal adjustment on a bracket 28 by means of a stud 29 threaded into a lug 30 provided on the bracket 28. The stud 29 passes through the rear end plate 27 of the sleeve 25 with collars 31 on opposite sides of the plate 27, so that turning the adjusting stud 29 by means of a suitable handle 32 causes the sleeve 25 with the abutment assembly to be shifted longitudinally on the bracket 28. As best shown in Fig. 3, the frame member 2 provides an opening 33 for receiving the front portion of the sleeve 25 with the nose portion 19 of the abutment 13 projecting beyond the face of the frame 2.

As best shown in Fig. 1, the abutment supporting bracket 28 is right angled and extends around to the front face of the frame member 2 where it is in engagement with a recessed seat 34 provided in the frame member 2 adjacent the opening 33. The whole bracket 28 carrying the abutment assembly is adapted to be adjusted laterally with respect to the axis of coiling by means of a stud 35 coacting with a nut 36 carried by the frame member 2. This construction is clearly shown in Fig. 4, wherein the nut 36 is shown as being clamped to the frame 2 by means of a lock nut 37 coacting with a threaded portion of a shank 38 extending from the nut 36 into the frame 2. The adjusting stud 35 is provided with a handle 39, whereby it may be conveniently turned to shift the bracket 28 on the frame 2, and after the bracket has been adjusted, it can be locked in its adjusted position by means of a bolt 40 passing through a slot 41 in the bracket 28 and threaded into the frame 2.

In Fig. 1 there are also shown a pair of studs 42 threaded into the top and bottom faces of the bracket 28 with their heads abutting surfaces of the frame member 2 above and below the seat 34. By means of the studs 42, the bracket 28 with the abutment assembly can be adjusted vertically on the frame member 2 to shift the axis of the abutment 13. Fig. 1 also shows a groove 43 formed on the bracket 28, which groove receives a tongue 44 provided on the outer sleeve 25 so as to guide the sleeve 25 on the bracket 28 when the abutment assembly is shifted longitudinally, as previously described with reference to Fig. 4.

As best shown in Figs. 1 and 3, the upper coiling roll 14 is carried by a bracket 45 which overhangs the abutment assembly and is secured to the frame member 2 by means of bolts 46, shown in Fig. 1. The bracket 45 provides bearings 47, 47 for a shaft 48 which carries the roll 14 at its inner end. The roll shaft 48 also carries a gear 49 intermediate the bearings 47, and the manner in which the shaft 48 is driven by the gear 49 will be hereinafter described.

The lower coiling roll 15 is carried by a bracket 50, which, as best shown in Fig. 3, projects forwardly from the frame member

2 beneath the axis of the abutment 13. The roll 15 itself is carried at the inner end of a shaft 51 supported by bearings 52 provided in a sleeve 53 which is adjustable on the bracket 50. For the purpose of adjusting the roll 15, a stud 54 is threaded into the sleeve 53 and passes through a lug 55 secured to the bracket 50 with suitable collars 56 provided, whereby turning of the stud 54 by its handle 57 causes the bearing sleeve 53 to shift the roll 15 axially with respect to the abutment 13. In order to lock the bearing sleeve 53 in position on the bracket 50 after it has been adjusted, bolts 58 are provided which pass through slots 59 in the bracket 50 and are threaded into the sleeve 53.

As best shown in Fig. 1, the bracket 50, as a whole, is angularly adjustable about the axis of a shaft 60 which is journalled in both frame members 2 and 3. By reason of its pivotal support on the shaft 60 the bracket 50 tends to swing downwardly about the axis of the shaft 60 away from the abutment 13 and the distance between the lower face of the abutment 13 and the periphery of the lower coiling roll 15 is determined by means of an adjusting stud 61 threaded into a lug 62 projecting forwardly from the frame member 2. The upper end of the stud 61 bears against an ear 63 formed integrally with the bracket 50, so that the stud 61 positively determines the spacing of the periphery of the coiling roll 15 from the lower surface of the abutment 13. In order to secure the bracket 50 to the frame member 2 following an adjustment thereof by the stud 61, and in order to relieve the stud 61 from the direct pressure of the bracket 50, bolts 64 which pass through curved slots 65 in the bracket 50 are threaded into the frame member 2, the slots 65 being concentric about the axis of the shaft 60.

As best shown in Fig. 6, the shaft 60 extends through the bracket 50 and carries at its end a gear 66 in mesh with a gear 67 mounted on the shaft 51 which supports the lower coiling roll 15. It will be noted that the teeth 66*a* of the gear 66 are longer than the teeth 67*a* of the gear 67, so as to insure proper meshing of the gears 66 and 67 when the shaft 51 is shifted axially with respect to the shaft 60 by means of the stud 54 cooperating with the sleeve 50, as previously described. The shaft 60 is driven directly from the power shaft 8 through the engagement of a gear 68 thereon with the pinion 9 on the shaft 8, only a portion of which is shown in Fig. 6. As previously pointed out, the pinion 9 is also in engagement with a gear 10 driving the lower feed roll shaft 7, and as shown in Fig. 6, the teeth 9*a* of the pinion 9 are long enough to be engaged simultaneously with the gears 10 and 68.

As best shown in Fig. 5 the gear 49 on the upper coiling roll shaft 48 is in mesh with a gear 69 mounted on a shaft 70 extending parallel to the shaft 60 and supported in both frame members 2 and 3. The rear end of the shaft 70 carries a gear 71 which is adapted to be driven from the lower roll driving shaft 60 by means of the arrangement of gearing, shown in Fig. 8. This gearing comprises a gear 72 mounted on a stud 73, which gear 72 is in mesh with the gear 71 on the shaft 70 as well as a gear 74 on the shaft 60. The gears 71, 72, and 74 being of the same diameter and having the same number of teeth, the shafts 60 and 70 are driven in the same direction of rotation, namely counterclockwise, as viewed in Fig. 1. Consequently, the coiling roll shafts 48 and 51 are both driven in a clockwise direction, which results in the surface of the upper roll 14 moving across the upper surface of the abutment 13 in the direction of wire feed, while the surface of the lower roll 15 moves in the opposite direction with respect to the lower surface of the abutment 13, which results in the coiling action of the rolls, in cooperation with the abutment.

In the operation of the machine, a coil is started by feeding the stock 4 by hand and winding several convolutions after which power is applied to the shaft 8 to continuously drive the feed rolls 6 and coiling rolls 14 and 15. As the stock 4 is forcibly fed to the rotatably driven coiling rolls 14 and 15 and freely rotatable abutment 13 it is formed into a helix which moves away from the abutment 13, as indicated in Fig. 9. Obviously the relation between the grooves 16 and 17 of the coiling rolls with respect to the groove 18 on the abutment 13 will determined the pitch of the helix being formed, while the radical spacing of the peripheries of the abutment and coiling rolls with respect to the coiling axis will determine the diameter of the helix.

When it is desired to change the diameter or pitch of the helix being formed, both the abutment 13 and the lower roll 15 can be adjusted in the manner previously described to secure the desired results. For example, the abutment 13 can be shifted longitudinally with respect to the coiling axis by turning the handle 32 while the roll 15 can be similarly shifted by turning the handle 57, in order to change the pitch of the helix. Furthermore, the abutment 13 can be shifted with respect to the stationary guides 12 by means of the handle 39 on the stud 35 which causes bodily shifting of the whole bracket 28 with the abutment assembly thereon. Further adjustment of the axis of the abutment 13 can be secured by the studs 42 cooperating with the bracket 28 and the frame 2. The distance between the periphery of the lower roll 15 and the abutment 13 can be varied by means of the stud 61 cooperating with the pivotally mounted bracket 50 carrying the roll 15. Following any of the above described adjustments, the abutment bracket 28 can be locked on the frame by means of the bolt 40, while the roll bracket 50 can be locked in its adjusted position by means of the bolts 64. Following shifting of the roll 15 along the coiling axis, the roll coiling sleeve 53 can be locked in position by means of bolts 58.

From a comparison of Figs. 9 and 10 it is evident that the machine provides a wide range of adjustment in the production of coils of different diameter and pitch, the setting of the coiling tools shown in Fig. 9 being such as to cause the formation of a helix of greater diameter and of greater pitch than the helix being formed with the setting of coiling tools shown in Fig. 10.

Referring now to Figs. 11 to 15, inclusive, there is shown a portion of the machine with the coiling rolls and abutment mounted in a different manner, so as to obtain adjustment of all of the coiling tools in any one, or all, of three planes. In Figs. 11 to 15, some of the portions of the machine which are constructed in the same manner as previously described with reference to Fig. 1 are omitted for the sake of simplifying the drawings and only the modified manner of mounting the coiling tools will be described, like reference characters being used wherever possible. As best shown in Figs. 11 and 13, the coiling abutment 13*a* is rotatably supported in the sleeve 25*a* in substantially the same manner as shown in Fig. 4, the sleeve 25*a* being capable of longitudinal adjustment on a bracket 75 that is capable of angular adjustment about its own longitudinal axis. To this end, the bracket 75 provides a shank 76 that is received in a cylindrical opening 77 formed on a plate 78 secured to the frame by bolts 79 threaded into the frame and received in curved elongated slots 80. The slots 80 are concentric about the center of the plate 78, so that the latter may be swung on a horizontal axis parallel to the axis of coiling, the bolts 79 serving to clamp the plate 78 in position.

The cylindrical shank 76 of the bracket 75 is clamped in the opening 77 of the plate 78 by means of a bolt 81 cooperating with blocks 82 adapted to engage the shank 76 on opposite sides of its axis, see Fig. 14. Turning the bolt 81 into one block 82 draws them together, thus serving to clamp the shank 76 in any desired angular position with respect to the longitudinal axis of the shank 76 which extends at right angles to the pivotal axis of the plate 78. By turning the bracket 75 about the axis of its shank, it is possible to skew the groove 18*a* of the coiling abutment 13*a* as will be apparent from Fig. 12. In addition, the bracket 75 may be adjusted longitudinally of the shank 76 by means of a stud 83 in threaded engagement with a lug 84 projecting from the plate 78, loosening of the bolt 81 permitting the shank 76 to be adjusted in either direction, lengthwise.

Referring to Figs. 11 and 13, the coiling rolls 14*a* and 15*a* are each mounted on a holder 85 that carries a shaft 86 for supporting the roll and a parallel shaft 87 for driving the shaft 86 through intermeshing gears 88. The holders 85 are identical in construction and each is capable of angular adjustment about a vertical axis passing through a supporting stud 89, which stud 89 is adapted to be clamped in a sleeve 90 providing opening 91. As best shown in Fig. 15, each sleeve 90 provides an opening 91*a* at right angles to the opening 91 and a bolt 92 serves to draw cooperating clamping blocks 93 together to engage the swivel stud 89 and maintain the roll holder 85 any position to give the desired pitch to the groove 16*a* of the roll 14*a*, or the groove 17*a* of the roll 15.

The sleeve 90 is in turn mounted on a horizontally extending shaft 94 projecting forwardly from a block 95 which is capable of vertical adjustment between clamping guides 96. The sleeve 90 is slotted at 97 at one side of the opening 98 which receives the shaft 94, so that the sleeve 90 may be clamped on the shaft 94 by means of a bolt 99 which is adapted to draw the sleeve together on opposite sides of the slot 97 to maintain the sleeve with the roll holder 85 in any desired position along the shaft 94. In order to provide for vertical adjustment of the block 95 which supports the shaft 94, a stud 100 is provided to bear on the end of the block 95, the stud being threaded into a cross bar 101 secured to the vertical guides 96.

In order to provide for driving the shaft 87 of each roll holder 85, so as to permit adjustment of each roll about any one or all of three axes extending at right angles to each other, each shaft 87 provides at its inner end a universal joint 102 for connecting the shaft 87 to an intermediate shaft 103, see Fig. 12. Each intermediate shaft 103 is in turn connected through a sliding sleeve 104 and universal joint 105 to a shaft 106 supported by a bracket 107 projecting forwardly from the frame member 3, as best shown in Fig. 12. Each shaft 106 carries a gear 108 which is in mesh with the gear 72 on the shaft 73, so that rolls 14*a* and 15*a* are driven in the same manner as described with reference to Fig. 8.

With the above described modified manner of mounting the coiling tools it is possible to adjust the coiling abutment and one or both of the rolls in any one or all of three planes, so as to vary the pitch and diameter of the springs coiled by the machine. Thus the coiling abutment can be adjusted longitudinally of the axis of coiling by means of the handle 32, shown in Fig. 4, and at the same time the abutment 13*a* is also capable of both angular and longitudinal adjustment with respect to the axis of the holder shank 76. Furthermore, each roll 14*a* or 15*a* may be adjusted so that its groove will be skewed with respect to the axis of coiling by swiveling the roll holder 85 on its stud 89 within the supporting sleeve 90. In addition to this adjustment, each roll holder 85 may be moved back and forth along the axis of coiling on its supporting shaft 94, while radial adjustment of the roll can be obtained through the slidable block 95 which supports the shaft 94.

I claim,

1. In a machine of the class described, the combination with means for feeding wire in a straight line in the direction of a rotatable abutment and rotatably driven coiling rolls arranged above and below the axis of said abutment, of means for separately varying the coiling relation of said abutment and at least one of said rolls in a direction parallel to the axis of rotation of said abutment to control the pitch of the helix into which the said wire is formed by the cooperation of said abutment, said rolls, and said feeding means.

2. In a machine of the class described, the combination with a rotatable abutment and rotatably driven coiling rolls arranged about the horizontal axis of coiling, of means for adjusting said abutment and at least one of said rolls in at least two of three planes at right angles to each other, one of said adjustments for said abutment and rolls being parallel to the axis of rotation of said abutment.

3. In a machine of the class described, the combination with a rotatable abutment and rotatably driven coiling rolls arranged about a horizontal axis of coiling, and means for feeding wire towards said rolls transversely to the axis of coiling, of means for shifting both said abutment and at least one of said rolls along the axis of coiling to vary the pitch of the helix into which the wire is coiled by the cooperation of said abutment and said rolls.

4. In a machine of the class described, the combination with a rotatable abutment and rotatably driven coiling rolls arranged about a horizontal axis of coiling, and means for feeding wire towards said rolls transversely to the axis of coiling, of means for shifting the axis of rotation of said abutment and at least one of said rolls with relation to the axis of coiling to vary the diameter of the helix into which said wire is coiled by the cooperation of said abutment and said rolls.

5. In a machine of the class described, the combination with a rotatable abutment and rotatably driven coiling rolls arranged about a horizontal axis of coiling, and means for feeding wire towards said rolls transversely to the axis of coiling, of means for shifting the axes of said abutment and at least one of said rolls out of parallelism with the axis of coiling to vary the pitch of the helix into which said wire is coiled by the cooperation of said abutment and said rolls.

6. In a machine of the class described, the combination with a rotatable abutment and rotatably driven coiling rolls arranged about a horizontal axis of coiling, and means for feeding wire towards said rolls transversely to the axis of coiling, of means for swiveling said abutment and at least one of said rolls about axes at right angles to the axes of rotation of said abutment and said rolls.

MICHEL NIGRO.