

July 12, 1932.

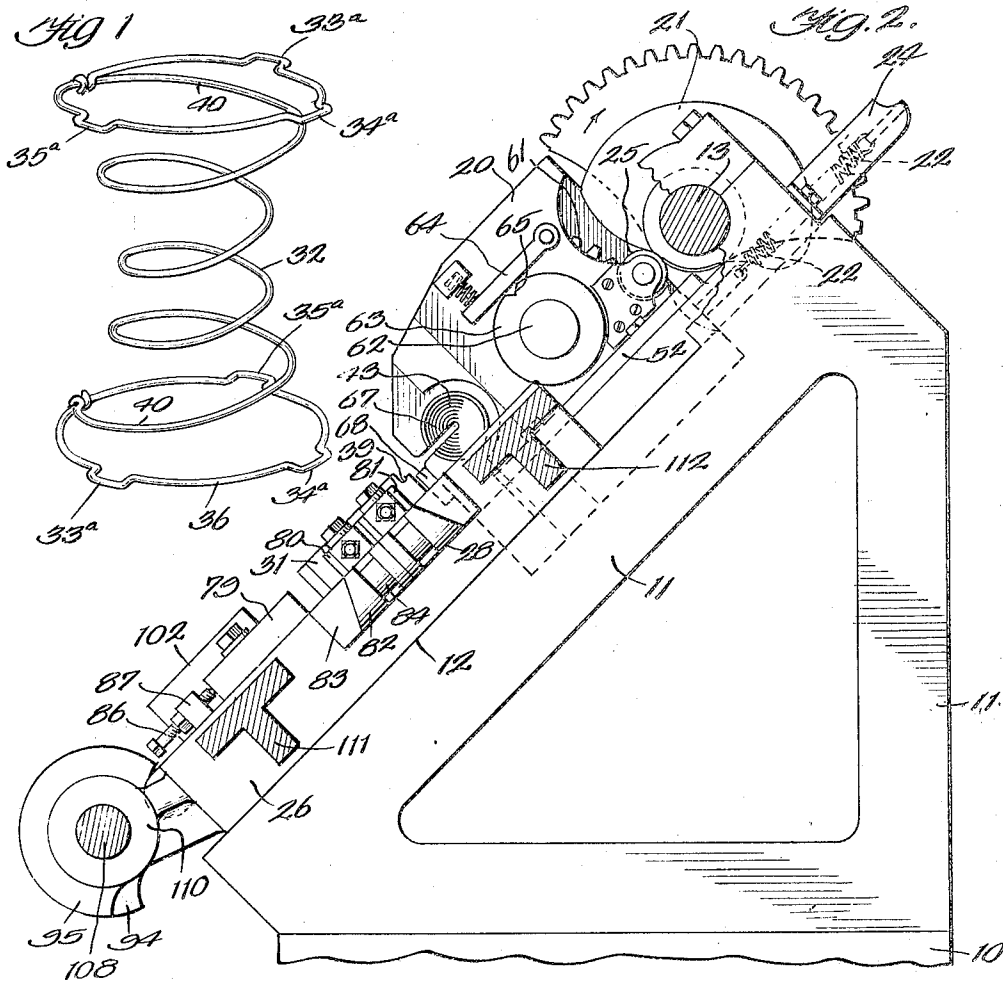
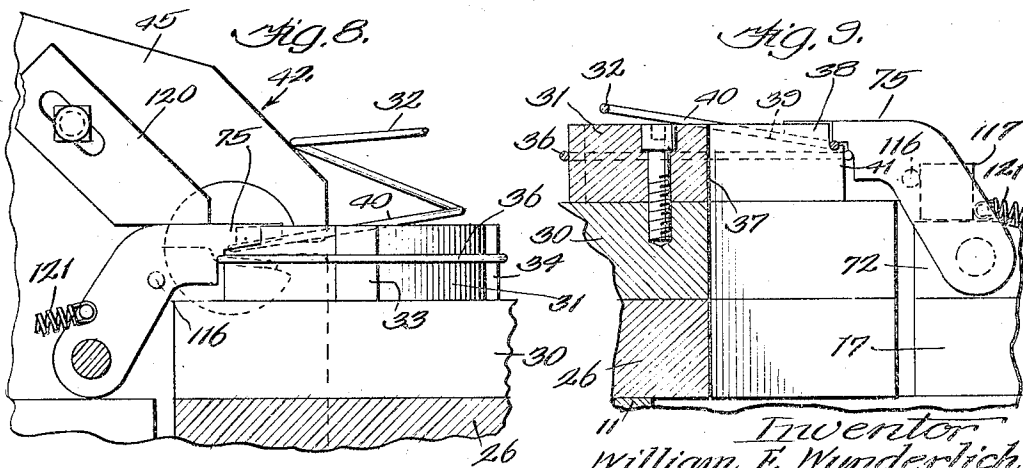
W. E. WUNDERLICH

1,867,128

SPRING FORMING MACHINE

Filed Feb. 21, 1931

4 Sheets-Sheet 1



Inventor
William E. Wunderlich
By John E. Titus atty.

July 12, 1932.

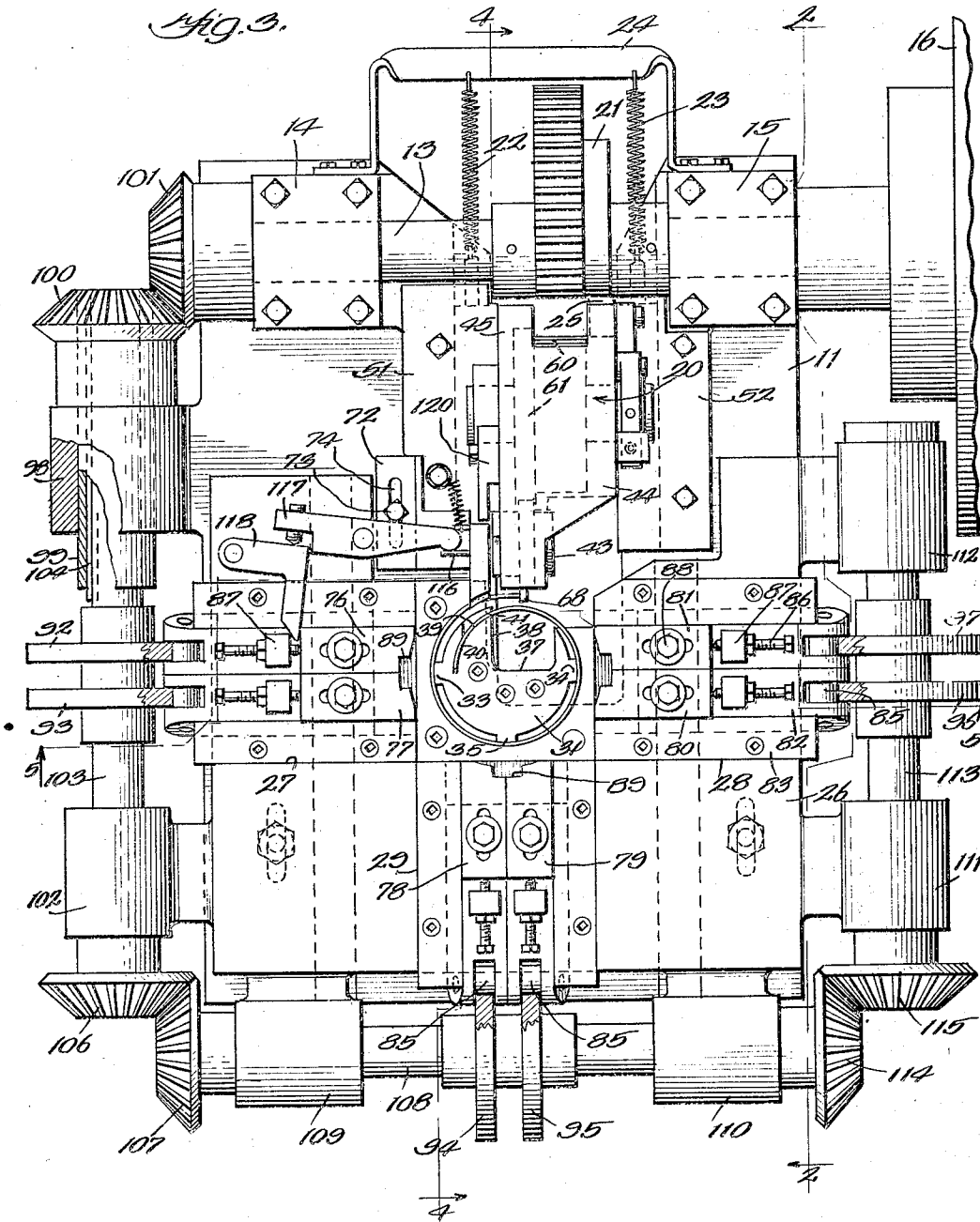
W. E. WUNDERLICH

1,867,128

SPRING FORMING MACHINE

Filed Feb. 21, 1931

4 Sheets-Sheet 2



Inventor:
William E. Wunderlich
By John E. Titus atty.

July 12, 1932.

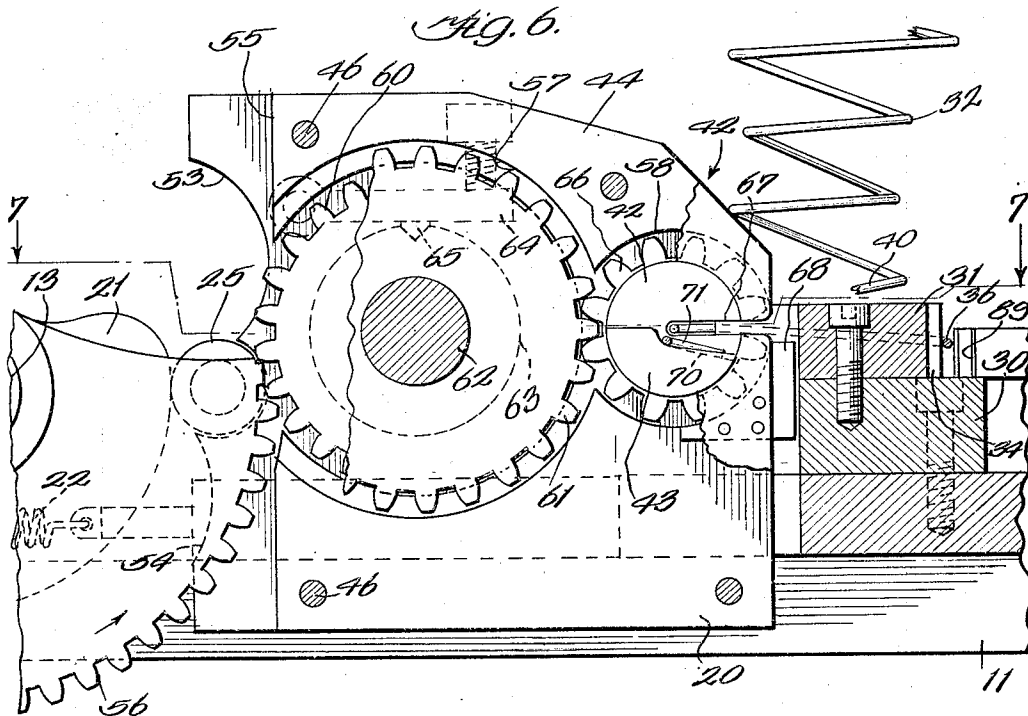
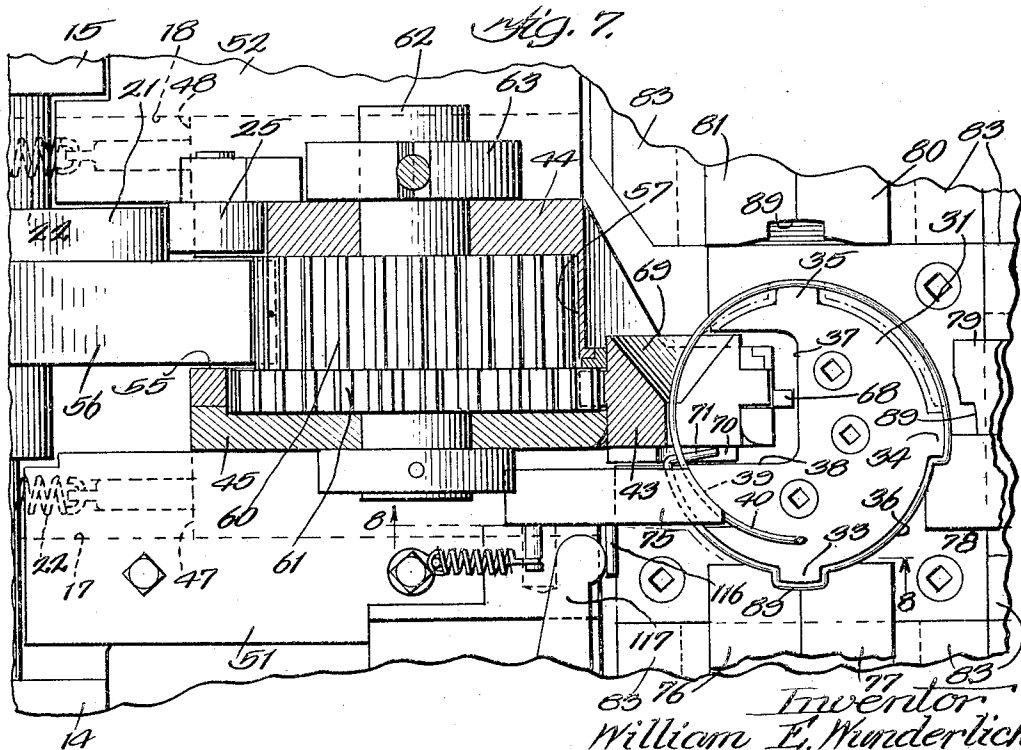
W. E. WUNDERLICH

1,867,128

SPRING FORMING MACHINE

Filed Feb. 21, 1931

4 Sheets-Sheet 4



Inventor
William E. Wunderlich
By John E. Titus atty

UNITED STATES PATENT OFFICE

WILLIAM E. WUNDERLICH, OF MUNCIE, INDIANA, ASSIGNOR TO THE MOORE COMPANY,
OF MUNCIE, INDIANA, A CORPORATION OF INDIANA

SPRING FORMING MACHINE

Application filed February 21, 1931. Serial No. 517,502.

This invention relates to improvements in spring forming machines, especially machines for making coiled bed or cushion springs, and more particularly to means for closing the end coil and forming loops there-
in.

In the illustrative embodiment of this invention which is shown in the accompanying drawings, a spring is coiled up and presented to the machine. The machine then closes the end coil by wrapping the end around the adjacent coil, and in the same operation forms outwardly projecting loops in the end coil by which the ends of the spring are to be connected to build up the bed spring or cushion. In the particular form of spring shown the connection is accomplished by threading a coiled wire through the loops, the coiled wire extending between the rows of springs engaging the loops of both adjacent springs and also completely around the assemblage of springs. Accordingly, the springs at the edges require loops on three sides, and the springs in the intermediate portion only require loops on two opposite sides. Also, the individual springs are made in different sizes. Accordingly, among the objects of this invention is to provide a machine which is readily adaptable for springs of different sizes or with a different number of loops, or other differences in formation as may be desired.

Other objects of the invention are to provide improved means for twisting over the ends; to provide means for combining the operations of closing the ends and forming the loops so as to produce the springs economically, and to provide simple means for accurately and uniformly effecting the formation of the spring ends.

In the drawings:

Fig. 1 is a perspective view of a completed spring.

Fig. 2 is a side elevation of the operating mechanism of the machine, taken on the line 2—2 of Fig. 3.

Fig. 3 is a face view of the mechanism looking downwardly from the upper left side of Fig. 2.

Fig. 4 is a medial section substantially on the line 4—4 of Fig. 3.

Fig. 5 is a transverse section on the line 5—5 of Fig. 3, looking upwardly toward the twister head.

Fig. 6 is a side view of the twister head and a section of the die block or mandrel, taken substantially on the line 6—6 of Fig. 5.

Fig. 7 is a plan section along the line 7—7 of Fig. 6.

Fig. 8 is a side view of the mandrel and clamp finger, substantially along the line 8—8 of Fig. 7.

Fig. 9 is a reversed view of the mandrel and clamping finger shown in Fig. 8.

The machine is constructed generally along the lines of an inclined punch press, with a base 10 on which is supported a frame 11 having an inclined slide supporting surface 12, and a cam shaft 13 rotatably mounted in spaced bearings 14 and 15 in the upper portion of the frame.

The shaft is driven by means of a fly wheel 16 which is rotatably mounted on the right end of the shaft and is constantly driven, the fly wheel being connectible to the shaft for one revolution by any well known automatically tripped punch-press clutch.

In the guideways 17 and 18, Fig. 5, supported on the inclined face 12 of the frame 11, is slidably mounted a ram 20 which is drawn upwardly into engagement with a cam 21, formed on the shaft 13, by means of springs 22 and 23 which are anchored to a U-shaped bracket 24, the legs of which are bolted to the bearings 15 and 16. The ram is provided with a roller 25 for engaging the cam, and the profile of the cam is such that during the one revolution of the shaft 13 the ram is forced rapidly downward, where it dwells for a little over 120 degrees of the rotation; then it is allowed to return and dwell in the upper position as the single rotation is completed.

On the surface or pad 12 is bolted a rectangular bed plate 26, which is slidably adjustable along said surface to determine the space relationship to the ram. The surface of the bed plate 26 is slotted transversely and also longitudinally to the movement of the

ram to provide the guideways 27, 28 and 29; and at the intersection of the slots is fixedly mounted a block 30 to which is fitted a mandrel or die block 31 for shaping the end of the spring 32, as shown in Fig. 1.

Since these loops 33^a, 34^a and 35^a are required in the end coil 36, corresponding peripheral projections 33, 34 and 35, conforming to the inside of the loops, are provided, the projections 33 and 35 being at the left and right sides, and 34 at the lower side. The upper side of the mandrel is cut away to provide a wide recess 37, leaving a side 38 near the longitudinal center line; and in the upper surface of the mandrel and adjacent the side 38 is formed a helical groove 39 which conforms to the initial portion of the second coil 40 of the spring, the marginal surface adjacent the groove being relieved to form a sloping shelf 41. Thus when the spring 32 is placed on the mandrel, the lower coil 36 encircles said projections and the second coil is engaged in the groove 39, which positions and supports the spring vertically.

The twister head 42, comprising the twisting wheel 43, functions generally in accordance with the mechanism described in the patent to E. E. Eyster, No. 1,287,931, dated December 17, 1918, except that certain modifications and improvements are provided herein, which will be pointed out.

The ram 20, in the lower end of which the twister wheel 43 is rotatably mounted, comprises an upturned block 44 and a cover plate 45, which are fastened together by the screws 46, laterally projecting slides 47 and 48 being provided, which operate, respectively, in the guideways 17 and 18 having the cover plates 51 and 52, as best shown in Fig. 5.

In the upper end of the block 44 are provided clearance recesses 53, 54, for the lobes of the cam 21, and a vertical slot 55 for accommodating the segmental gear 56, fixed on the shaft 13 at the side of the cam. In the left side of the block are provided the intersecting circular recesses 57 and 58, see Fig. 6; and rotatably mounted in the recess 57 is a gear 60 which meshes with the gear segment 56, the gear 60 being turned one complete revolution by the segment. At the side of the gear 60 is secured a gear wheel 61, and the shaft 62, to which the gears are keyed, is provided, at the right-hand side of the block, with an indexing collar 63, pinned to the shaft. As best shown in Fig. 3, the gears are positioned at the end of each stroke of the ram by means of the spring-pressed index lever 64, which is pivotally mounted on the right-hand side of the block 44 and yieldably engages in a notch 65 provided in the collar 63.

The twister wheel 43 has a pinion 66 formed thereon, which meshes with the gear 61, the pinion being proportioned to turn twice at each revolution of the driving gear

61. The block and the cover plate 45 have a projecting formation around the wheel, so that, in the downward stroke of the ram, the wheel may enter the recess 37 in the mandrel, with the axis of the wheel coinciding with the adjacent spring wire, the wheel having a radial slot 67 for receiving the wire.

On the right-hand surface of the cover plate 45, which is exposed below the twister wheel, is secured a gauge plate 68 which extends in front of the pinion 66. This plate regulates the projection of the end of the spring beyond the wall 38, the spring being rotated when placed on the mandrel so that the end strikes the gauge plate, as best shown in Fig. 3.

The right-hand side of the twister has a conical bore 69 for clearing the adjacent portion of the spring, and in the left-hand surface of the twister the upper portion is cut away, leaving a shelf 70 for engaging the spring end portion 71, which is bent inwardly along the recess surface 38 when the twister wheel is advanced into the recess, as best shown in Fig. 7.

The lower end of the guide plate 51 is shortened to provide space for a bracket plate 72 which is adjustably secured to the bed plate 12 by means of a screw 73 which extends through an elongated slot 74 in the bracket, as shown in Fig. 3. On the inner side of the bracket 72 is pivotally mounted a clamp finger 75. As best shown in side elevation in Fig. 8, the finger is notched and recessed at the end to engage the upper surface of the mandrel and clamp the second coil portion 40 in the groove 39. This clamps the spring securely in position and prevents rotational displacement thereof.

The loops 33, 34 and 35 are formed progressively, starting with the side of the loop 33 nearest the end of the spring, by means of the slidably mounted and independently movable dies 76 and 77 mounted in the guideway 27; 78 and 79 in the guideway 29; and 80 and 81 in the guideway 28. As shown in Fig. 2, each of these dies is mounted on a slide 82; and the sloping outer sides of the die slides are engaged by the conforming angular surfaces of the gibs 83, which are secured in the sides of the guideway slots. At the outer ends, each of the slides 82 has a notch 84 in which is journaled a cam roller 85; and the dies are each adjustably positioned on their respective slide blocks 82, by means of a screw 86 which is threaded through an upstanding lug 87 formed on the block, the die piece being clamped in position by a screw 88 which extends through a slot in the dies and threads into the slide block. At the inner ends the pairs of dies have notches 89 in the adjacent sides which cooperate to bend the wire around the corresponding mandrel projections.

The dies 76—81 are independently moved inwardly by means of the die cams 92, 93, 94,

95, 96 and 97, respectively, which engage the corresponding roller 85; the mounting of the cams being described as follows: On the frame 11, below the left end of the cam shaft 13, as viewed in Fig. 3, is formed a bearing 98 in which is rotatably mounted a sleeve 99. On the upper end of the sleeve is fixedly mounted a miter gear 100 which meshes with a miter gear 101 fixed on the left end of the shaft 13. A bearing 102 in alignment with the fixed bearing 98 is integrally formed on the bed plate 26; and rotatably mounted in the bearing 102 is provided a cam shaft 103 on which are fixedly mounted the cams 92 and 93, the cams being positioned so that the die 76 is advanced slightly ahead of the co-operating die 77. At the upper end, the shaft 103 telescopes into the sleeve 99 and is slidably connected thereto for rotation by the spline key 104, so that the bed plate 26 with the mandrel 31 mounted thereon may be adjusted with reference to the ram and twister wheel 43.

On the lower end of the shaft 103 is keyed a miter gear 106, and this gear meshes with a mating gear 107 keyed on the cam shaft 108, on which are keyed the cams 94 and 95 for the dies 78 and 79, the shaft 108 being rotatably mounted in bearings 109 and 110 formed on the lower edge of the bed plate; and on the right side of the bed plate are formed the spaced bearings 111 and 112 in which are rotatably mounted the shaft 113 carrying the cams 96 and 97, the shafts 108 and 113 being connected by the miter gears 114 and 115.

The holding finger 75 is moved to clamp the spring initially by the first inward movement of the die 76. A projecting pin 116 is provided in the side of the finger 75, which is engaged by a lever 117 pivotally mounted on the bed plate, and the lever 117 is operated by an angular lever 118, also pivoted on the bed plate, which is engaged by the projection 87 of the slide 82 on which the die 76 is mounted, as shown in Fig. 3. Then, as the ram moves downwardly, the cam plate 120, adjustably secured to the side of the plate 45 of the ram, engages and holds the finger down, as shown in Fig. 8. The finger is retracted to normal or raised position, as shown in Fig. 4, by means of the spring 121.

To review the operation of the machine, the bed spring is placed on the mandrel, as described above, with the end of the spring against the gauge finger 68 and the second coil portion supported in the groove in the upper surface of the mandrel.

The operator then sets the cam shaft 13 in motion by connecting the constantly driven fly wheel to the shaft. The parts are shown in initial position in Fig. 2, and as the shafts 13, 103, 108 and 113 rotate, the cam 21 moves the twister head into position, as shown in Fig. 7, and the die cams start

to successively move the dies inward. As the first die 76 starts to move in, the lever 117 is rotated to move the holding finger down to clamp the spring on the mandrel. Then as the twisting wheel moves into cooperative relation with the mandrel, the end of the spring is bent over and the segment 56 engages the gear 61 to rotate the twister wheel and wrap the end around the adjacent coil. As the ram completes its downward stroke, the plate 120 moves over the finger 75 and locks it down. At the same time, the dies start to engage the projections on the mandrel. This forms the loops 33^a, 34^a and 35^a and wraps the spring tightly around the mandrel. Then, at the completion of the one turn of the shafts, the parts are returned to normal position.

In this manner the end of the spring is closed and the loops formed in a rapid and accurate manner. The amount of wire can be correctly gauged for the winding and forming of the loops so that the end coils are exactly alike. When a larger or smaller spring is to be made, the mandrel is replaced by a mandrel corresponding to the spring, and the bed plate adjusted to position the mandrel with respect to the twister head. This adjusting can be done without disturbing the driving connection to the die cam shafts, and the dies can be readily adjusted to correctly engage the loop-forming projections on the mandrel.

While I have described but one illustrative embodiment of my invention, many alterations and omissions may be made without departing from the spirit of the invention, as defined in the following claims.

I claim:

1. In combination, a mandrel for positioning and supporting a coiled spring, means for clamping and wrapping the end of the spring around the adjacent coil, and means co-operating with the mandrel for forming loops in the end coil of the spring while the spring is clamped on the mandrel.

2. In combination, a mandrel for positioning and supporting a coiled spring, means for clamping and wrapping the end of the spring around the adjacent coil, and means for forming loops in the end coil of the spring comprising dies for cooperating with the mandrel in succession to form the side of each loop nearest the end of the spring and then the opposite side of the loop.

3. In combination, a mandrel for positioning and supporting a coiled spring, means for clamping and wrapping the end of the spring around the adjacent coil, and means for forming two or more loops in the end coil of the spring, said forming means cooperating with the mandrel to form the loops in succession starting with the loop nearest the end of the spring.

4. In combination, a mandrel for position-

ing and supporting a coiled spring, means for clamping and wrapping the end of the spring around the adjacent coil, the mandrel having peripheral projections, and a plurality of dies for cooperating with said projections in succession starting at the projection nearest said end for forming loops in the end coil of the spring.

5. In combination, a mandrel for positioning and supporting a coiled spring, means for clamping and wrapping the end of the spring around the adjacent coil, the mandrel having two or more peripheral projections, and a plurality of dies for cooperating with first one side and then the other side of each projection so as to wrap the spring around the mandrel in a progressive manner starting from said end.

6. In a machine of the class described, a mandrel or stationary die block for supporting a coiled wire spring, the mandrel having peripheral projections, a movable twister for engaging and twisting the end of the spring around the adjacent coil, and movable dies for engaging and bending the wire about said projections.

7. In combination, a mandrel for positioning and supporting a coiled wire spring, means for clamping the spring on the mandrel, a twister head cooperating with the mandrel for wrapping the end of the spring around the adjacent coil, and a plurality of dies for successively cooperating with the mandrel for forming loops in the end coil of the spring progressing away from the end of the spring.

8. In combination a stationary mandrel for supporting a coiled wire spring, the mandrel having a grooved recess in its upper surface conforming to a portion of the second coil of the spring, a yieldably mounted stop for gauging the position of the end of the spring; a movable clamp for clamping said portion in said recess, a twister head movable into cooperative relation with the mandrel for bending the end of the spring and twisting the end around the second coil, and means for operating the clamp and the head.

9. In combination, a stationary mandrel for supporting a coiled wire spring, the mandrel having a recess in one side and a helical groove in the upper surface conforming to a portion of the second coil of the spring, a movably mounted finger for clamping said portion in said recess, a gauge finger yieldably mounted in front of said recess for positioning the end of the spring, a twister head mounted to move into the recess for bending the end of the spring against the side of the recess and twisting the end around the second coil, and means for operating the finger and the twister head.

10. In combination, a stationary mandrel for a coiled wire spring, the mandrel having a helical groove in its upper surface con-

forming to an intermediate portion of the spring, a finger for clamping said portion in said groove, a twister head for twisting the end of the spring around the adjacent coil, and movable dies for engaging the peripheral surface of the mandrel, the mandrel and dies having cooperating surfaces for forming loops in the end portion of the spring.

11. In combination, a stationary mandrel for supporting a coil spring, a stop for locating the end of the spring, a clamp for clamping the spring on the mandrel, a twister head for engaging and wrapping the end of the spring around the adjacent coil, and dies cooperating with the mandrel for forming loops in the spring while said end is being wrapped.

12. In combination, a bed plate, a mandrel fixedly mounted on the bed plate, a finger pivotally mounted on the bed plate for clamping a coil spring on to the mandrel, a plurality of pairs of cooperating dies slidably mounted on the bed plate for engaging the mandrel to form loops in the spring, and means for operating the dies, said finger being operated by one of the dies.

13. In combination, a frame, a bed plate bolted to the frame, a spring-supporting mandrel fixedly mounted on the bed plate, a finger pivotally mounted on the bed plate for clamping the spring on the mandrel, a ram slidably mounted in the frame and having a twister head for wrapping the end of the spring around the adjacent coil, and a plurality of dies slidably mounted in the bed plate for cooperating with the mandrel for forming loops in the end coil of the spring, means for operating the ram and twister head, and means for operating the dies, the finger being operated by one of the dies and by the ram.

14. In combination, a frame, a bed plate bolted to the frame, a spring-supporting mandrel fixedly supported on the bed plate, a finger pivotally mounted on the bed plate for clamping the spring in position on the mandrel, a ram slidably mounted on the frame, a twister mounted in the ram for engaging the spring and wrapping the end of the spring around the adjacent coil, means mounted on the frame for operating the ram and twister, pairs of dies slidably mounted on the bed plate for engaging the mandrel to form loops in the end coil of the spring, and means slidably connected to said means for operating the dies, said finger being initially operated to clamp the spring by one of said dies and thereafter lock it in position by the ram so that the spring is held in position while being engaged by the twister and locked in position during the formation of the loops.

Signed at Muncie, this 14th day of January, 1931.

WILLIAM E. WUNDERLICH.