

C. P. BYRNES.
METHOD OF MAKING COILED SPRINGS.
APPLICATION FILED JAN. 23, 1908.

1,063,505.

Patented June 3, 1913.

2 SHEETS-SHEET 1.

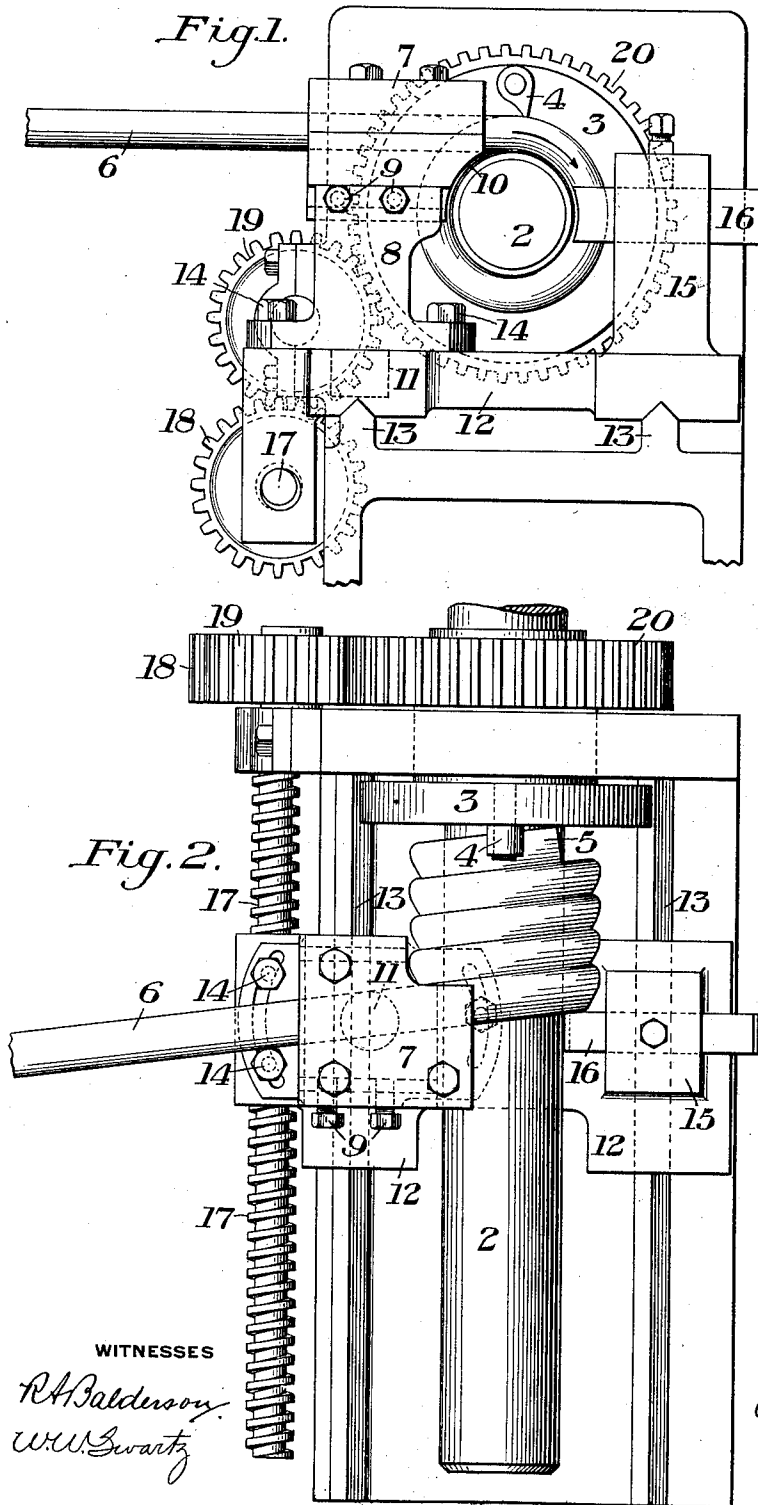


Fig. 3.

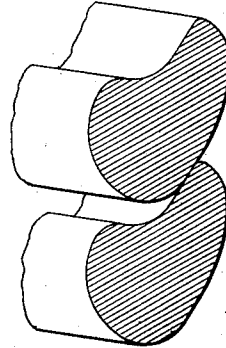


Fig. 4.

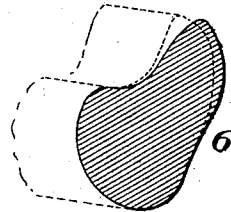
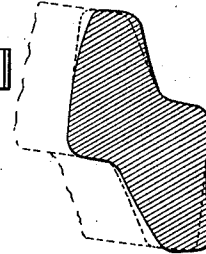


Fig. 5.



WITNESSES

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2 SHEETS—SHEET 2.

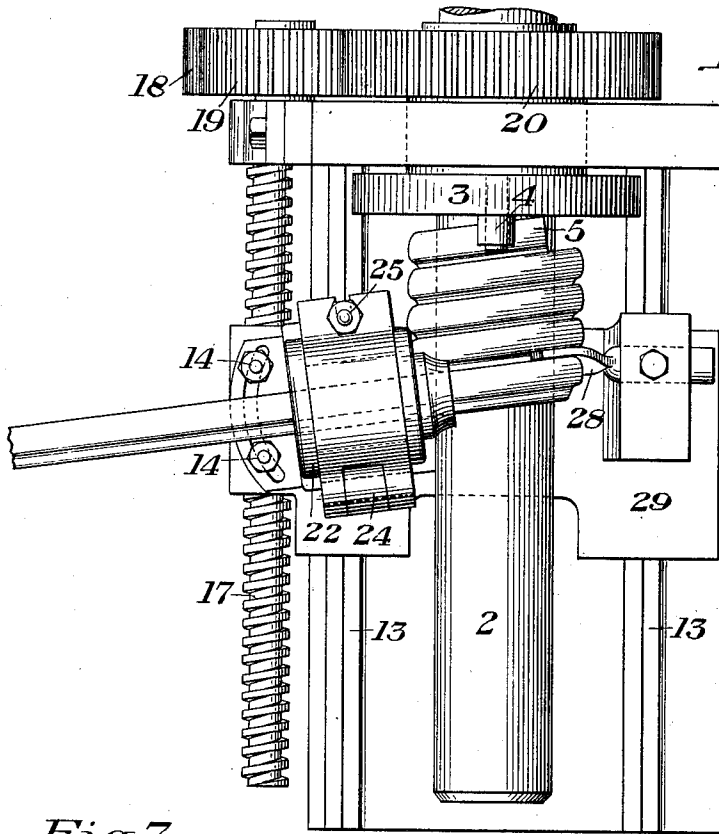


Fig. 6.

Fig. 7.

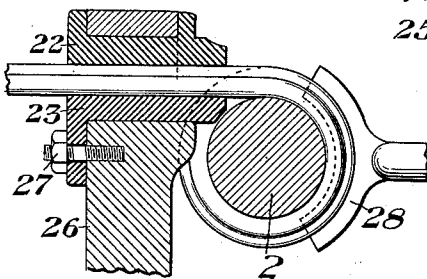
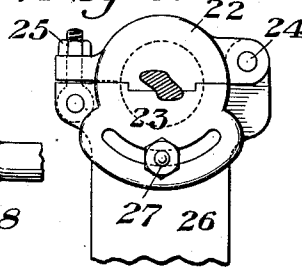


Fig. 8.



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METHOD OF MAKING COILED SPRINGS.

1,063,505.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed January 23, 1908. Serial No: 412,276.

To all whom it may concern:

Be it known that I, CLARENCE P. BYRNES, of Sewickley, Allegheny county, Pennsylvania, have invented a new and useful Method of Making Coiled Springs, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

- 10 Figure 1 is a partial end elevation showing the step of winding the spring; Fig. 2 is a similar top plan view; Fig. 3 is a partial view in section, showing two of the coils in wound position; Fig. 4 is a similar view showing one coil and illustrating the contour before and after winding; Fig. 5 is a view similar to Fig. 4, showing another form of cross section; and Fig. 6 is a plan view and Figs. 7 and 8 are detail views showing another form of guide and a separator arranged to wind the coils in separated position.

- My invention relates to the manufacture of the class of springs wherein resistance is increased by friction and cam coaction between the coils; as in the springs set forth in my United States Patent Number 743,689, dated November 10, 1903. In the manufacture of such springs, having an irregular cross sectional contour and flanges or cam faces which coact with each other, it has been found difficult to give the proper relative shape and position to the coacting faces of the coils when wound. Moreover, the relative interfitting position of the parts should be substantially the same throughout all parts of the coils in such springs; in order that the spring shall not become distorted and shall have an even action throughout its length during the stroke.

- I have found that a desirable positioning of the parts for increasing the resistance and attaining a substantially even contact and turning or twisting action throughout, may be obtained by forming the section of a distorted contour other than that desired, and changing this contour in the act of forming or winding the heated bar under tension to its coiled or helical spring shape. In other words, I change the cross-section of any individual portion of the stock by the winding operation hereinafter described. In carrying out my invention, therefore, I roll, forge or otherwise form a bar of irregular cross section and of a cross sectional shape which differs from that desired in the wound

spring; and I then wind this shape when properly heated so as to bend or force the metal into the desired cross sectional shape and contour.

In the drawings, referring to Figs. 1 and 2, I have shown a preferred form of apparatus for carrying out the winding operation. In these figures, 2 represents the mandrel which may be either of ordinary form or grooved to receive successive turns, and either cylindrical, conical, or of other shape, according to the shape of spring desired. 3 is the face plate to which may be attached a securing device for the end of the bar, which device I have shown as comprising a pivoted, pointed dog 4, so positioned that the strain upon it will cause it to bind more tightly upon the end of the bar which is inserted beneath it. Any suitable holder may of course be used. The bar 6 is preferably fed through a guide 7, which I have shown as consisting of two parts, having within them a hole, shaped approximately to the form of the bar and adjustably secured to the head of a post 8 by set screws 9. This allows an adjustment of the guide at right angles to the axis of the mandrel. In order to bring the guide as close as possible to the mandrel, it is preferably chamfered or curved, as shown at 10; this guide also assisting in holding the successive coils in place. The post 8 is preferably arranged to be adjusted around a vertical axis; as by having a stem 11, which projects down into or through the sliding support 12, which moves on the V-shaped slides 13. To adjust the guide to its desired angular position, I have shown bolts 14, extending through arc-shaped slots in flange portions of the post. The post may also be adjusted vertically by means of liners inserted between its base flanges and the support 12. The guide, therefore, has rotary, vertical and horizontal adjustments to provide for different sizes of mandrel or bar, etc. In order to hold the opposite sides of the coils in proper place, I preferably provide the support 12 with a post 15, carrying the adjustable bar 16, which bears against the coils at the opposite side from the guide. In most cases, I prefer to wind the coils in contact, and then open the coils while the spring is hot and before tempering, where a partial stroke is desired, before the coils contact with each other. The feed screw 17 may be driven by any suitable con-

nections, such as replaceable gears 18 and 19 between it and the toothed wheel 20 on the mandrel shaft, which may be changed for different pitches of spring.

5 In Fig. 3 I show two of the coils of one form after coiling. In Fig. 4 I show in full lines one form of bar before coiling, the dotted lines indicating approximately the changed form after coiling. In Fig. 5,
10 I show another form of section for the bar, which is double-headed and preferably symmetrical from both ends, the full lines again indicating the shape before coiling and the dotted lines approximately the shape after
15 coiling. In these figures, I have shown the flange or head on the bar as projecting externally, but this may project internally within the next coil. The bar should be given sufficient tension within the guide or
20 otherwise, to insure the metal of the bar being drawn down into properly inclined position, thus changing the cross sectional shape to the final form. To assist in imparting this proper final shape, I may wind
25 the coils in overlapping position in contact with each other, and then if it is desired to have the coils separate in the final spring, they may be separated in any desirable manner, either before or after coiling. I have
30 shown the bars as fed in approximately the level of the upper surface of the mandrel, but the bar may be fed in at different levels relative to the mandrel, and by varying the angle of feeding in relative to the mandrel, the change in shape of the section may
35 be more or less varied and regulated. In this way also the amount of tension may be varied, since if the guide is below the top of the mandrel, the metal will bend upwardly from the guide in passing into the
40 mandrel.

In Figs. 6, 7 and 8, I have shown a preferred form of guide formed in two halves 22 and 23, giving a cylindrical or barrel
45 form, which is recessed to receive the hinging device 24, secured by the hook bolt 25, movable within a slot in the upper half of the clamping collar. This clamp is formed as the upper part of the head 26 and the
50 guide barrel may be rotated to different angles and secured at the proper angle by a clamping nut 27, extending through an arc-shaper slot in a flange of the lower half and into the head. This guide also preferably
55 has the adjustment referred to in the form of Figs. 1 and 2; but this rotary adjustment of the guide is important in order to get the desired angle and proper engagement of the coils. In these figures I also show an arc-
60 shaped separator 28, which is mounted on the traveling carriage 29, carrying the guide and is arranged to project between and separate the successive coils. This may be used

in case it is desired to obtain a certain amount of free spring action before the in- 65 creased resistance, due to torsion and friction, is begun. It will be noted that the change in cross sectional shape during winding is unsymmetrical as regards the axis of the coil at right angles to the axis of the 70 spring. In other words, the projecting flange is flexed or bent slightly relatively to the larger body portion of the cross section.

The advantages of my invention result from forming the bar of a cross sectional 75 shape other than the desired shape, and then bending or changing the contour during winding or coiling. By proper tension in coiling, the bar will then be brought to the desired form during winding, the coacting 80 faces will be brought into such relation as to give the increased resistance, and substantially even action thus given to the several coils of the spring. This problem does not arise in ordinary springs of circular cross 85 section where the coils do not interfit to give the torsional action of the springs above referred to. The process is also of advantage in varying the angle of the operating face of the cam flange or head. 90

The spring may be formed by forcing or drawing the heated bar through a die or dies, and many other changes may be made in the form and size of the bar, the forming apparatus, etc., without departing from 95 my invention as defined in my claims.

I claim:—

1. The method of making spiral springs having co-acting flanges or projections, consisting in winding a bar of spring steel and 100 of unsymmetrical cross-section into spiral form, and simultaneously changing the cross-sectional shape by the act of coiling; substantially as described.

2. The method of forming coil springs 105 having co-acting coils of irregular cross-section, consisting in winding a spring steel bar of irregular cross-section other than that desired in the final spring and changing the cross-sectional shape of the bar by the act 110 of winding into coil shape; substantially as described.

3. The method of making coil springs, consisting in feeding a spring steel bar of irregular cross-section other than that de- 115 sired in the final spring through a guide, winding the bar into a spiral and changing its cross-sectional shape after leaving the guide and during the act of winding; substantially as described. 120

In testimony whereof, I have hereunto set my hand.

CLARENCE P. BYRNES.

Witnesses:

H. M. CORWIN,
R. D. LITTLE.