2 Sheets—Sheet 1.

G. L. TURNER.

Machine for Coiling Springs.

No. 47,882. Patented May 23, 1865.

Fig. 1.

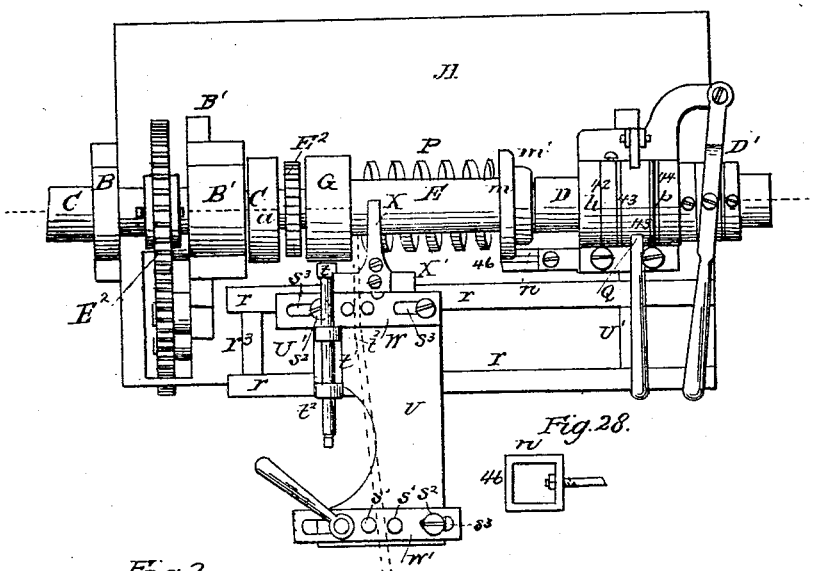
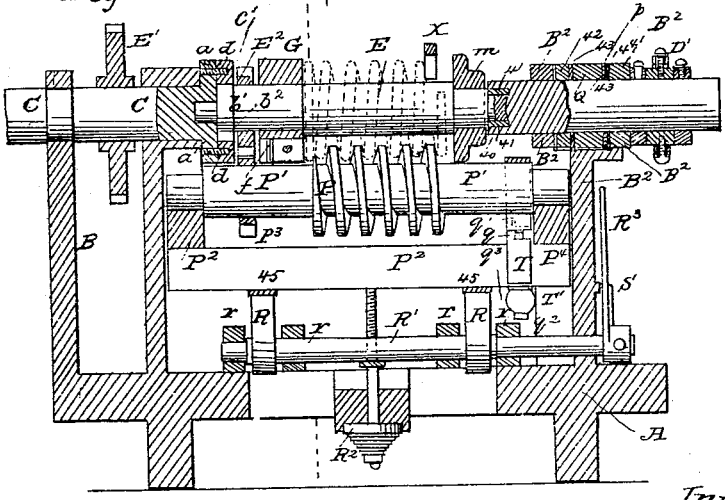


Fig. 28.

Fig. 2



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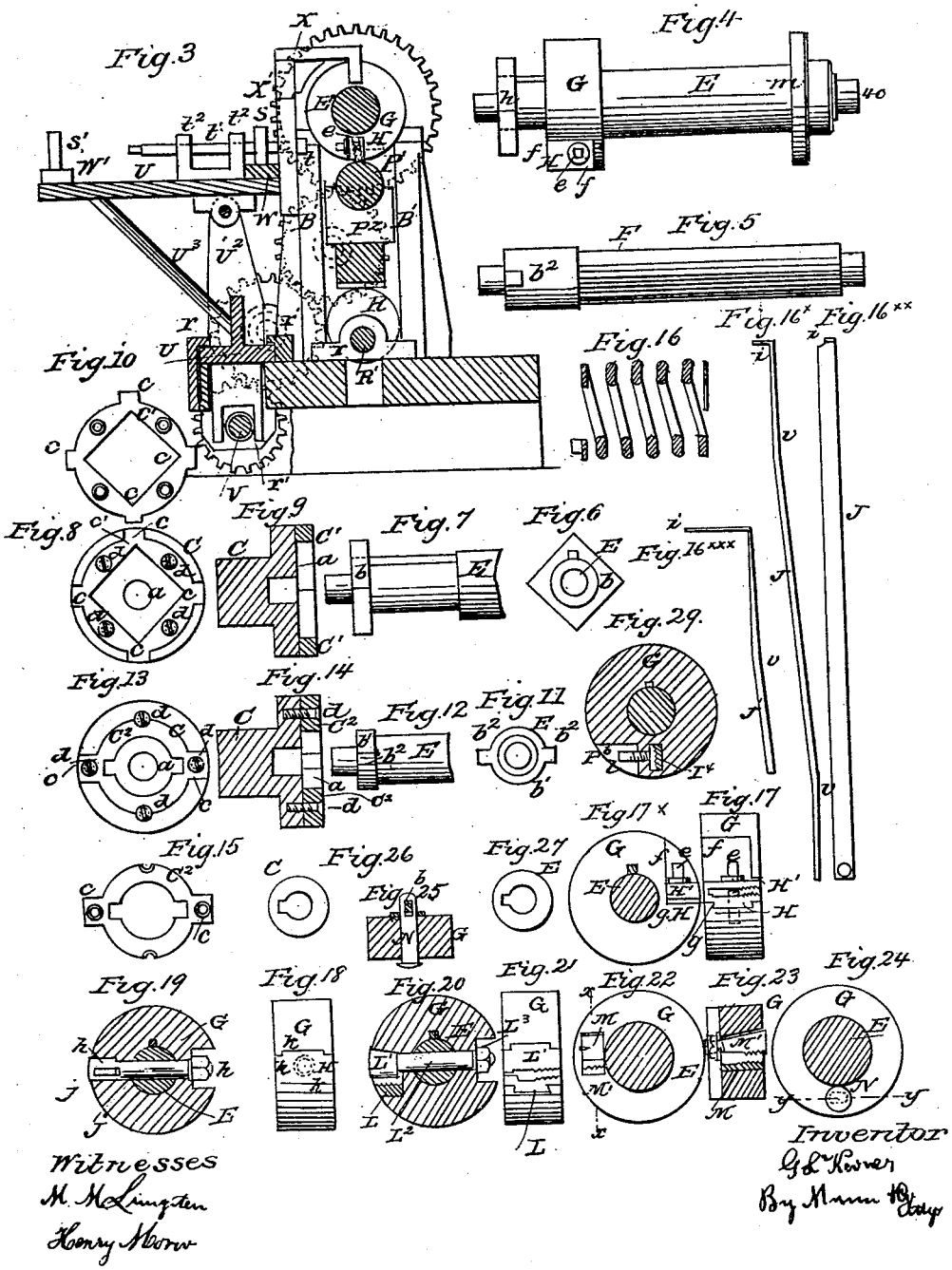

UNITED STATES PATENT OFFICE.

GREENLEAF L. TURNER, OF NEW YORK, N. Y.

IMPROVEMENT IN MACHINERY FOR COILING SPRINGS.

Specification forming part of Letters Patent No. **47,882**, dated May 23, 1865.

To all whom it may concern:

Be it known that I, GREENLEAF L. TURNER, of the city, county, and State of New York, have invented new and useful Improvements in Machinery for Coiling Steel Springs; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan of a machine to which my improvements have been applied. Fig. 2 is an elevation of a longitudinal vertical section thereof. Fig. 3 is an elevation of a transverse vertical section thereof. Figs. 4 to 27 are views of the details, which will be hereinafter explained.

Similar letters of reference indicate like parts.

These improvements are, for the most part, intended to be used in connection with a coiling-machine, some of the elements of which constitute the subject-matter of Letters Patent No. 16,793, granted to Perry G. Gardiner, March 10, 1857, and their object in part is to overcome some serious difficulties which present themselves in the operation of that machine, and partly to adapt the machine to the coiling of spiral springs of other kinds than the conical volute spring, for which that machine was more especially designed.

The frame of the machine consists principally of a bed-plate, A, and three standards, B B' B^2. C is the main or rotating arbor, fitted to a suitable bearing in the standards B B', and D is the secondary or sliding arbor, between which and the main arbor the mandrels E or F are placed. The sliding arbor D is fitted to a bearing in the standard B^2. The mandrel E (shown in position in Figs, 1, 2, and 3) is for coiling spiral springs whose coils do not lap each other as in the conical volute spring, and the same mandrel is shown in Fig. 4, which is a longitudinal view; but the mandrel F for conical volute springs, which may be called the "Gardiner mandrel," is shown in Fig. 5, which is also a longitudinal view. Whichever of these mandrels is used, its head is fitted into a socket, *a*, provided for its reception in the rotating arbor C, and it has at its opposite end a journal, which is fitted to a bearing provided for its reception in the sliding arbor D.

The improvement which I will first describe relates to both of the above mandrels and to the socket of the rotating arbor, and in order to explain it and the objects I had in view in inventing it I will first state that, owing to the fact that the head of the mandrel in Gardiner's machine is much smaller than its body, and is merely a cylinder with a feather on one side, the said head soon becomes loose in the socket of the rotating arbor and great loss of motion occurs between the arbor and the mandrel, and the accurate coiling of the spring is rendered impracticable. The socket of the arbor is of corresponding shape.

Figs. 26 and 27 are views of the socket of the arbor and of the head of the mandrel as thus constructed, and it will be readily seen that the bearing-surfaces between that of the arbor and the projecting feather on the side of the head of the mandrel, through which the rotary motion is to be produced, and upon which immense strain comes, are so limited and are located so near the axis of motion that they are not equal to the work of the machine, the socket end of the arbor not unfrequently being burst by the undue strain upon it at only one point, invariably causing thereby other serious breakages of the machine.

My improvements in this part consist in furnishing the mandrel with a fast collar of hardened steel and the rotating arbor with a hardened-steel bushing for the reception of such collar. This collar and bushing may be of various forms.

Fig. 6 is an end view, and Fig. 7 a side view, of a head with a square collar, *b*.

Fig. 8 is a face view, and Fig. 9 an axial section, of the socket of the rotating arbor containing a square bushing, C', for the reception of such collar *b*.

Fig. 10 is a face view of the bushing C', detached from the arbor.

Fig. 11 is an end view, and Fig. 12 a side view, of a head having a collar, b', of the form of a circle, with two square projections, b^2 b^2, on opposite sides.

Fig. 13 is a face view, and Fig. 14 an axial

section, of the socket of a rotating arbor containing a bushing, C^2, of a form to correspond with the collar b'.

Fig. 15 is a face view of the bushing C^2, detached from the arbor.

The steel collars b b' may be welded or otherwise formed upon the mandrel and hardened after they have been finished to the proper form, or the whole mandrel may be made of steel and the collars hardened.

The bushings C' C^2 are made with lugs c c to fit corresponding recesses in the socket of the arbor to prevent them from turning therein, and they are secured in the socket by means of screws d d, Figs. 8, 13, and 14.

The collars b b' may be made as large or larger than the body of the mandrels E or F, on which the spring is coiled, in order that the arbor may obtain a firm and powerful hold upon the mandrel by which to turn it.

The improvement which I will next describe relates to the mandrel E for coiling spiral springs, more especially springs made of steel, of a form substantially as illustrated in Fig. 16, which represents an axial section of a spring or of any form in which the width of the bar in a direction radial to the axis of the coils is greater than its thickness in a direction parallel with the said axis or of any other form and proportions. This improvement consists in furnishing the mandrel with a head-block, G, Figs. 1, 2, 3, 4, 17×, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 29. This head-block consists of a strong cylindrical block of cast or wrought iron or steel keyed to the mandrel near the head, which is received in the socket of the arbor C. The object of this head-block is to secure the bar J or J′, as shown in Figs. 16× 16×× 16×××, of which the spring is to be formed, to the mandrel during the operation of coiling it, and to keep the greatest width of the bar upright; or, in other words, to keep the bar edgewise during the operation, or in such other position as the bar is presented in order to make a spring of any other form and proportions required, and for these purposes the said head-block is fitted with a suitable gripping or holding device. This holding device may be of various kinds. In Figs. 2, 3, 4, 17, and 17* it is represented as consisting of a pair of steel dies, H H′, and a screw, e. Fig. 17 is a front view of a head-block exhibiting these dies. Fig. 17* is a view of the side which is nearest the head of the mandrel. These dies are arranged in an angular recess, f, formed in the head-block in the manner shown in Figs. 4, 17, and 17*, the die H being secured permanently to one side of this recess with its face radial to the axis of the head-block and mandrel, and H′ being attached loosely by the screw e, with its face parallel with the face of the die H. The end of the die H′ next to the head of the mandrel is made with a heel, g, (see Fig. 17,) to rest upon the die H, and the bent end i of the bar shown in Fig. 16*, which represents an edge view of the bar, is inserted between the opposite ends of the dies and secured by screwing in the screw e.

The device represented in Figs. 18 and 19 consists of a draft-bolt, I, having a slotted head, h, at one end and a nut, h', at the other end, passing through the head-block and the mandrel.

Fig. 18 is a peripherical view of the head-block, and Fig. 19 a view of a transverse section. The slotted head h of the bolt is wide enough to extend across the width of the head-block (see Fig. 18) in a groove, k, provided for it, and the nut h' is let into a counter-sink on the opposite side of the head-block, as seen in Fig. 19. The end i of the bar is inserted in the slot j of the bolt I, and by screwing up the nut i the bolt is made to clamp it against the back of the groove k in the head-block.

The device represented in Figs. 20 and 21 consists of a fixed die, L, secured in a groove cut transversely in the face of the head-block, and a movable die, L′, composed of the head of a bolt, L^2, which is inserted through the head-block and secured by a countersunk nut, L^3, at the other end. The back of this die L′ is wedge-shaped, as shown in Fig. 20, which is a transverse section of the mandrel and head-block, and the corresponding side of the groove in the head-block is made of like form, so that when the nut is screwed up to draw in the die the wedge-like action of the latter draws it toward the fixed die and makes it gripe the bar J.

Fig. 21 is a peripherical view of the head-block.

The device shown in Figs. 22 and 23 is composed of a fixed die, M, and a movable die, M′, formed of the wedge-shaped head of a screw-bolt, and only differs from that shown in Figs. 20 and 21 in this: that the bolt is inserted parallel with the axis of the head-block instead of transversely.

Fig. 22 is a face view, and Fig. 23 a section, in the plane x x in Fig. 22.

The device shown in Figs. 24 and 25 consists simply of a headed bolt, N, inserted through the head-block parallel with the axis of the mandrel and secured by a key, t. For coiling with this bolt the bar J is made without the bend i, and instead thereof it has provided in it near its end a hole large enough to receive the bolt N, the head of which is made to clamp it against the face of the head-block by driving the key t.

Fig. 24 is a face view of the head-block and Fig. 25 a section in the plane y y in Fig. 24.

Fig. 29 is a sectional view of the head-block, showing another device for holding the end of the bar during the process of coiling. In this case a slot or mortise cut through the head-block parallel with the mandrel is provided with a hardened cast-steel die, P^4, with raised teeth or a corrugated surface, which lies flush

with the face of the head-block. The slot or mortise is to be wide enough to receive the bent end or lip of the bar in front of the die, against which it is pressed and held securely throughout the process of coiling by means of a hardened-steel set-screw, *e*, passing through the head-block tangentially. A recess, P^6, of right-angled shape, is cut in the periphery of the head-block, one side of which is parallel with the face of the die P^4. This parallel side of the recess is to be tapped to receive the screw *e*, and if the head-block is not of steel it may be bushed with steel where the set-screw comes to enable it to withstand the wear and strain of the operation of coiling. The recess P^6 allows room for the head of the screw, so that it is wholly within the line of the circumference of the head-block, and the screw is forced against the lip *i* of the bar by means of a socket-wrench from the back side of the machine.

The mandrel E is furnished near the end farthest from the head-block C with a movable steel collar, *m*, presenting a broad, hardened face opposite to the head-block G. This collar is secured on the mandrel by a key, *m'*, passing through the two. Its duty is to operate in combination with a stationary guide, *n*, secured to the standard B', and with a worm, P, to be presently described, for the purpose of guiding the last end of the bar J, which is to be coiled in such a position that its greatest width will be perpendicular to the axis of the mandrel. This collar *m* has to be taken off the mandrel after the coiling operation, and after the removal of the mandrel from the machine, before the spring can be drawn off.

Fig. 28 is a front view of the guide *n*, the operating-face 46 of which is flush with the inner face of the collar *m* when the mandrel is in the machine.

The journal 40, at the end of the mandrel which rotates in the arbor D, should be of hardened steel, and the arbor D is fitted with a hardened-steel bush, 41, (see Fig. 2,) to serve as a suitable bearing for the journal of the mandrel. The arbor D is moved lengthwise when necessary by a lever, D', in a manner substantially similar to that practiced in Gardiner's machine; and in order to secure it in position for holding the mandrel in place, and yet permit it to be moved back for the removal of the mandrel from the machine, the bearing provided in the standard B^2 for the said arbor has an opening, *p p*, within which there is secured to the arbor a collar, 42, which limits the longitudinal movement of the said arbor, and the said arbor is secured in position to hold the mandrel E in the machine by means of a cap-lever, Q, which fits between the said collar and the back portion of the hardened-steel bearings, as shown in Figs. 1 and 2, substantially like the machine now in use, except that I make the collar 42 of steel and harden it, and provide the cap-lever Q with hardened-steel faces 43 43, and the face of the back part of the bearing in the standard B^2 with a hardened-steel face, 44, for the sake of greater durability.

The worm P, before mentioned, consists of a screw-thread formed upon a cast-steel shaft, P', arranged below and parallel with the mandrel E in bearings in a frame, P^2, which is fitted to slide vertically in guides in the standards B' B^2. Its pitch corresponds with the pitch which the springs to be coiled are to have, but in the reverse direction. Its depth is nearly equal to the greatest width of the bar J—that is, the width of any bar of which the spring is to be made. The thickness of its threads corresponds with the width of the spaces to be formed between the coils of the springs, and the spaces between its threads correspond with the thickness of the bar from which the spring is to be formed. The worm-shaft P' is furnished with a gear, P^3, to gear with a gear, E^2, of equal size, upon the mandrel, so that the worm may be driven by the mandrel to make revolution for revolution therewith. The principal object of this worm is to regulate accurately the distances between the coils while the bar is being wound upon the mandrel to form the spring, and to bend the bar around the mandrel; and it also serves, in combination with the vertical guide *n*, to keep the last end of the bar upright or perpendicular with the axis of the mandrel as the coiling is completed. The frame P^2 is raised up to bring the worm in suitable proximity to the mandrel preparatory to the coiling of the spring by means of two steel cams, R R, on a shaft, R', worked in fixed bearings *r r* on the bed-plate A below the said frame, the said cams working against the hardened-steel faces 45 45 on the bottom of the frame; and after the coiling of the spring has been completed it is necessary, in order to permit the removal of the mandrel, that the said frame should be lowered far enough to remove the worm from between the coils of the spring, and for this purpose a spring, R^2, Fig. 2, is applied in connection with the frame P^2 to pull it down with the frame, when the cam-shaft is turned in such a direction that the cams will permit its descent, the sudden action of the spring when it is at its greatest tension serving to start the threads of the worm out from between the said coils. After they have been started the threads are easily withdrawn entirely therefrom. The cam-shaft is worked by a hand-lever, R^3, at the right-hand end, and the frame is secured either in its elevated or depressed condition by springing the said lever into one of two notches in the projecting rim of a semicircular plate, S, secured to the outside of the standard B^2.

In order to coil the spring properly it is necessary that a certain point in the circumference of the worm should be exactly opposite to a certain point in the circumference of the mandrel at the commencement of the coiling operation, and in order to obtain this result it is necessary to prevent the worm

from turning while the mandrel is being taken out of the machine to remove the spring, and while it remains out of the machine. This is accomplished by means of a friction-strap, T, applied to the shaft P′ of the worm, the strap being attached to the frame P^2 by one of its ends and the other end being attached to a spring, T′, of india-rubber or other material, which causes the strap to bind with a certain degree of force upon the worm-shaft, the tension of the spring being regulated by means of a screw-bolt, q, and nut q', whereby it is compressed to the desired degree between a nut, q^2, at the other end of the screw-bolt, below the spring, and a plate, q^3, secured on the bottom of the frame P^2.

In order that the arbor C and mandrel may be brought to the proper position relatively to the worm when the mandrel is replaced in the machine, a dotted line is made upon the top of the bearing provided in the standard B′ for the arbor C, and another on the periphery of the socket a of said arbor, and a third upon the head-block C of the mandrel, and these lines should be brought to coincide with each other before the frame P^2 is raised to bring the worm into gear with the mandrel preparatory to the coiling operation. Similar lines (not shown) are made on the upper portion of the friction-band T and on the worm shaft P′, and for the same purpose.

U is a traveling table for holding the bar J at the required angle or degree of obliquity to the axis of the mandrel preparatory to the coiling operation, and for supporting the uncoiled portion of the bar in the same position during the operation. This table is sustained in a horizontal position upon a horizontal slide, U′, by means of two standards, U^2, and a diagonal brace, U^3; and the said slide is fitted to guides r' r', secured to the bed-plate A parallel with the axis of the arbor, mandrel, and worm, and the said slide has imparted to it by means of a screw, V, Fig. 3, arranged parallel with and below the guides r' r', a longitudinal movement at the proper speed relatively to that of the rotary motion of the arbor C and the mandrel E, and the pitch of the coil of the spring. This screw V has journals at its ends, fitted to fixed bearings (see Fig. 3) under the bed-plate, and has no longitudinal movement. Its thread is fitted into a nut secured to the bottom of the slide U′, after a manner well known to the art, and, therefore, not necessary to be here particularly set forth. It derives the necessary rotary motion from the arbor C, through a train of gearing or other equivalent devices.

The drawings show a train of gearing, the upper gear, E′, being fast to the arbor C. The pitch of the said screw V, if it be driven in the same direction as the mandrel, must be in the same direction as that which the spring is to have, and consequently it is the reverse of that of the worm P; but if the screw is driven in the opposite direction to the mandrel the pitch of its thread must be reversed. The table U is fitted on top with two slides, W W′, which are adjustable in directions parallel with the arbors and mandrel. The slide W carries two upright pins, s s, at a distance apart corresponding with the thickness of the bar J, which is required to slide between them, and the slide W′ carries two similar pins, s' s', the said pins serving in the coiling operation to guide the bar to the mandrel at the necessary degree of obliquity to its axis, according to the desired pitch of the coil.

To provide for the adjustment of the said slides, so that the said pins s s s' s' shall guide the bar at various degrees of obliquity, they are attached to the table U by means of screws s^2 s^2, which pass through slots s^3 s^3 in the slides, and screw into holes tapped in the table. These screws are slacked to permit the slides to be moved, and tightened to secure them when adjusted. The table U is also represented as carrying a socket-wrench, t, having its shank t' arranged at right angles to the axis of the arbor C and mandrel E, in suitable bearings, t^2 t^2, secured to the table. This wrench is for the purpose of operating the screw e, (shown in Figs. 2, 3, 4, 17, 17*,) when the mode of fastening the end i of the bar J, represented in those figures, is adopted, and it is so arranged upon the table that when the several parts of the machine are in position to commence the coiling operation, as shown in Figs. 1 and 3, the said wrench is directly opposite the head of the said screw.

The shank t' of the wrench is fitted to slide longitudinally, as well as to turn in the bearings t^2 t^2, so that it may be drawn forward out of the way after the bar J has been secured and before starting the machine. To provide for turning this wrench without interference from the table U, its shank should be fitted with a ratchet-wrench.

X is what I term a "distance-gage," secured firmly to the top of a standard, X′, which is firmly bolted to the table U for the purpose of operating above the mandrel to keep the coils of the springs at the proper distance apart while they are being formed upon the mandrel. This gage is so formed, as shown in Fig. 3, that its end dips toward and directly over the axis of the mandrel to enter between the coils as they are formed; and the thickness of its end is to be equal to the intended width of the spaces between the coils. The said gage, moving with the table U in the coiling operation, follows between the coils from one end to the other of the spring.

Instead of a distance-gage constructed like that described, a comb-like piece of steel may be so arranged that its teeth will enter between the coils above the mandrel, such piece having a movement parallel with the mandrel, imparted to it by any suitable means, or a second worm, like P, may be used above the mandrel, the shaft of such worm being provided with a gear to gear with the gear E′, and being so applied as to be capable of being raised from the mandrel to permit the latter

to be removed from the machine for the purpose of taking off the spring.

It will be seen by reference to Figs. 16× and 16××× that the bar is made taper at each end, and that it is bent at *r*, where the taper commences. The object of this is to bring the ends of the spring, or the faces of its terminal coils, parallel with each other, and make them form portions of planes perpendicular to the axis of the coils to give the spring a broad and firm bearing at each end.

It has already been described that the said bar J, at the end which is to be secured to the head-block G, and at which the coiling commences, is either formed with a hook, *i*, or has in it a hole, according to the mode in which it is to be attached to the head-block for coiling it. 16××× are edge views, and Fig. 16×× a face view, of the bars, the bent end *i* being turned over more or less according to the grip it is desired to take upon it in the head-block.

The machine is prepared for coiling by turning the crank so as to bring the sliding table U gently against the stop r^3, which extends between the guides r' r' and the bed-plate at the left-hand end of the machine. The frame P^2 is then to be lowered so as to disengage the worm P from the mandrel. The dotted line on the periphery of the socket *a* of the arbor is next to be made to coincide with the dotted line on the top of the bearing provided for the arbor in the standard B′. Next, the dotted line on the periphery of the head-block G is to be made to coincide with that on the socket *a* of the arbor C. Next, place the dotted line (not shown) on the worm-shaft P′ in coincidence with the corresponding mark (not shown) on the friction-band T. The bent end of the bar J is next to be secured in the head-block by means of any of the devices for that purpose above described, and firmly secured therein by means of a wrench and screws. The frame P^2 is then to be brought up to engage with the mandrel by means of the spring-lever R^3 and the cams R R, the lever R^3 being locked in the proper notch *s*.

The machine is now ready for operation. Rotary motion being given to the arbor C in the proper direction, the mandrel E and worm P receive rotary motion in opposite directions to each other, and the table U receives motion toward the right-hand end of the machine. By the rotary motion of the mandrel and worm the bar is caused to be drawn between the guide-pins *s s* and *s′ s′*, and coiled upon the mandrel, and by the movement of the table the uncoiled portion of the bar is carried along to keep it directed toward the mandrel at the angle corresponding with the pitch required, while, by the rotary movement of the worm, the part of the bar where the coiling is taking place is carried along the mandrel, and the coils are properly spaced, the worm being aided in the latter operation by the distance-gage X. But the gage X is not indispensably necessary to the coiling operation, as the operation can be performed without it. When the coiling has been completed as far as the last taper portion of the bar, that portion of the bar is guided on to the mandrel by the stationary guide *n* and the collar *m* of the mandrel in such a manner that its outer face is perpendicular to the axis of the mandrel and of the coil. When the coiling is completed the machine is stopped, and the worm P is lowered from between the coils by lowering the frame P^2, and the cap-lever Q is raised and the arbor D drawn back to free the journal 40 of the mandrel, when the mandrel is taken from the socket *a* of the arbor C.

To remove the spring the mandrel from the collar *m* is first taken off, and the spring is then drawn over the end 40 of the mandrel.

Before replacing the mandrel in the machine to coil another spring upon it the carriage U is run back to the first-described position, and the collar *m* is replaced upon the mandrel, and the operation is repeated in the order above explained.

In making conical volute springs the worm P is omitted from the machine, and the mandrel E shown in Fig. 5 is to be employed.

In order to operate the socket C′ with the mandrel E, the foregoing directions are to be observed and the same result will be brought about.

It is to be observed always that when the holding device shown on the head-block by Fig. 29 is to be used, the screw *e* must be operated from the back side of the machine, as the screw is inserted in the head-block in such a manner as to cause the strain from the end *i* of the bar J to fall upon the die and not upon the point of the screw, which it would do if the position of the die and screw were reversed.

When it is desired to remove the socket C′ and put in its stead the socket C^2, first remove the key which secures the gear E′ to the rotary arbor, then draw out the socket C′ and put the socket C^2 in its place, then replace the key, and put in the machine the mandrel which is to be used, when it will be found by observing the above directions that the machine is again prepared for coiling.

The bar J′ has a lip, *i*, of greater length than J, for the reason that it is better to have a longer-bearing-surface in operating with the holding device in Fig. 29 than in operating with some of the other holding devices, although the principle of operation is in all respects the same.

The arrangement of the framing of the machine may be altered to secure greater strength or a more economical use of material or to suit the convenience or taste of the operator, and the sliding and fixed arbors may have their positions reversed. Such changes work of course no change in the principle of my invention, and the other changes in the several parts of the machine, which will of necessity result from any alterations of this sort—such for instance, as the change of the direction of the screw-thread of the screw V—can easily

be made by any mechanic skilled in the art.

I claim as new and desire to secure by Letters Patent—

1. I do not claim to have invented couplings for connecting and driving rolls, nor do I claim bushing the couplings of rolls, but I claim, in machines for coiling steel springs, whether used for coiling volute, spiral, or other steel or metallic springs, the employment and use of the collars *b* and *b'* on the mandrel, and the bushings C and C' in the socket of the rotating arbor which receives the mandrel, in combination with the mandrel E and the rotating arbor C, substantially as and for the purpose above described.

2. I do not claim the invention of a base or head block with holding or gripping devices for operating with wire in machines that do not produce parallel ends to the spring when wound upon the mandrel, but I claim, in machines for coiling spiral springs, the employment and use of a base or head block, such as that shown at G, or its equivalent, with holding or gripping devices such as those herein shown and described, or their equivalents, in combination with the mandrel E, the worm P, the guide *n*, and the collar M, when used for the purpose of producing spirally-formed springs with parallel ends on the said mandrel, substantially as and for the purposes above set forth.

3. I do not claim, broadly, a movable collar upon a mandrel, but I claim, in machines for coiling metallic springs of a spiral form, the employment and use of a movable collar, such as that shown at M, or its equivalent, in combination with the worm P, the mandrel E, and the guide *n*, when used for the purpose of making that end of the spring which is next to the said collar perpendicular to the axis of the mandrel, substantially as and for the purpose above set forth.

4. I do not claim, broadly, the invention of stationary or adjustable guides, as I am aware that their use is common in mill-rolls and in many other machines, but I claim the employment and use of a guide such as that shown at *n*, or its equivalent, in combination with the mandrel E, the worm P, and the collar M, when used for the purpose of suddenly checking the diagonal movement of the end of the bar and of keeping it in its necessary vertical position—that is to say, at right angles to the mandrel—and guiding it at right angles with the face of the mandrel preparatory to forming that end of the spring parallel, substantially as and for the purpose above described.

5. The worm P, or its equivalent, in combination with a coiling-mandrel, when used for coiling spiral springs, substantially as above described.

6. I do not claim, broadly, the invention of a friction-band, as it is an old device, but I claim, in machines for coiling spiral or other steel springs, the employment and use of a friction-band, T, or its equivalent, in combination with the spring T', the worm-shaft P', and the frame P^2, or their equivalents, when used for the purpose of coiling metallic springs, substantially as above described.

7. I do not claim a locking device in itself considered, but I claim in combination the frame P^2, which carries the worm, the cams R R, and the spring R^2, or their several equivalents, substantially as and for the purposes above described.

8. I do not claim to have invented stationary or adjustable guides, as the device is common in machines for other purposes, but I claim the employment and use of adjustable guides such as those shown at W W, S S, and S' S', or their equivalents, in combination with the sliding table U, or other equivalent carriage, and when used for the purpose of keeping the width of the bar vertical and of guiding it diagonally between the threads of the worm and the face of the mandrel during the process of coiling the spring, substantially as herein set forth.

9. The distance-gage X, or its equivalent, applied upon the sliding table U, or other equivalent carriage, to operate substantially as above described.

10. I do not claim the material of which the cams R R are made, but I claim the employment and use of the cams R R, in combination with the frame P^2 and the worm P, the office of said cams being to elevate and hold in proper position the frame P^2 and the worm P during the operation of coiling spiral springs, substantially as above set forth.

11. I do not claim the material of which the collar 42 is made, or of the faces of the cap-lever Q, but I claim the employment and use of the collar 42, constructed as shown, and secured adjustably to the sliding arbor D, in combination with the cap-lever Q, constructed as shown, for the purpose of holding the said arbor stationary during the operation of coiling volute, spiral, or other metallic springs, substantially as above described.

GREENLEAF L. TURNER.

Witnesses:

M. M. LIVINGSTON,

JAMES P. HALL.