

June 17, 1924.

1,497,965

B. L. VAN ORMAN

WIREWORKING MACHINE

Filed March 26, 1923

8 Sheets-Sheet 1

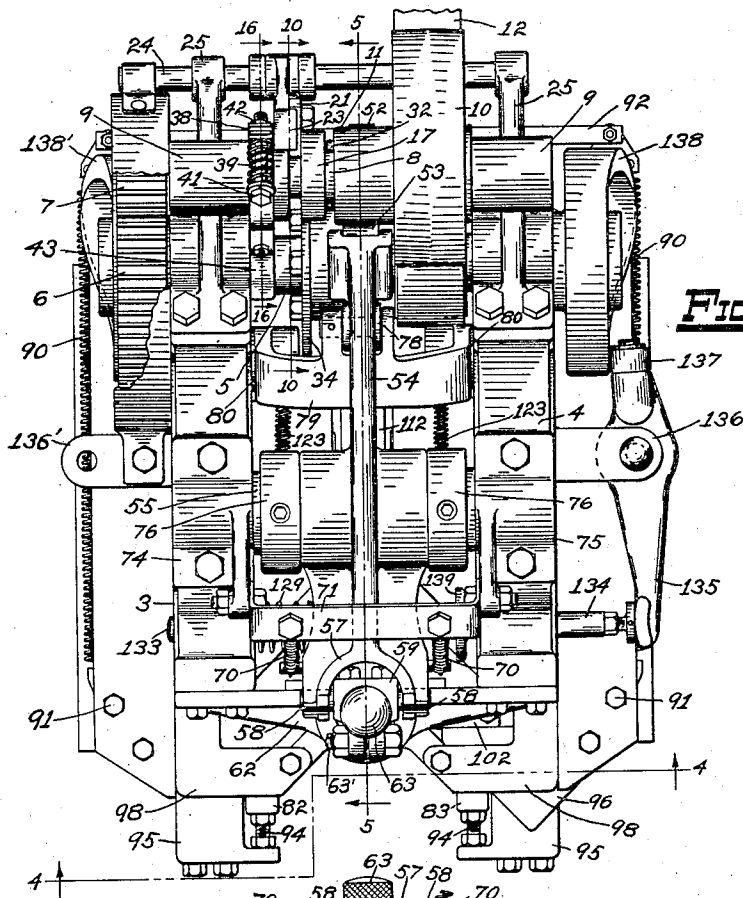


Fig. I

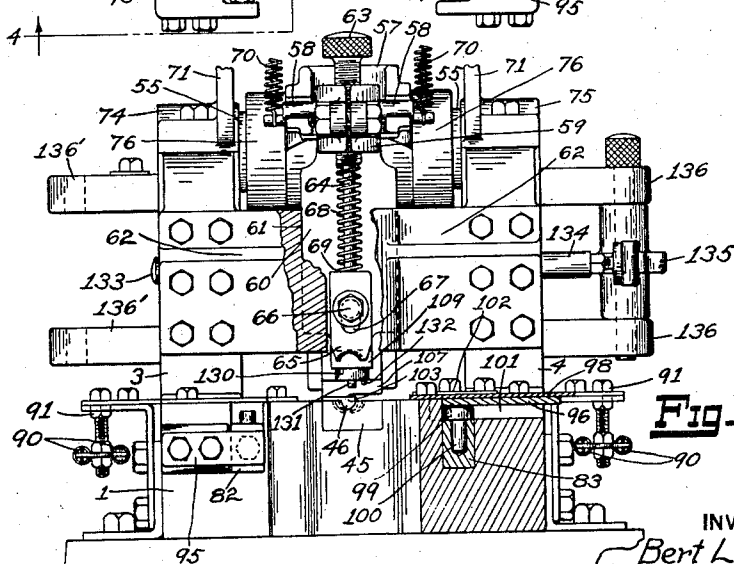


Fig. IV

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8 Sheets-Sheet 2

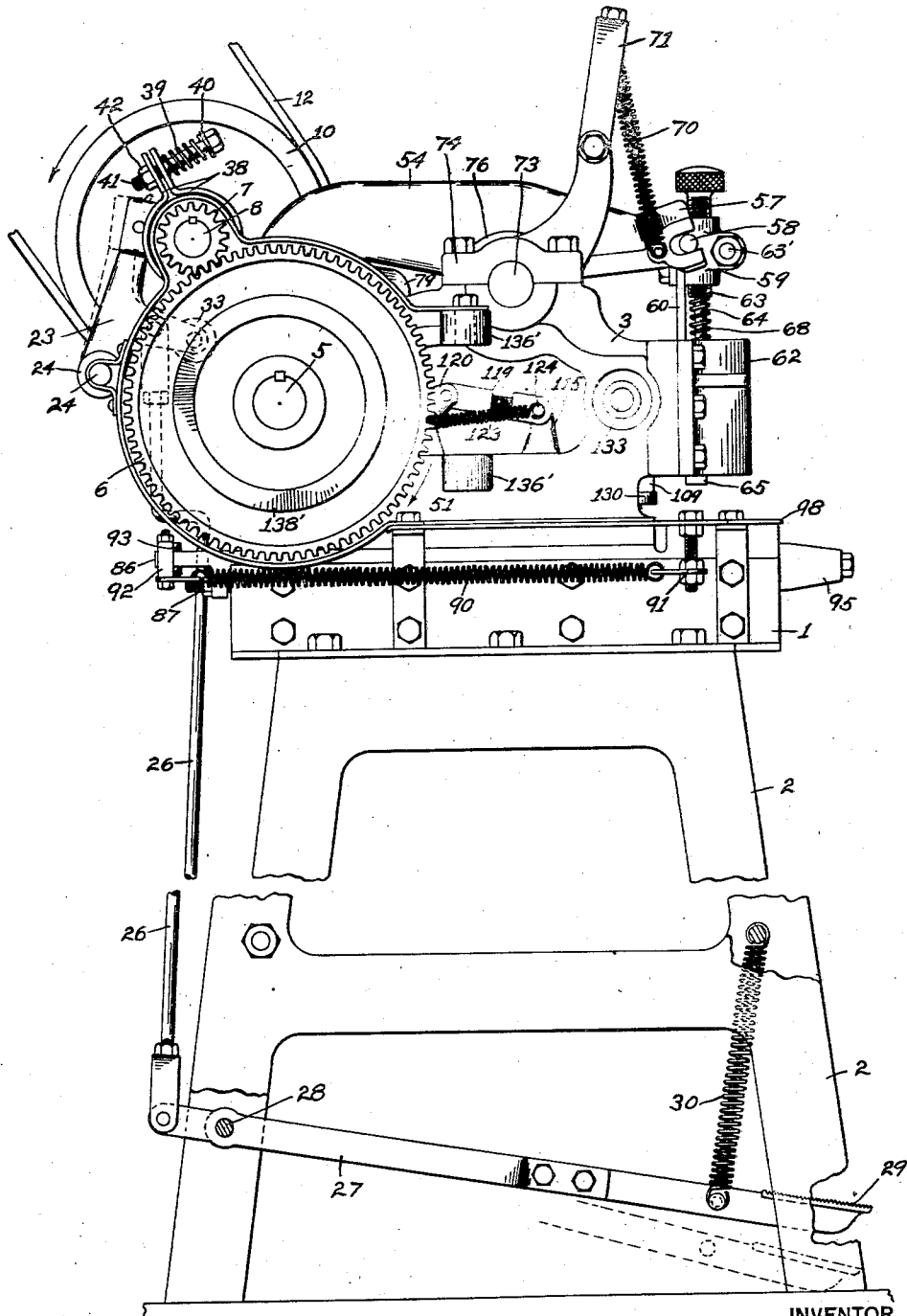


FIG. II

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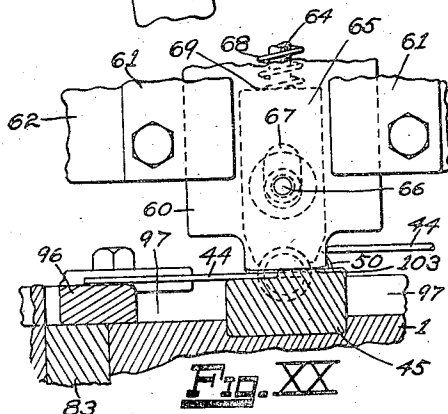
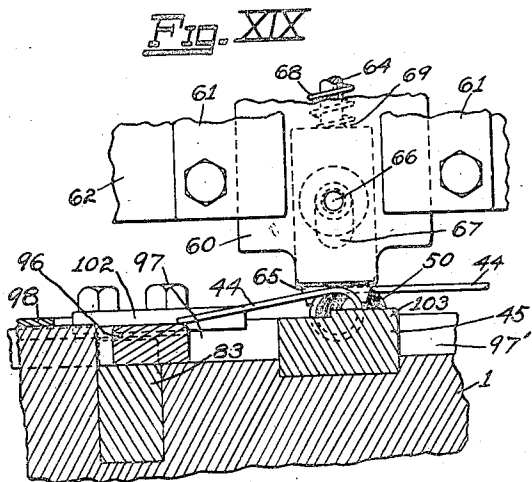
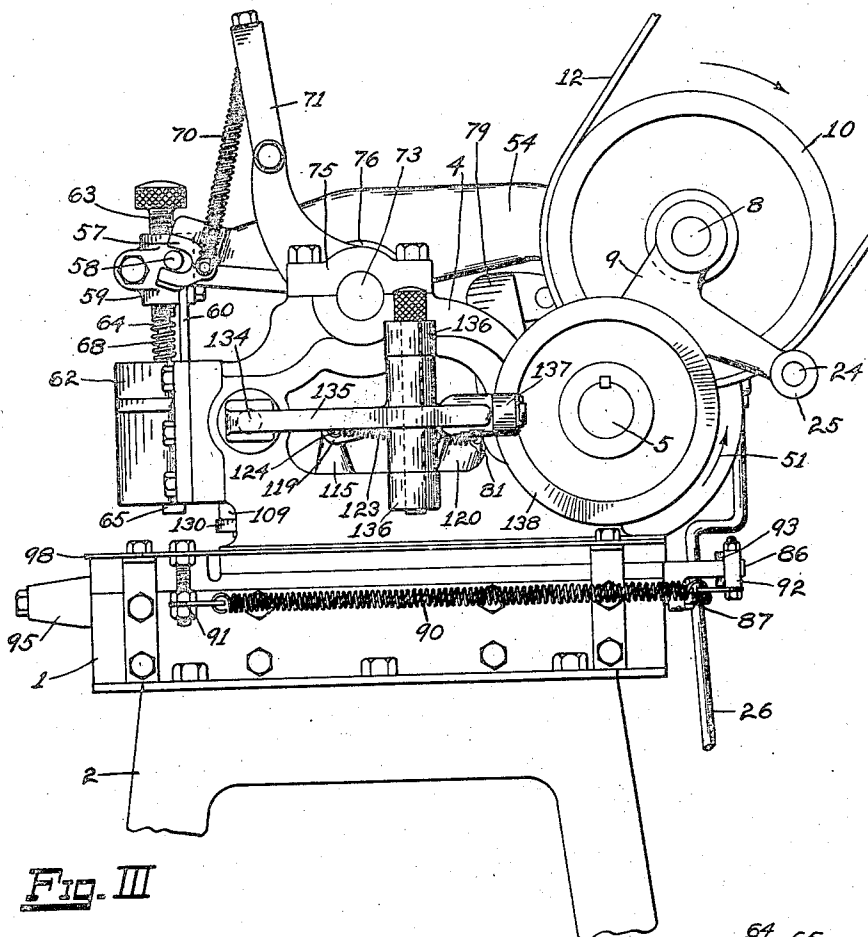
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8 Sheets-Sheet 3



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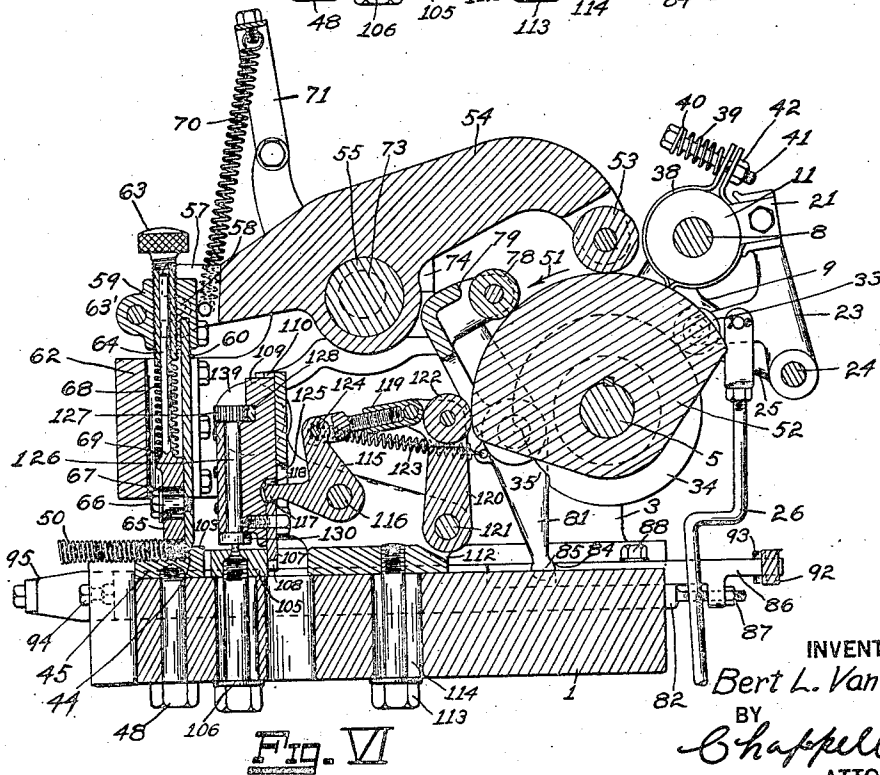
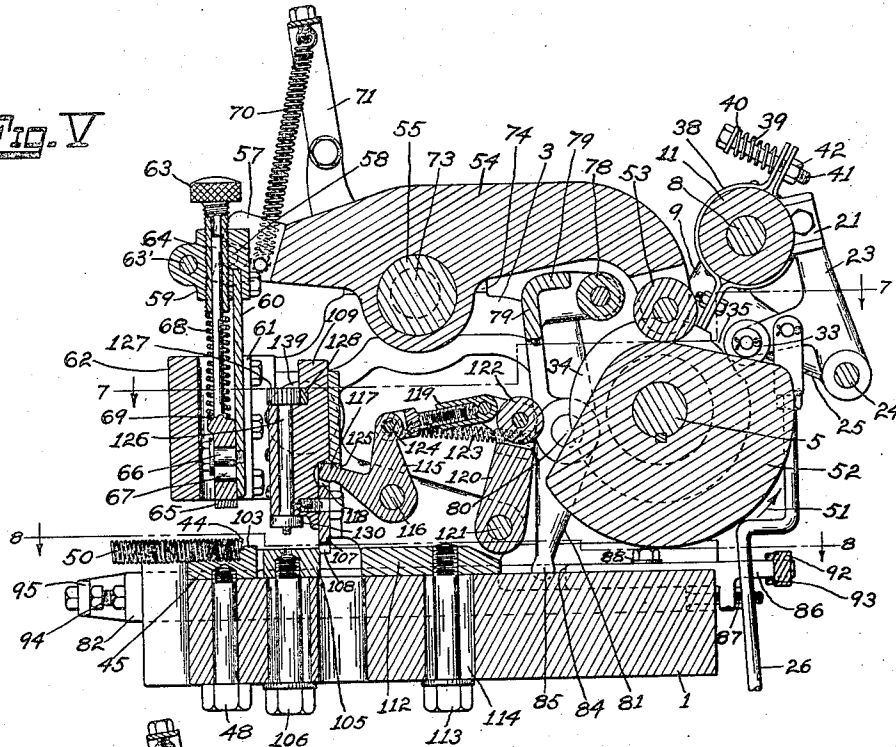
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Fig. V



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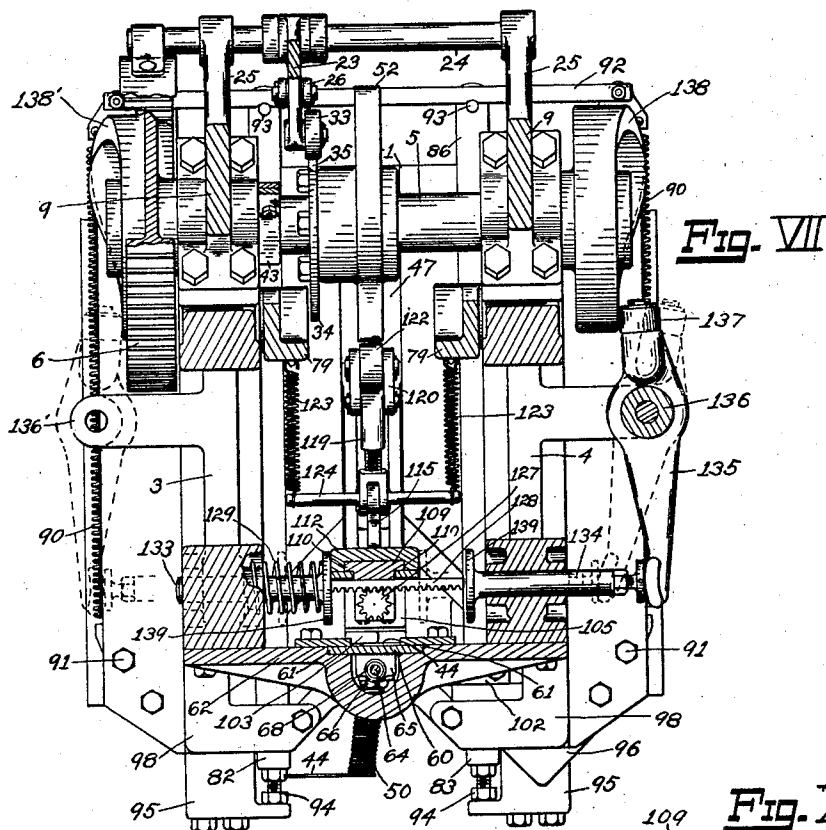


Fig. VII

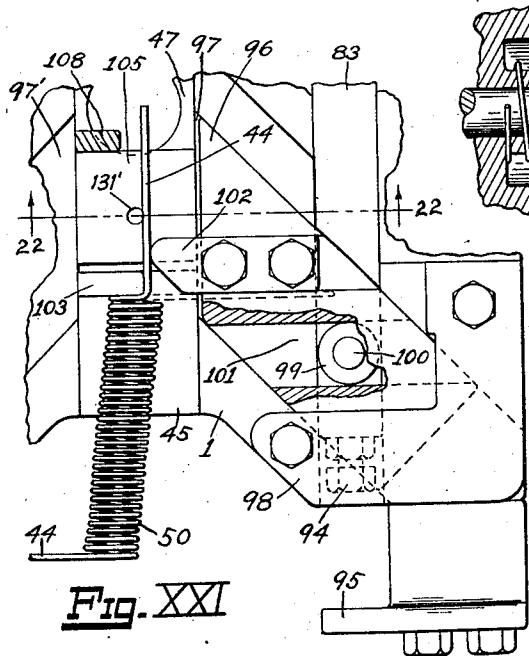


Fig. XXI

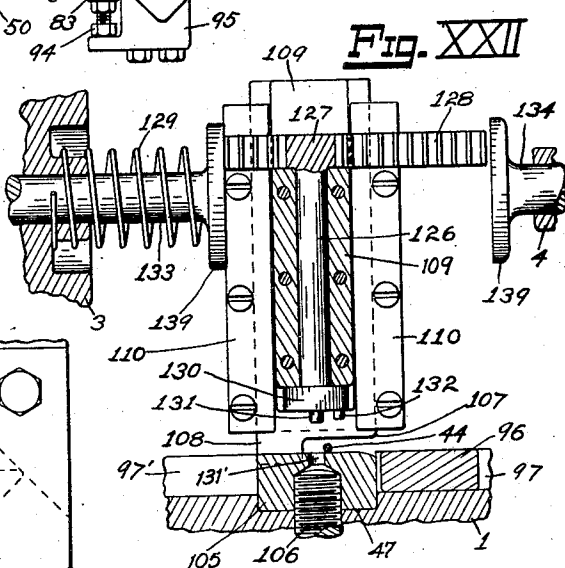


Fig. XXII

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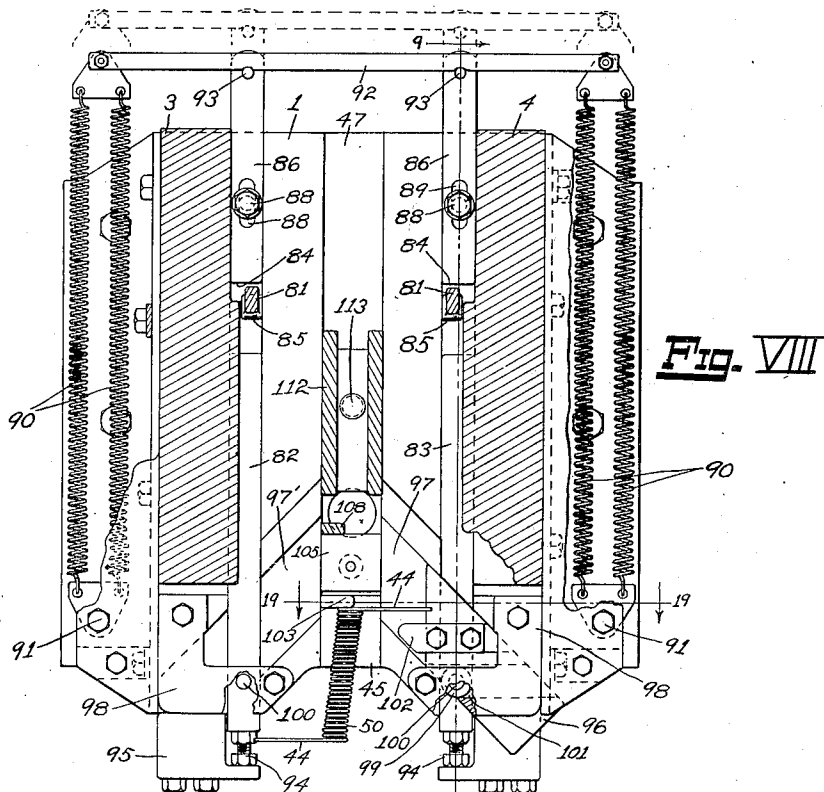


Fig. VIII

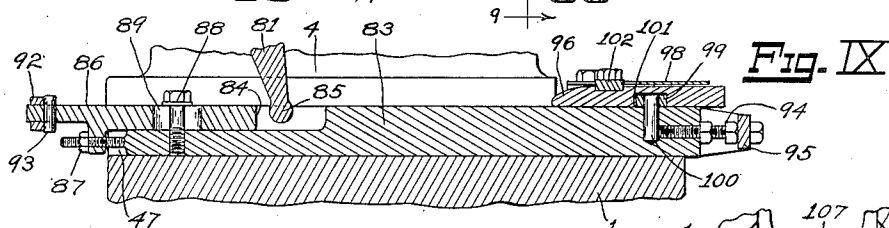


Fig. IX

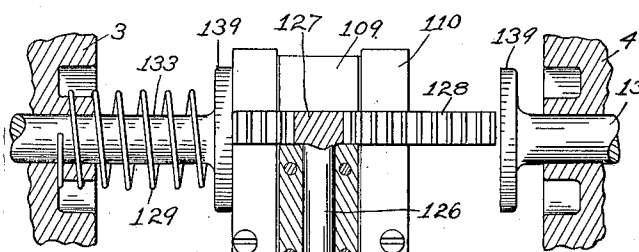


Fig. XXIII

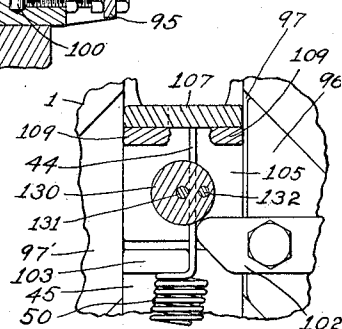
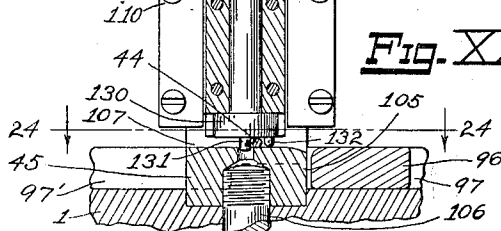


Fig. XXIV



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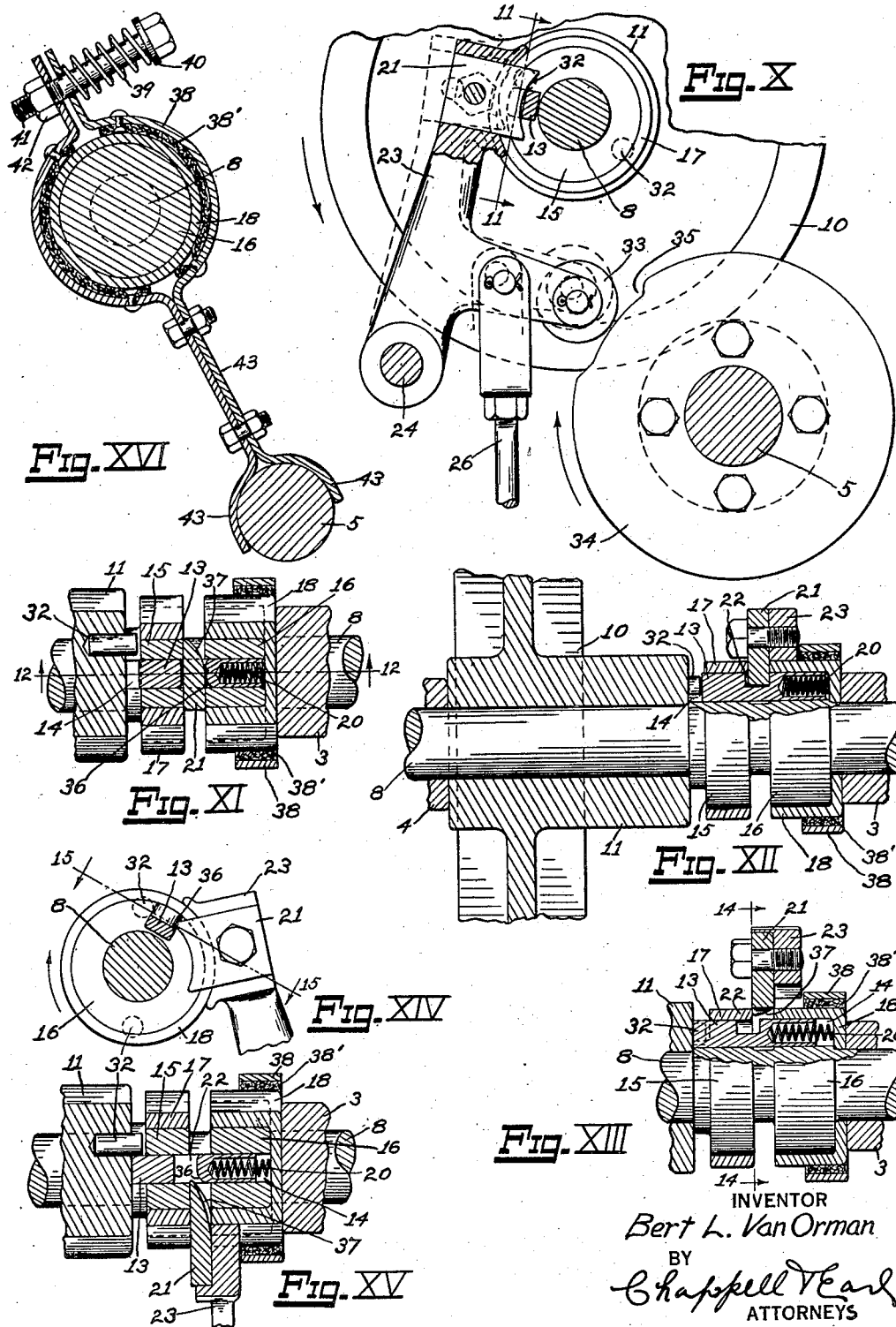
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8 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE.

BERT L. VAN ORMAN, OF HIGHLAND PARK, MICHIGAN, ASSIGNOR TO L. A. YOUNG INDUSTRIES, INC., OF DETROIT, MICHIGAN.

WIREWORKING MACHINE.

Application filed March 26, 1923. Serial No. 627,763.

To all whom it may concern:

Be it known that I, BERT L. VAN ORMAN, a citizen of the United States, residing at Highland Park, county of Wayne, State of Michigan, have invented certain new and useful Improvements in Wireworking Machines, of which the following is a specification.

This invention relates to improvements in wire working machines.

In the use of tension springs, it is necessary that the ends be shaped to some form that will permit the spring to be hooked or otherwise attached to the parts acted upon.

This invention relates particularly to a machine for forming the end of a coiled spring into a suitable hook which shall be in alignment longitudinally with the center of the coils. The accomplishment of this result requires several distinct movements or operations which, previous to the development of my present machine, were done by separate devices.

The main objects of this invention are:

First, to provide a machine adapted to form a complete centrally aligned hook end on a coiled spring by means of a single machine, thereby eliminating the time and labor necessary to change from one operation to another.

Second, to provide a machine adapted to produce a uniform product by holding the spring firmly in position during all of the successive operations, thus assuring accurate application of the different movements.

Third, to provide a machine capable of being easily adapted to the forming of different types of spring ends.

Fourth, to provide a machine that may easily be adapted to operate upon springs coiled either right or left hand.

Fifth, to provide a machine of the class described which may be easily adjusted or repaired and which may be so constructed as to be strong enough to withstand considerable use.

Further objects, and objects relating to structural details, will definitely appear from the detailed description to follow.

A structure which is a preferred embodi-

ment of my invention is clearly illustrated in the accompanying drawing forming a part of this application, in which:

Fig. I, Sheet 1, is a general plan view. 55

Fig. II, Sheet 2, is a view in elevation of the left side of the machine, the pedestal being partially broken away.

Fig. III, Sheet 3, is an elevation of the right side, the pedestal being partially broken away. 60

Fig. IV, Sheet 1, is a fragmentary view, partially in front elevation and partially in transverse section on a line corresponding to line 4—4 of Fig. I. 65

Fig. V, Sheet 4, is a view in vertical longitudinal section on a line corresponding to line 5—5 of Fig. I, showing a coiled spring in position to be operated upon by the machine. 70

Fig. VI, Sheet 4, is a view corresponding to Fig. V, but with parts in actuated position.

Fig. VII, Sheet 5, is a view in horizontal section on a line corresponding to line 7—7 of Fig. V. 75

Fig. VIII, Sheet 6, is a view in horizontal section on a line corresponding to line 8—8 of Fig. V.

Fig. IX, Sheet 6, is a detail view in longitudinal section on a line corresponding to line 9—9 of Fig. VIII. 80

Fig. X, Sheet 7, is an enlarged view in section on a line corresponding to line 10—10 of Fig. I, illustrating details of a clutch for connecting the machine with a source of power. 85

Fig. XI, Sheet 7, is a view partially in section on a line corresponding to line 11—11 of Fig. X. 90

Fig. XII, Sheet 7, is a detail view partially in section on a line corresponding to line 12—12 of Fig. XI, showing further details of the clutch.

Fig. XIII, Sheet 7, is a view in detail similar to Fig. XII, showing the driven clutch dog in operative position. 95

Fig. XIV, Sheet 7, is a detail view in section on a line corresponding to line 14—14 of Fig. XIII, but showing the releasing member in position to disengage the driven clutch dog. 100

Fig. XV, Sheet 7, is a detail view partially in section on a line corresponding to line 15—15 of Fig. XIV.

Fig. XVI, Sheet 7, is an enlarged detail section of the clutch brake, taken from a line corresponding to line 16—16 of Fig. I.

Fig. XVII, Sheet 8, is a perspective view of an end of a coiled spring such as my machine is designed to operate upon.

Fig. XVIII, Sheet 8, is an enlarged perspective view of the spring holder member.

Fig. XIX, Sheet 3, is an enlarged detail view in section on a line corresponding to line 19—19 of Fig. VIII, showing a spring clamped in the holder and a forming die in position to begin the first operation upon the spring.

Fig. XX, Sheet 3, is a detail view similar to Fig. XIX showing completion of the first operation.

Fig. XXI, Sheet 5, is an enlarged fragmentary view similar to a portion of Fig. VIII, showing the position occupied by the parts at the completion of the second operation.

Fig. XXII, Sheet 5, is a detail vertical section taken on a line corresponding to line 22—22 of Fig. XXI.

Fig. XXIII, Sheet 6, is a detail view similar to Fig. XXII showing the position of the parts at the completion of the third operation.

Fig. XXIV, Sheet 6, is a detail view in section on a line corresponding to line 24—24 of Fig. XXIII.

Fig. XXV, Sheet 8, is a detail view similar to Fig. XXIII, showing the position of the parts at completion of the fourth operation.

Fig. XXVI, Sheet 8, is a detail view in section on a line corresponding to line 26—26 of Fig. XXV.

Fig. XXVII, Sheet 8, is an enlarged perspective view of a completed spring end.

Fig. XXVIII, Sheet 8, is a view similar to Fig. XXVI, showing changes in position or form of parts necessary to adapt the machine for operation upon springs coiled left hand.

Fig. XXIX, Sheet 8, is a perspective view of a modified form of spring end.

Fig. XXX, Sheet 8, is a view similar to Fig. XXVI, showing the form of parts necessary to shape the spring end illustrated in Fig. XXIX.

In the drawings, similar reference characters refer to similar parts throughout the several views and the sectional views are taken looking in the direction indicated by the little arrows at the ends of the section lines.

Referring to the drawing, a main frame base or bed 1 resting upon a suitable pedestal 2 provides support for side frame mem-

bers 3 and 4. A driven shaft 5, which is journaled in suitable bearings in the members 3 and 4, imparts motion to the several mechanisms which constitute the working parts of the machine. The shaft 5 carries a gear 6 which meshes with a pinion 7 secured to a drive shaft 8 which is supported by bearing brackets 9, the gear ratio preferably being such that several revolutions of the drive shaft are required to cause a single revolution of the driven shaft 5.

The embodiment of my invention illustrated is designed to be intermittently actuated. The actuating means comprises a pulley 10 which is normally free to rotate on the drive shaft 8, being connected to a source of power by a belt 12. The pulley 10 is connected with the drive shaft 8 by a clutch consisting of a pawl or dog 13 lying in a longitudinally disposed groove-like way 14, which is formed in enlargements 15 and 16 on the drive shaft—see Figs. X to XIV inclusive. The dog 13 is retained in the way 14 by a ring 17 and cap 18 on the enlargements 15 and 16 respectively which are shrunk upon or otherwise firmly secured thereto. The dog 13 is urged toward the pulley 10 by a compression spring 20 which lies in a recess in the dog and is supported by the cap 18. The dog 13 is held normally in retracted position by the releasing member 21 which engages a slot 22 in the dog—see Figs. XI and XII.

The releasing member 21 is carried by a rock arm 23 pivoted on a rod 24 supported by brackets 25. The rock arm 23 is connected by a link 26 to one end of a lever 27 which is pivoted at 28 to the main frame and has a suitable pedal 29 positioned to be conveniently reached by the operator,—see Fig. II. The pedal is normally held upward by the spring 30 which has one end attached to the lever 27 and the other end secured to the frame, thereby normally holding the releasing member in contact with the dog 13. When the pedal 29 is depressed the releasing member 21 is disengaged, allowing the spring 20 to project the dog 13 into range of driving pins 32 which are secured in the hub 11 of the pulley 10—see Figs. XIII and XV. The dog is engaged by one of the pins 32 causing the drive shaft 8 to rotate with the pulley 10 and throwing the machine into action.

As soon as the clutch is engaged the operator releases the pedal 29, but the releasing member 21 is prevented from immediately disengaging the clutch by means of a roller 33 mounted on an extension of the rock arm 23, to coast with a disc 34 secured to the driven shaft 5—see Figs. VI and X. When the shaft 5 has completed a revolution, the roller 33 passes into a depression 35 in the periphery of the disc 34 permitting the re-

leasing member to swing into position to disengage the clutch dog 13. The clutch is disengaged during the first revolution of the pulley 10 after the releasing member drops into range of the dog 13. The releasing member is provided with a wedge part 37 which first enters the slot 22, the edge of the slot being rounded at 22 to permit easy engagement of the parts—see Figs. XIV and XV.

To insure stopping of the machine when the clutch is released, I provide brake bands 38 lined with suitable frictional material 38' in contact with the cap 18—see Fig. XVI. Any desired pressure is applied by a spring 39 in compression between one of the bands 38 and a collar 40 on a spring keeper 41 which is held in place in the brake bands by an adjusting nut 42. To prevent rotation of the brake, it is provided with a forked extension 43 engaging the shaft 5—see Fig. XVI.

The machine illustrated is designed to receive springs 50 (the work) formed with an extension 44 at each end substantially as shown in Fig. XVII, there being a sufficient amount of uncoiled wire 44 left to form the hooks—shown in Fig. XXVII.

The work 50 is held in position in the machine by a block-like work holder 45—see Fig. XVIII—having a seat 46 adapted to receive the work, the seat preferably having thread-like spirally disposed grooves adapted to receive the coils of the particular spring to be operated upon. The grooves assist in holding the spring firmly in position. The work holder 45 is removable, it being held in position in a groove 47 in the frame bed 1 by a screw 48—see Fig. VI.

With the springs in position in the machine, see Figs. V, VI and VIII, the operator operates the pedal 29 which allows the clutch described to engage, thereby driving the main shaft 5 in the direction indicated by the arrow 51.

A cam 52 on the shaft 5 first engages a roller 53 on the rock lever 54 pivoted on the supporting shaft 55. The other end of the rock lever is forked at 57 to embrace the plunger head 59, the arms of the fork being slotted to engage the pins 58 projecting from the sides of the head 59.

The plate-like extension centering plunger 60 is secured to the head so that it is reciprocated as the rocker arm of the lever 54 is actuated, the plunger being supported in the vertical guides 61 carried by the frame cross member 62. The plunger carries a clamping member 65 having a stem 64 slidably engaging a longitudinal bore in the threaded supporting member 63 carried by the head 59. The clamping member 65 is longitudinally slotted and supported for reciprocating movement on the plunger by

means of the stud 66 engaging the slot 67—see Fig. V.

The coiled spring 68 acts upon the clamping member to normally hold it in its lower position on the plunger 60, the spring resting upon the shoulder 69 of the clamping member and its upper end being engaged by the lower end of the supporting and spring adjusting member 63—see Figs. V and XIX. The member 63 is secured in its adjusted position by means of the clamping bolt 63'. The plunger 60 and the clamp 65 are normally held in retracted position by the spring 70 connected to the rock lever 54 and to the overhanging bracket 71 on the frame.

With the work 50 in position in the work holder 45, as shown in Figs. V and XIX, the plunger 60 is actuated by the mechanism described, operation being controlled by the operator through the foot control lever. As the plunger descends, the spring pressed work clamp 65 first engages the work under tension of the spring 68, the connections just described permitting the plunger to continue its downward movement after such engagement of the work clamp. The plunger 60 is designed to engage the end coil of the spring 50 and press it down upon the work holder 45, leaving the extension 44 extending diametrically across the coil—see Figs. XIX and XX. This completes the first or extension centering operation.

I preferably provide means for accurately determining the stroke of the plunger 60. This, in the structure illustrated, I accomplish by providing the supporting shaft 55 on which the rock lever 54 is mounted with eccentric pins 73 resting in bearing-like supports in the frame members 3 and 4, the shaft 55 being normally held from turning by clamping the caps 74 and 75 thereon. By loosening these caps and turning the shaft by means of the collar 76 secured to the shaft, the position of the pivot center of the lever 54 may, due to the eccentricity of the pins 73, be adjusted.

After this first or centering operation has been performed by means of the plunger 60, the cam 52 next engages a roller 78 carried by a lever 79 pivoted at 80. This lever 79 has downwardly extending arms 81 engaging the slide members 82 and 83 supported in groove-like ways in the frame bed 1. Each slide member has a shoulder 84 positioned to coact with one of the arms or the lower end of the lever 79. These shoulders 84 are formed by the ends of the adjustable members 86 which are adjustably secured to the slides by the adjusting screw or bolt 87 and the clamping screw 88, the screw extending through the slot 89 in the adjustable sections 86.

The slides 82 and 83 are retracted by the springs 90 which are secured to the frame at 91 and connected at their forward ends to a cross bar 92 bearing against pins 93 on the adjustable members 86 of the slides—see Fig. VIII. The limit of forward movement of each slide is determined by an adjustable stop screw 94 engaging a stop block 95 on the bed of the machine. By adjusting the slide members 86 and the stop screws 94, any desired range of movement of the slides may be obtained.

Former members 96 are slidably mounted in the groove-like ways 97 in which they are retained by the overhanging frame member 98 which overlies the slide 83. These ways are disposed diagonally relative to the path of the slides. A roller 99 carried by the pin 100 on the slide engages the lateral groove 101 in the lower surface of the member 96 so that when the slide 83 is reciprocated as described, the former block is actuated—see Fig. XIX. There is one of these mechanisms for each slide 82 and 83. As these are duplicated, I confine my description to one.

The former member 96 is provided with a tappet or finger 102 which engages the extension 44 of the spring 50 with a wiping action, bending it to the position shown in Fig. XXI, a former block 103 being provided on the work holder so that the end 44 is bent around the same. The shape and position of this former block determines the bend in the extension 44. The bending of the extension 44 to the position shown in Fig. XXI constitutes the second operation in the forming of the hook.

I desire to mention at this point that while being acted upon by the machine, the spring is preferably positioned at an angle to the longitudinal center line of the machine so that the end 44 is bent slightly in excess of the amount of the bend of the completed hook desired at this point. This is to compensate for the tendency of the spring wire to return to its original position, thus leaving the hook substantially parallel with the center line of the spring when the spring is removed from the machine.

The next or third operation is to cut off any surplus stock on the spring extension 44. When the extension 44 is bent to the position shown in Fig. XXI, it overlies a block-like supporting and shear member 105 which is secured in the groove 47 of the bed or frame by means of the screw 106, the screw passing through a slot-like hole permitting longitudinal adjustment of the block 105—see Fig. V. This head block 105 also constitutes a shear block.

The end of the extension of the coil projects under a blade 107 which has a guide extension 108 at one side to guide the blade across the end of the member 105—see Figs.

V and XXII. The blade 107 is mounted on the vertically reciprocating carriage 109 supported in the ways 110 of the bracket 112. This bracket 112 is adjustably secured in the groove 47 of the bed or base 1 by means of the screw 113 disposed through the elongated hole 114 thereby permitting the adjustment of the bracket.

The carriage 109 is actuated by the bell crank lever 115 pivoted at 116 on the bracket 112. One end 117 of this lever 115 is formed to engage an opening 118 in the carriage 109. The other end of the lever 115 is connected by the adjustable link 119 to a lever 120 pivoted at 121 and carrying a roller 122 adapted to be engaged by the cam 52. The cam 52 engages this roller 122 after the cam has acted upon the lever 79 described and actuates the carriage to cut off the spring extension to the proper length—see Figs. VI, XIII and XXIV.

The carriage 109 is normally held in elevated position by the springs 123 attached to the pin 124 connecting the link 119 to the lever 115, the other ends of the link being connected to the machine—see Fig. VII. The springs 123 hold the lever 115 yieldingly against the top of the slot 125 formed in the bracket 112—see Fig. V.

The downward limit of the stroke of the carriage 109 may be determined by the adjustment of the link 119, the link being made up of threaded sections, as shown in Fig. V. In addition to carrying the blade 107 the carriage 109 carries the mechanism for bending the end of the spring extension into the form of a hook. This mechanism comprises the vertically disposed spindle 126 having a pinion 127 on its upper end meshing with the rack 128 mounted on the carriage for reciprocation transversely of the spindle 126.

The spindle 126 is provided with a head 130 at its lower end carrying downwardly projecting pins 131 and 132, the pin 131 being centrally disposed relative to the axis of the spindle 126 while the pin 132 is located eccentrically relative thereto. The member 105 is provided with a hole 131' adapted to receive the end of the pin 131 when the carriage is in actuated position.

When the carriage 109 is actuated, the wire is cut off and the head 130 is positioned so that the pins 131 and 132 engage on opposite sides of the wire—see Figs. XXIII and XXIV.

The rack 128 is actuated by the tappet rod 133 which is mounted in the frame member 3 and is urged against the bracket 112 by the coiled spring 129, thereby normally holding the rack 112 to the right and the head 130 so that its pin 132 is in proper position to engage the wire.

After the carriage has been lowered to engage the pins 131 and 132 with the spring extension, the rack 128 is actuated toward the

left by the tappet rod 134 which is actuated by the lever 135—see Fig. I, the lever being pivoted in the bracket 136 and having a roller 137 coacting with a cam 138 on the main shaft 5.

The inner ends of the tappet rods 133 and 134 are enlarged in order to engage the rack throughout the stroke of the carriage. The actuation of the rack by the tappet rod 134 as described rotates the head 130 approximately 180°, and bends the spring extension 44 around the center pin 131 of the head—see Figs. XXV and XXVI, thus completely forming the hook. As the shaft 55 completes its revolution, each of the actuating members returns to initial position so that when the hook is completely formed the spring 50 is released and may be reversed to form the hook on its other end, the springs being manually placed in the work holder, in the embodiment illustrated.

The spindle is actuated prior to the retracting of the former slide so that the work is securely held during this hook forming operation.

In the foregoing description, I have described the operation of the machine upon right-hand coiled springs. The machine is readily adapted and operates equally as well on left-hand coiled springs by the replacing of certain parts appropriately formed for left-hand work and changing the position of other parts—for instance, a left-hand spring roller 45' replaces the holder 45 and a left-hand former block 96' corresponding to the former block 96 is placed in the left diagonal groove 97', the roller 99 being placed on the pin 100 on the left-hand slide member 82—see Fig. XXVIII. The cut off knife 97 is reversed so that it faces the left. The position of the tappet rods 133 and 134 is reversed, the forming head being positioned so that the pin 132 drops down on the left-hand side of the spring extension 44. The cam lever 35 is changed to the bracket 136' on the left-hand side of the machine and coacts with the cam 138' carried by the gear 6, the cam being timed to correspond with the cam 138. The actuation of the rack 128 from the left rotates the head 130 in proper direction to bend the extension 44 to the right, as shown in Fig. XXVIII.

By variations in the forming member and in the adjustment, other types and proportions of hooks and parts of wire may be formed by this machine.

Fig. XXIX illustrates a modification in which the hook is substantially the whole width of the spring. This form of hook is produced by extending the form block 103 around which the extension 44 is bent in the second operation and enlarging the center pin 131, the location of the pin 132 being correspondingly changed—see Fig. XXX.

I have not attempted to illustrate or de-

scribe certain other modifications or adaptations which I contemplate to adapt my machine to other forms of work as I believe the disclosure made will enable those skilled in the art to which my invention relates to embody or adapt my improvements as may be desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, said holder being provided with a former block at the end of the seat, a support member disposed at the end of said work holder, the rear edge of said support member constituting a shear member, a vertically reciprocating centering forming plunger for the spring extension adapted to engage the first coil of a spring arranged in the work holder, a work clamp yieldingly mounted on said plunger to clamp the work prior to the operation of said plunger thereon, a former member adapted to bend the spring extension around said former block on said work holder and across said support member to a longitudinal position relative to the spring, a carriage mounted to reciprocate above said support member, a blade on said carriage coacting with the shear portion of said support member, a forming spindle mounted on said carriage and provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto, to engage the spring extension while supported by said support member so that upon the rotation of the spindle the extension is bent into a hook, means for actuating said spindle, and means for actuating said plunger, former member and carriage and said spindle, timed so that they are successively actuated, said spindle being actuated prior to retracting of said former member and carriage.

2. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, said holder being provided with a former block at the end of the seat, a support member disposed at the end of said work holder, a vertically reciprocating centering forming plunger for the spring extension adapted to engage the first coil of a spring arranged in the work holder, a work clamp yieldingly mounted on said plunger to clamp the work prior to the operation of said plunger thereon, a former member adapted to bend the spring extension around said former block on said work holder and across said support member to a longitudinal position relative to the spring, a carriage mounted to reciprocate above said support member, a forming spindle mounted on said carriage and

provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto, to engage the
 5 spring extension while supported by said support member so that upon the rotation of the spindle the extension is bent into a hook, means for actuating said spindle, and means
 10 for actuating said plunger, former member and carriage and said spindle, timed so that they are successively actuated, said spindle being actuated prior to retracting of said
 former member and carriage.

3. In a structure of the class described,
 15 the combination of a work holder adapted to receive a spring having an end extension, said holder being provided with a former block at the end of the seat, a support member
 20 disposed at the end of said work holder, the rear edge of said support member constituting a shear member, a vertically reciprocating centering forming plunger for
 the spring extension adapted to engage the first coil of a spring arranged in the work
 25 holder, a former member adapted to bend the spring extension around said support member to a longitudinal position relative to the spring, a carriage mounted to recip-
 30 erate above said support member, a blade on said carriage coacting with the shear portion of said support member, a forming
 spindle mounted on said carriage and provided with a head having pins thereon, one
 35 of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto, to engage the spring
 extension while supported by said support member so that upon the rotation of the
 40 spindle the extension is bent into a hook, means for actuating said spindle, and means
 for actuating said plunger, former member and carriage and said spindle, timed so that
 45 they are successively actuated, said spindle being actuated prior to retracting of said
 former member and carriage.

4. In a structure of the class described, the combination of a work holder adapted
 to receive a spring having an end extension, said holder being provided with a former
 50 block at the end of the seat, a support member disposed at the end of said work holder,
 a vertically reciprocating centering forming plunger for the spring extension adapted to
 engage the first coil of a spring arranged
 55 in the work holder, a former member adapted to bend the spring extension around
 said former block on said work holder and across said support member to a longitudinal
 position relative to the spring, a carriage
 60 mounted to reciprocate above said support member, a forming spindle mounted on said
 carriage and provided with a head having pins thereon, one of which is disposed cen-
 65 trally relative to the axis of the spindle and the other eccentrically relative thereto, to

engage the spring extension while supported
 by said support member so that upon the
 rotation of the spindle the extension is bent
 into a hook, means for actuating said spin- 70
 dle, and means for actuating said plunger,
 former member and carriage and said spin-
 dle, timed so that they are successively ac-
 tuated, said spindle being actuated prior to
 retracting of said former member and car- 75
 riage.

5. In a structure of the class described, the
 combination of a work holder adapted to
 receive a coiled spring having an end exten- 80
 sion, said holder being provided with a for-
 mer block at the end of the spring, a sup-
 port member disposed at the end of said
 work holder, the rear edge of said support
 member constituting a shear member, a cen- 85
 tering plunger for said extension adapted
 to engage the coil of which said extension
 is a continuation, means for bending such
 extension to a longitudinal position relative
 to the spring, a carriage mounted to recip- 90
 erate above said support member, a blade
 on said carriage coacting with the shear
 portion of said support member, a forming
 spindle provided with pins positioned to en- 95
 gage the spring extension on opposite sides
 thereof so that on rotation of the spindle
 the extension is formed into a hook, a rack
 mounted on said carriage to reciprocate 100
 transversely of the spindle, a pinion on said
 spindle coacting with said rack, a tappet
 member for actuating said rack, and an op-
 posed spring pressed tappet member for re-
 turning said rack. said tappet members be- 105
 ing provided with heads permitting move-
 ment of the rack transversely of the tappet
 members.

6. In a structure of the class described, 105
 the combination of a work holder adapted to
 receive a coiled spring having an end exten-
 sion, said holder being provided with a
 former block at the end of the spring, a
 support member disposed at the end of said 110
 work holder, a centering plunger for said
 extension adapted to engage the coil of
 which said extension is a continuation, means
 for bending such extension to a longitudinal
 position relative to the spring, a carriage 115
 mounted to reciprocate above said support
 member, a forming spindle provided with
 pins positioned to engage the spring exten-
 sion on opposite sides thereof so that on
 rotation of the spindle the extension is 120
 formed into a hook, a rack mounted on said
 carriage to reciprocate transversely of the
 spindle, a pinion on said spindle coacting
 with said rack, a tappet member for actu- 125
 ating said rack, and an opposed spring pressed
 tappet member for returning said rack, said
 tappet members being provided with heads
 permitting movement of the rack trans-
 versely of the tappet members.

7. In a structure of the class described, 130

the combination of a work holder, a support member, a carriage mounted to reciprocate above said support member, a forming spindle provided with pins positioned to engage the spring extension on opposite sides thereof so that on rotation of the spindle the extension is formed into a hook, a rack mounted on said carriage to reciprocate transversely of the spindle, a pinion on said spindle coacting with said rack, a tappet member for actuating said rack, said tappet member being provided with a head permitting movement of the rack transversely of the tappet member.

8. In a structure of the class described, the combination of a support member constituting a shear member, a carriage mounted to reciprocate above said support member, a blade on said carriage coacting with the shear portion of said support member, a forming spindle provided with pins positioned to engage the spring extension on opposite sides thereof so that on rotation of the spindle the extension is formed into a hook, a rack mounted on said carriage to reciprocate transversely of the spindle, a pinion on said spindle coacting with said rack, and means for actuating said rack.

9. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, a support member disposed at the end of said work holder, a carriage mounted to reciprocate above said support member, a forming spindle provided with pins positioned to engage the spring extension on opposite sides thereof so that on rotation of the spindle the extension is formed into a hook, a rack mounted on said carriage to reciprocate transversely of the spindle, a pinion on said spindle coacting with said rack, and means for actuating said rack.

10. In a structure of the class described, the combination of a support member constituting a shear member, a carriage mounted to reciprocate above said support member, a blade on said carriage coacting with the shear portion of said support member, a forming spindle provided with pins positioned to engage the spring extension on opposite sides thereof so that on rotation of the spindle the extension is formed into a hook, and means for actuating said spindle.

11. In a structure of the class described, the combination of a support member operatively associated with said work holder, a carriage mounted to reciprocate above said support member, a forming spindle mounted on said carriage and provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto to engage the spring extension while supported by said support member so that

upon the rotation of the spindle the extension is bent into a hook, said support member having a hole therein adapted to receive the central pin, and means for actuating said spindle.

12. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, said holder having a seat with transverse coil receiving grooves therein, and being provided with a former block at the end of the seat, a support member, a carriage mounted to reciprocate above said support member, a forming spindle mounted on said carriage and provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto, to engage the spring extension while supported by said support member so that upon the rotation of the spindle the extension is bent into a hook, said support member having a hole therein adapted to receive the central pin, and means for actuating said spindle.

13. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, a support member, a carriage mounted to reciprocate above said support member, a forming spindle mounted on said carriage and provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto, to engage the spring extension while supported by said support member so that upon the rotation of the spindle the extension is bent into a hook, and means for actuating said spindle.

14. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, a support member, a centering plunger for the spring extension adapted to engage the first coil of a spring arranged in the work holder, a carriage mounted to reciprocate above said support member, a forming spindle mounted on said carriage and provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the spindle and the other eccentrically relative thereto, to engage the spring extension while supported by said support member so that upon the rotation of the spindle the extension is bent into a hook, and means for actuating said spindle.

15. In a structure of the class described, the combination of a work holder, a support member, the rear edge of which constitutes a shear member, a carriage mounted to reciprocate above said support member, a blade on said carriage coacting with the shear portion of said support member, a forming

spindle provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the blade and the other eccentrically relative thereto, and means for reciprocating said carriage and rotating said spindle.

16. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, a support member disposed at the end of said work holder so that the spring extension overlies the same, a carriage mounted to reciprocate above said support member, a forming spindle provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the blade and the other eccentrically relative thereto, and means for reciprocating said carriage and rotating said spindle.

17. In a structure of the class described, the combination of a work holder, a support member, a carriage mounted to reciprocate above said support member, a forming spindle provided with a head having pins thereon, one of which is disposed centrally relative to the axis of the blade and the other eccentrically relative thereto, said support member having a hole therein adapted to receive the central pin, and means for reciprocating said carriage and rotating said spindle.

18. In a structure of the class described, the combination of a holder adapted to receive a coiled spring having an end extension, there being a former block positioned to support said extension, a slide reciprocating at the side of said work holder, a former member supported to reciprocate diagonally relative to the path of said slide and having a work engaging finger adapted to project over said holder to engage the extension and bend the same around said former block thereon, said former member having a transverse slot in the under side thereof, and a roller on said slide coacting with said groove in said former member whereby said former member is actuated by the reciprocation of said slide.

19. In a structure of the class described, the combination of a holder adapted to receive a coiled spring having a lateral end extension, a former block disposed at the end of said holder, and a reciprocating former member adapted to engage said extension, said former member being arranged to reciprocate in a path diagonal to the spring extension whereby the same is bent around said former block into alignment with the spring.

20. In a structure of the class described, the combination with a work holder, of a slide disposed to reciprocate at the side thereof, a spring for actuating the slide in one direction, a lever for actuating said slide in the opposite direction, a member adjust-

ably mounted on said slide to coact with said lever, and adjustable stop for said slide, a former member adapted to coact with the work supported in said holder, a way supporting said former member for reciprocating movement in a path diagonal relative to the path of said slide, said former member having a transverse groove in its under-side, and a cam for actuating said lever and holding it in its actuated position for a predetermined period.

21. In a structure of the class described, the combination with a work holder, of a slide disposed to reciprocate at the side thereof, a spring for actuating the slide in one direction, a lever for actuating said slide in the opposite direction, a former member adapted to coact with the work supported in said holder, a way supporting said former member for reciprocating movement in a path diagonal relative to the path of said slide, said former member having a transverse groove in its underside, and a cam for actuating said lever and holding it in its actuated position for a predetermined period.

22. In a structure of the class described, the combination of a bed having a groove in the face thereof, a work holder secured in said groove by means of a screw arranged through the bed from the bottom thereof, a support member disposed at the end of said work holder, means for adjustably securing said support member comprising a screw arranged through an elongated hole in said bed, a carriage supporting bracket disposed in said groove at the rear of said support member, means for adjustably securing said bracket comprising a screw disposed in an elongated hole in said bed member, a carriage mounted on said bracket to reciprocate above said support member, a former member carried by said carriage and adapted to act upon the work supported by said support member, means for reciprocating said carriage comprising a bell crank lever pivotally mounted on said bracket, an adjustable abutment for said lever on said carriage, a pivoted actuating lever, an actuating cam therefor, an adjustable link connecting said bell crank lever to said actuating lever, and a spring for retracting said bell crank lever.

23. In a structure of the class described, the combination of a work holder, a support member, a carriage reciprocating above said support member, a former member carried by said carriage and adapted to act upon the work supported by said support member, means for reciprocating said carriage comprising a bell crank lever pivotally mounted on said bracket, an adjustable abutment for said lever on said carriage, a pivoted actuating lever, an actuating cam therefor, an adjustable link con-

necting said bell crank lever to said actuating lever, and a spring for retracting said carriage.

24. In a structure of the class described, the combination of a work holder, a support member, a carriage reciprocating above said support member, a former member carried by said carriage and adapted to act upon the work supported by said support member, means for reciprocating said carriage comprising a bell crank lever pivotally mounted on said bracket, a pivoted actuating lever, an actuating cam therefor, a link connecting said bell crank lever to said actuating lever, and a spring for retracting said carriage.

25. In a structure of the class described, the combination of a work holder having a seat adapted to receive a coiled spring having an extension at the end thereof, a forming plunger adapted to engage the coil of the spring terminating the said extension, a head on said plunger provided with laterally projecting pins, a rock lever forked to embrace said head and slotted to engage said pins, a supporting shaft for said rock lever having eccentric pins at its end whereby the supporting shaft may be adjusted to adjust the position of the lever, an actuating cam for said lever, a work clamp slidably mounted on said plunger and provided with a stem, a spring mounted on said stem, and an adjusting member for said spring having a longitudinal bore for said stem, said adjusting member being threaded in said head whereby the tension of the spring may be regulated and said work clamp is slidably supported.

26. In a structure of the class described, the combination of a work holder having a seat adapted to receive a coiled spring having an extension at the end thereof, a forming plunger adapted to engage the coil of the spring terminating the said extension, a head on said plunger provided with laterally projecting pins, a rock lever forked to embrace said head and slotted to engage said pins, an actuating cam for said lever, a work clamp slidably mounted on said plunger and provided with a stem, a spring mounted on said stem, and an adjusting member for said spring having a longitudinal bore for said stem, said adjusting member being threaded in said head whereby the tension of the spring may be regulated and said work clamp is slidably supported.

27. In a structure of the class described, the combination of a work holder having a seat adapted to receive a coiled spring having an extension at the end thereof, a forming plunger adapted to engage the coil of the spring terminating the said extension, a head on said plunger provided with laterally projecting pins, a rock lever forked to

embrace said head and slotted to engage said pins, a supporting shaft for said rock lever having eccentric pins at its end whereby the supporting shaft may be adjusted to adjust the position of the lever, and an actuating cam for said lever.

28. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, said holder having a seat with transverse coil receiving grooves, a support for said end extension, a vertically reciprocating plunger forming member adapted to engage the first coil of the spring supported in the work holder to center the extension diametrically of the coil, and a work clamp yieldingly mounted on said plunger to clamp the work prior to the operation of said plunger thereon.

29. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, a support for said extension, and a vertically reciprocating plunger forming member adapted to engage the first coil of the spring supported in the work holder to center the extension diametrically of the coil.

30. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension extending laterally of the spring, means for centering said extension diametrically of the spring, means for bending said extension to a longitudinal position relative to the spring, means for cutting said extension to the desired length, means for bending the extension into a hook, and means for successively and automatically actuating the said several forming means.

31. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension extending laterally of the spring, a support for said end extension, means for centering said extension diametrically of the spring, means for bending said extension to a longitudinal position relative to the spring, means for bending the extension into a hook, and means for successively and automatically actuating the said several forming means.

32. In a structure of the class described, the combination of a work holder adapted to receive a coiled spring having an end extension extending laterally of the spring, means for centering said extension diametrically of the spring, means for bending said extension to a longitudinal position relative to the spring, means for cutting said extension to the desired length, and means for bending the extension into a hook, said several means being operatively associated to act on the spring while it is supported in said work holder.

33. In a structure of the class described, the combination of a work holder adapted to receive a coiled spring having an end extension extending laterally of the spring, a support for said end extension, means for centering said extension diametrically of the spring, means for bending said extension to a longitudinal position relative to the spring, and means for bending the extension into a hook, said several means being operatively associated to act on the spring while it is supported in said work holder.

34. In a structure of the class described, the combination of a work holder adapted to receive a coiled spring having an end extension extending laterally of the spring, means for bending said extension to a longitudinal position relative to the spring, means for cutting said extension to the desired length, and means for bending the extension into a hook, said several means being operatively associated to act on the spring while it is supported in said work holder.

35. In a structure of the class described, the combination of a work holder adapted to receive a coiled spring having an end extension extending laterally of the spring, a support for said end extension, means for bending said extension to a longitudinal position relative to the spring, and means for bending the extension into a hook, said several means being operatively associated to act on the spring while it is supported in said work holder.

36. In a structure of the class described, the combination of a work holder adapted to receive a coiled spring having an end

extension, means for centering said extension, means for cutting said extension to the desired length, and means for bending the extension into a hook, said several means being operatively associated to successively act on the spring while it is supported in said holder.

37. In a structure of the class described, the combination of a work holder adapted to receive a spring having an end extension, a relatively fixed former block adapted to support the spring extension, a coacting former member adapted to bend the spring extension around said former block, and means for bending said extension into a hook while supported by said former block and former member.

38. In a structure of the class described, the combination of a work holder adapted to receive a spring having a laterally projecting end extension, said holder having a seat disposed at an angle relative to the longitudinal plane of the machine and being provided with a former block around which the extension may be bent while supported in said seat to a position in a longitudinal plane of the machine, and means for forming such extension into a hook while the same is supported in such position whereby when the spring is removed from the holder, the hook extension will assume a position parallel to the longitudinal axis of the spring.

In witness whereof, I have hereunto set my hand and seal.

BERT L. VAN ORMAN. [L. s.]