Nov. 13, 1945. F. J. HORTON 2,389,055

SPRING BENDING MACHINE

Filed April 26, 1943 5 Sheets-Sheet 1

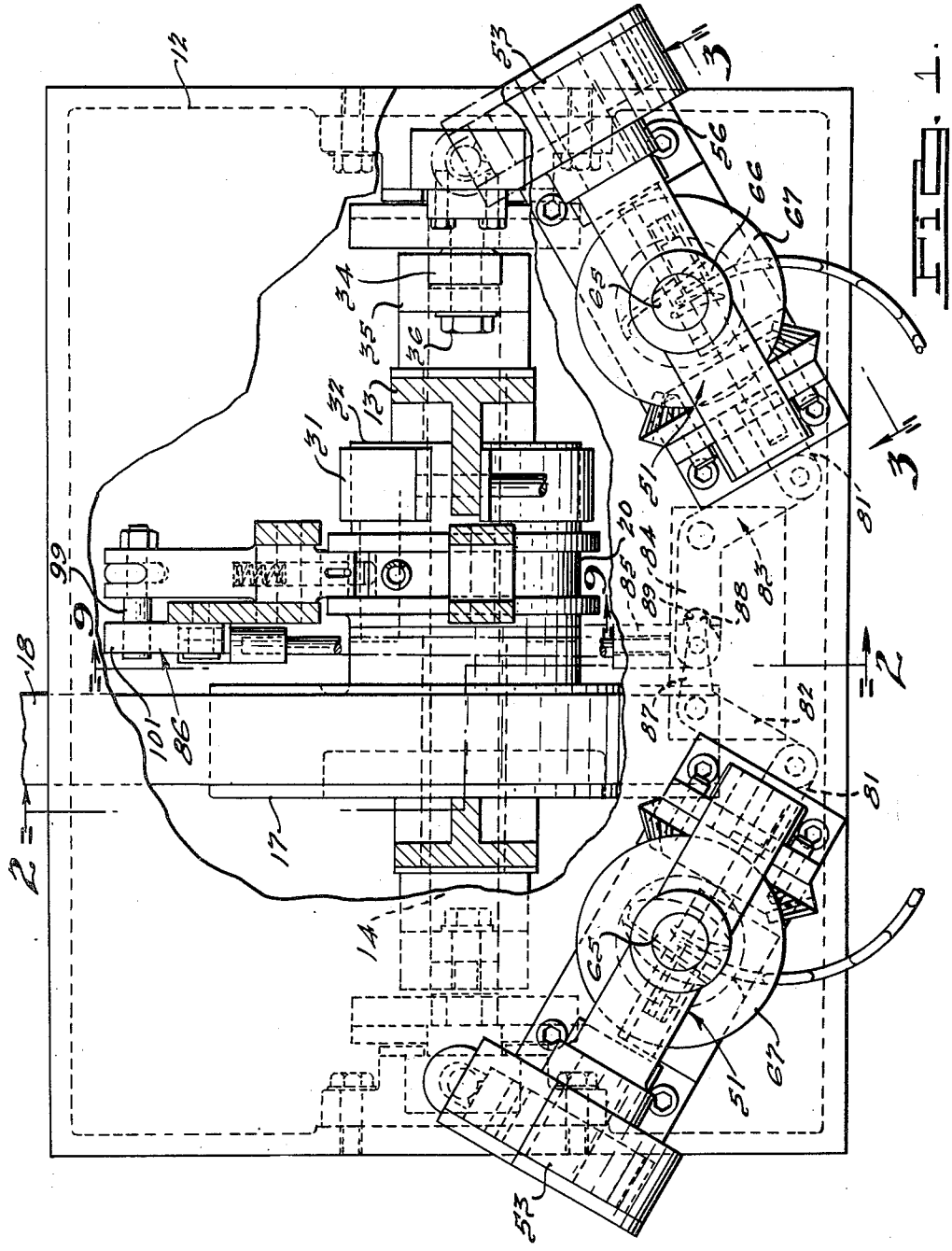


Fig. 1.

INVENTOR
Frank J. Horton.
BY
Harness, Dickey & Pierce
ATTORNEYS.

Nov. 13, 1945. F. J. HORTON 2,389,055

SPRING BENDING MACHINE

Filed April 26, 1943 5 Sheets-Sheet 2

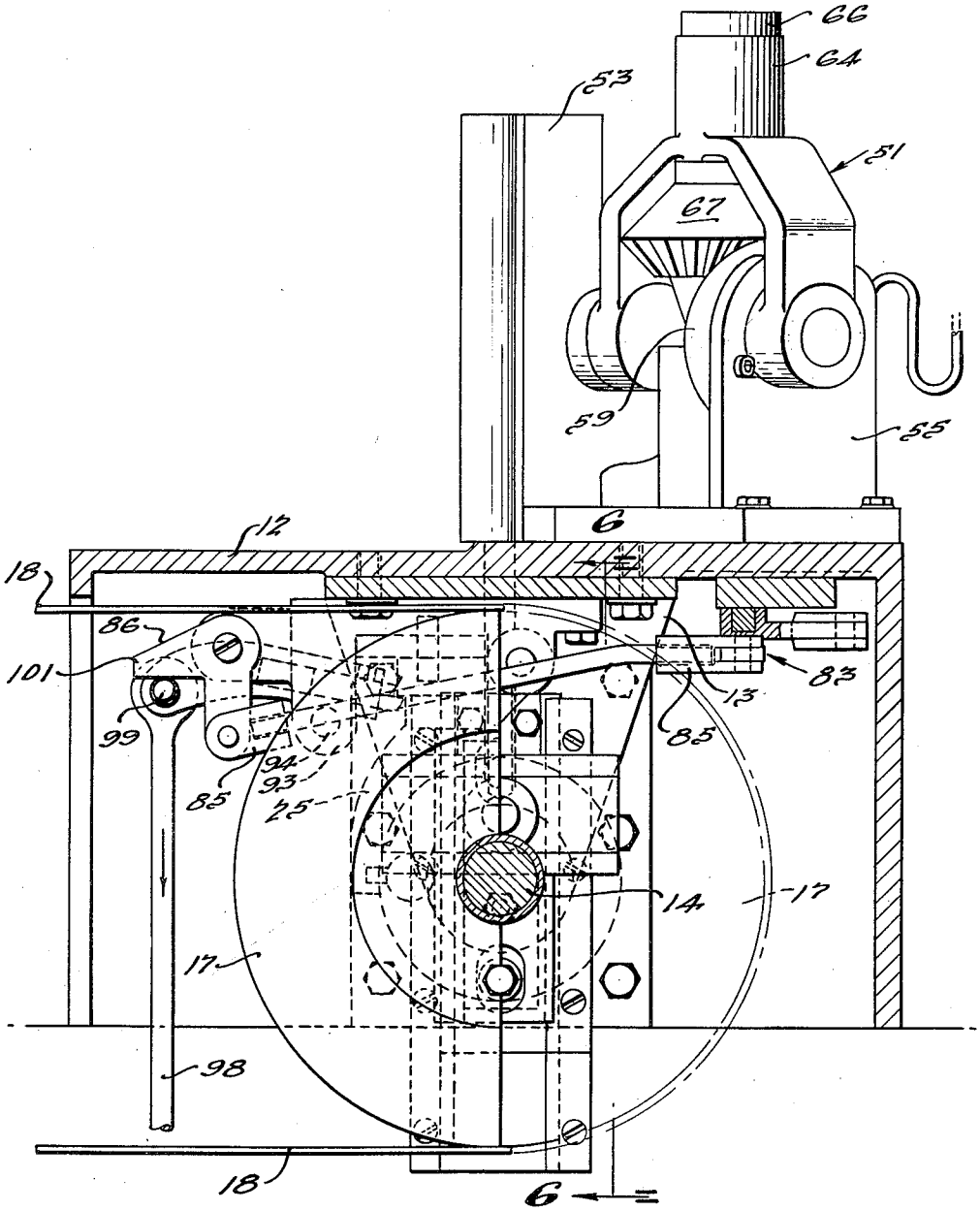


FIG. 2.

INVENTOR
Frank J. Horton.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

Nov. 13, 1945. F. J. HORTON 2,389,055

SPRING BENDING MACHINE

Filed April 26, 1943 5 Sheets-Sheet 3

Fig. 3.

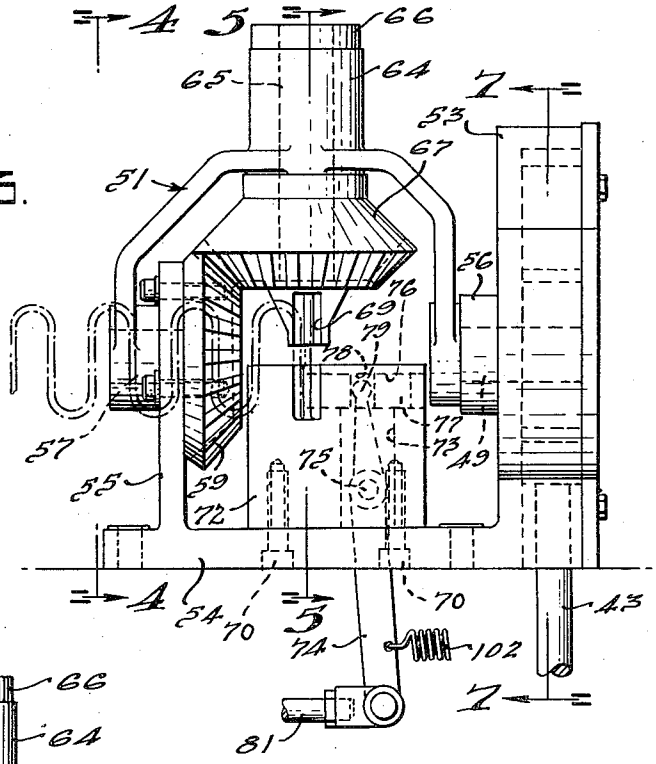


Fig. 4.

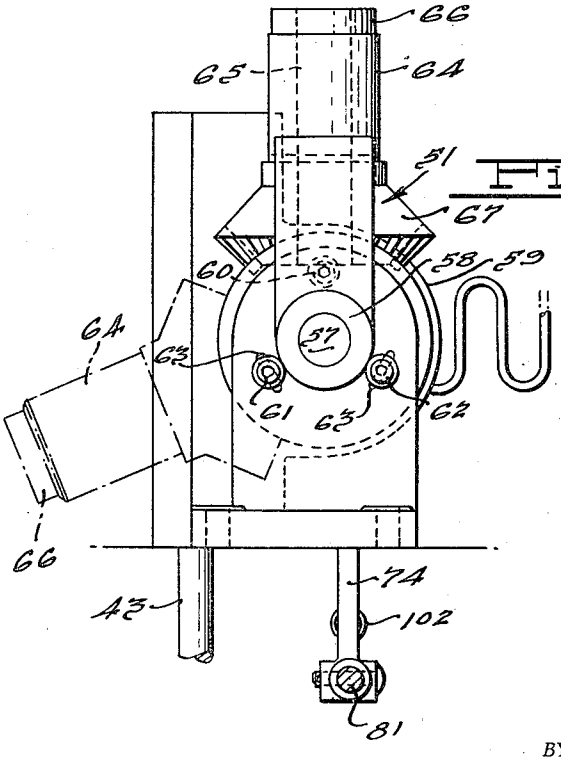
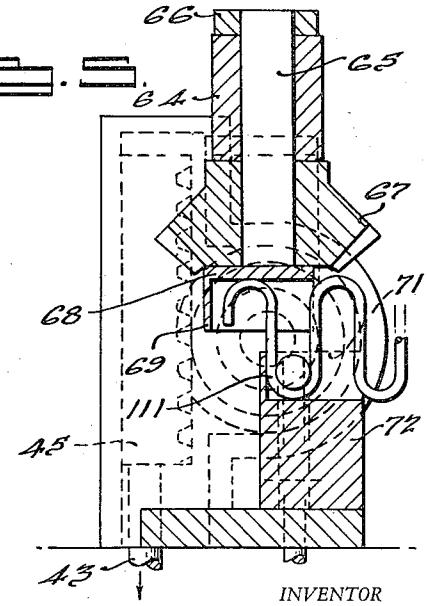


Fig. 5.



INVENTOR

Frank J. Horton.

BY

Harness, Dickey & Pierce.

ATTORNEYS.

Nov. 13, 1945. F. J. HORTON 2,389,055

SPRING BENDING MACHINE

Filed April 26, 1943 5 Sheets-Sheet 4

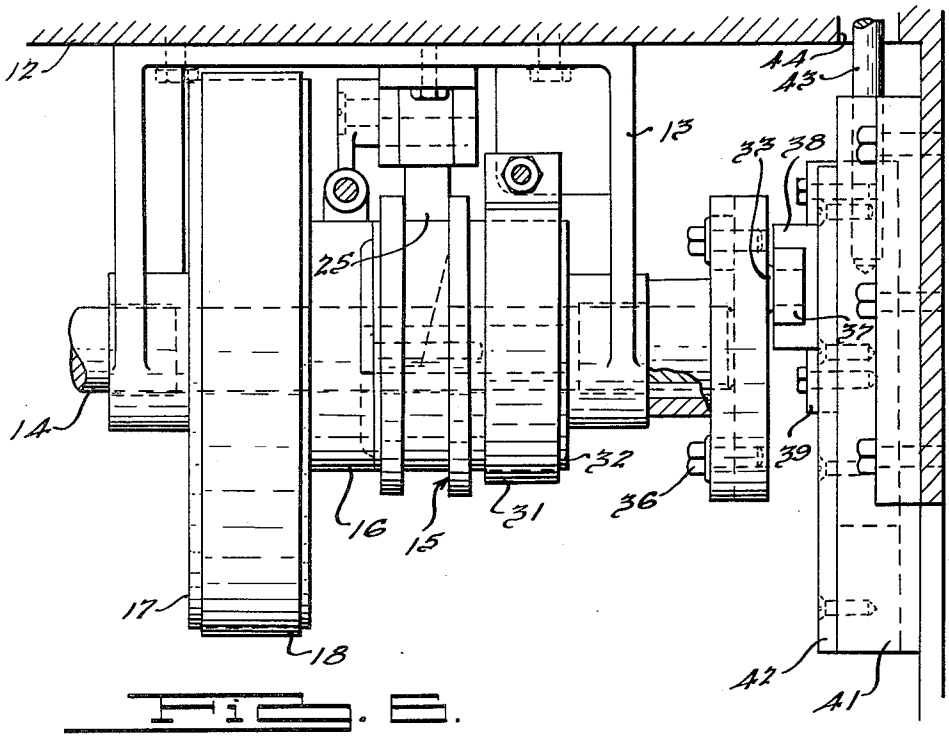


Fig. 1.

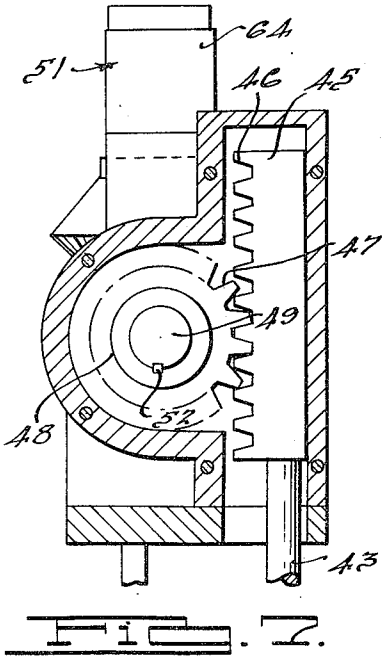


Fig. 2.

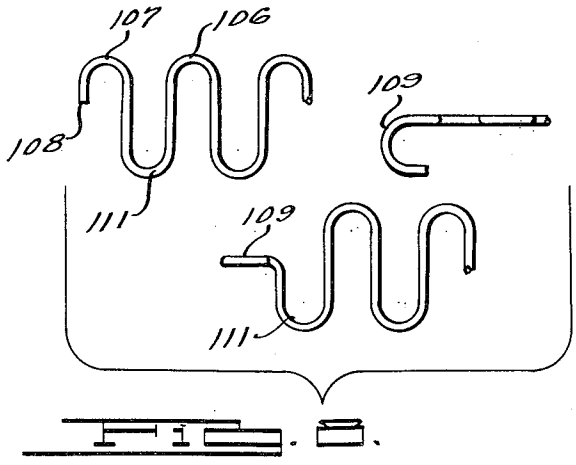


Fig. 3.

INVENTOR
Frank J. Horton.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

Nov. 13, 1945. F. J. HORTON 2,389,055

SPRING BENDING MACHINE

Filed April 26, 1943 5 Sheets-Sheet 5

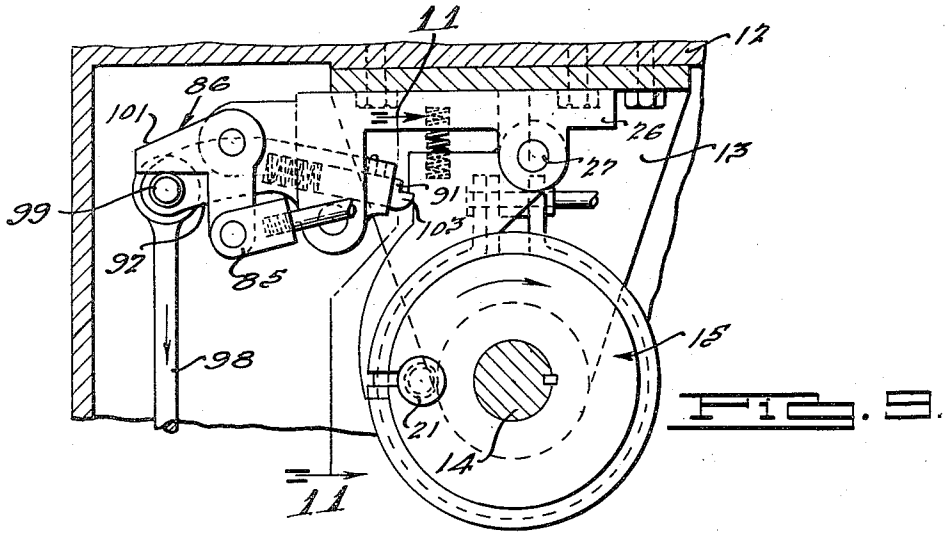


FIG. 9.

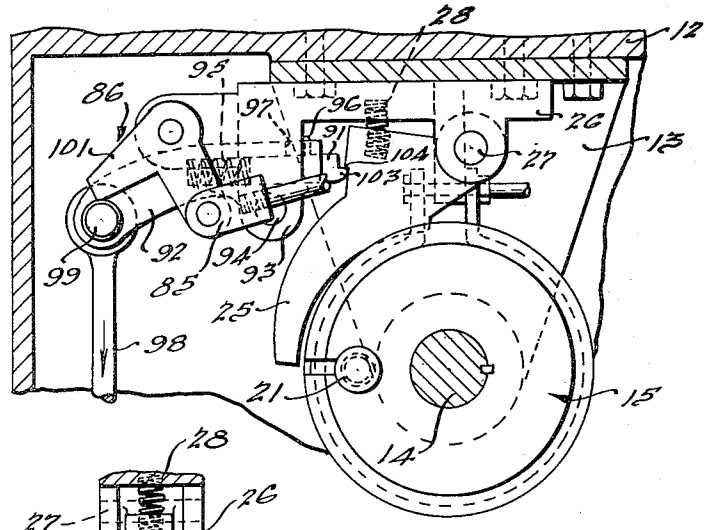


FIG. 10.

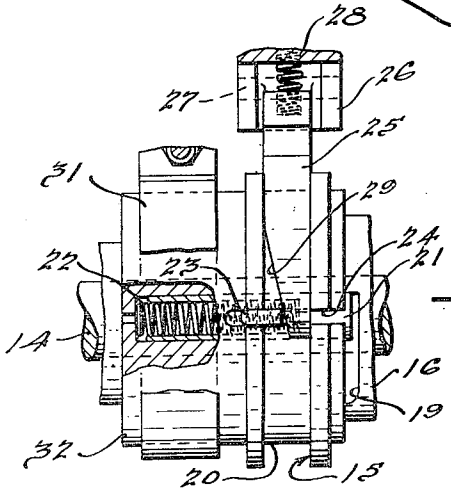


FIG. 11.

INVENTOR
Frank J. Horton.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

Patented Nov. 13, 1945 2,389,055

UNITED STATES PATENT OFFICE

2,389,055

SPRING BENDING MACHINE

Frank J. Horton, Detroit, Mich., assignor to No-Sag Spring Company, Macomb County, Mich., a corporation of Michigan

Application April 26, 1943, Serial No. 484,565

11 Claims. (Cl. 140—105)

This invention relates to spring bending machines and particularly to a machine for bending the end convolutions of sinuous spring strips to form hooks on the ends thereof.

The sinuous spring strip, on which hooks are to be formed by the machine embodying this invention, are similar to that illustrated, described and claimed in the reissue patent to Karl Kaden, No. Re. 21,263, issued November 14, 1939, and assigned to the assignee of the present invention. This spring is formed of wire bent back and forth in zigzag relation and rolled on an arc of small radius along its longitudinal dimension to provide an inherent set against downward deflection when the ends are extended and secured to opposite sides of a frame. Suitable clips are employed for engaging the ends of the strip and for retaining the ends extended when the clips are attached to the frame.

The present invention embodies a machine for upsetting the end convolutions of the strip on its longitudinal axis and bending the convolution downwardly in the plane of the axis to form hooks at the ends of the strip extending below its top surface. The machine has a pair of bending heads adjacently disposed to each other to receive both ends of a strip which may be operated on at the same time or upon the ends of two separate strips.

The end of the strip in each head is engaged by a pin which extends through the convolution adjacent to the one to be bent, to retain the strip in predetermined position in the bending head. The bending head is provided with a slot which engages the endmost convolution and twists the convolution 90° to the plane of the strip while bending the convolution 90° in the opposite direction into the plane to the longitudinal axis of the strip.

A fly wheel on the machine is driven by a motor, which is connected to an operating shaft by a clutch, which, when actuated, rotates the shaft through 360°, which is sufficient to perform the bending operations. The shaft drives a rack connected with the operating head for revolving the head through the 90° movement. The bending die is pivoted on the head and is driven by a beveled gear meshed with a stationary beveled gear carried by the head. This produces a rotation of the die when the head is revolved to produce the compound bending movement of the convolution at the end of the strip.

It is only necessary for the operator to insert the ends of a strip into the heads and to depress a foot pedal for throwing in the clutch, to first lock the ends in the heads and thereafter to drive the heads to bend the ends in the desired manner. After a single rotation of the shaft, the clutch automatically throws out, irrespective as to whether or not the foot pedal is retained in depressed position. When the foot pedal is released, the securing pins are withdrawn from the spring ends, which may then be removed from the heads.

Accordingly, the main objects of this invention are: to provide a bending head for spring strips, which twist the end 90° to the plane of the strip while bending the strip on its longitudinal axis to extend therebelow; to provide a bending machine with a pair of bending heads which are positioned to receive both ends of a strip and to bend hooks thereon in a single operation of the machine; to provide locking pins for the ends of the spring strips, which retain the ends in position when hooks are bent thereon; to provide a machine with a clutch, which operates to drive the shaft through a single revolution each time the clutch is actuated, for operating pins for securing the strip in position, and for twisting and bending the ends to form hooks thereon, and, in general, to provide a machine for bending hooks on the ends of a spring strip, which is simple in construction, positive in operation and economical of manufacture.

Other objects and features of novelty in this invention will be either specifically pointed out, or will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a broken plan view of a spring bending machine embodying features of this invention:

Fig. 2 is a sectional view of the structure illustrated in Fig. 1, taken on the line 2—2 thereof;

Fig. 3 is a view in elevation of a bending head of the machine illustrated in Fig. 1, as viewed from line 3—3 thereof;

Fig. 4 is an end view of the structure illustrated in Fig. 3, as viewed from line 4—4 thereof;

Fig. 5 is a sectional view of the structure illustrated in Fig. 3, taken on the line 5—5 thereof;

Fig. 6 is a sectional view of the structure illustrated in Fig. 2, taken from line 6—6 thereof;

Fig. 7 is a sectional view of the structure, as illustrated in Fig. 3, taken on the line 7—7 thereof;

Fig. 8 are views of the end of the spring strip before and after the bending operation is performed thereon;

Fig. 9 is a sectional view of the structure illustrated in Fig. 1, taken on the line 9—9 thereof, in the retracted position of the foot pedal;

Fig. 10 is a view of the structure illustrated in Fig. 9, before the downward movement of the foot pedal has been completed; and,

Fig. 11 is a sectional view of the structure illustrated in Fig. 9, taken on the line 11—11 thereof.

The machine embodies a base 12 which may be mounted on a bench, or which may be supported on a pedestal in the conventional manner. The undersurface of the base is provided with a bracket 13, in which a shaft 14 is journaled. The shaft is secured to a clutch element 15 by suitable means such as a key. The clutch element 15 is disposed adjacent to a hub 16 on a fly wheel 17, which is rotatably mounted on a shaft 14. The fly wheel is driven by a belt 18 from a motor not herein illustrated.

The hub 16, as illustrated in Figure 11, is provided with a recess 19 in which a detent 21 is urged by a spring 22. A projecting finger 23 extends from side of the detent 21 to operate in a slot 24 in the clutch 15. A clutch finger 25 is pivoted on a bracket 26 by a pin 27, and is urged toward the clutch 15 by a spring 28. The finger is provided with a sloping surface 29, which engages the projecting finger 23 as the clutch 15 rotates in a clockwise direction, urging the finger 23 to the left, as viewed in Figure 11, to retract the detent 21 from the recess 19, to thereby release the clutch and shaft from the boss 16 and fly wheel 17 after a single revolution thereof. A brake band 31 engages a brake drum 32 provided in the extension of the clutch 15, which is adjusted to produce a predetermined braking force for preventing the overrun of the shaft when separated from the fly wheel.

Each time the clutch finger 25 is raised from the clutch drum 20, the finger 23 is released to permit the detent 21 to be urged to the right, as viewed in Figure 11, to project into the recess 19 as the hub 16 rotates, to produce the rotation of the clutch and the shaft 14. Releasing mechanism is provided, which permits the clutch finger 25 to immediately return to a position in which the sloping surface 29 will engage the projecting finger 23 to retract the detent 21 at the end of a single revolution of the clutch and shaft.

The shaft is provided with an eccentric pin 33 attached to a block 34, which is adjustably positioned within a channel shaped block 35 by the bolts 36. The relation between the axis of the eccentric pin 33 may be adjusted relative to the axis of the shaft 14 to change the throw of the eccentric. A roller 37 is secured on the eccentric pin 33, to operate in a channel shaped block 38, which is supported on a vertical slide 39. The vertical slide is supported in a channel shaped block 41 and is retained therein by the gibs 42. The block 39 has a rod 43 threaded, or otherwise secured to is upper end which projects through an aperture 44 in the top portion of the base 12. The upper end of the rod 43 has a rack 45 secured thereto with teeth 46 meshed with the teeth 47 of the pinion gear 48, which is supported on a trunnion 49 of a yoke element 51 and secured against rotation relative to the yoke element by a key 52.

The gear and pinion are mounted within a housing 53, which projects from one end of a base portion 54, from which a standard 55 extends. The trunnion 49 of the yoke element 51 is journaled in a boss 56 on the side of the housing 53 in aligned relation with a pin 57 projecting from the standard 55 on which the opposite end 58 of the yoke 51 is journaled. The innerface of the standard 55 has a bevel gear 59 secured thereto by a plurality of screws 60, 61 and 62. The screws 61 and 62 project through slots 63 in the bracket 55, which are disposed concentric to the axis of the pin 57 so as to permit the beveled gear to be adjusted about the pin 57. The web of the yoke is provided with a boss 64 through which a shaft 65 extends, secured in position by a washer 66. The shaft 65 is supported in the yoke 51 for rotation about its axis as the yoke is revolved about the axis of its trunnion 49 disposed normal to the axis of the shaft. A bevel gear 67 is supported by the shaft 65 having a plurality of teeth meshed with the teeth of the bevel gear 59. The gear is retained in position by the head 68 on the lower end of the shaft 65. The gear 67 is keyed, or otherwise secured, to the shaft 65 to drive the shaft in rotation for turning the head 68, which produces the bending of the end of the wire as the yoke 51 is revolved about the axis of the trunnion 49 and pin 57.

The head 68 has a slot 69 for receiving the end convolution of the spring strip. The slot 69 is disposed in aligned relation with a slot 71 in a block 72, which is secured to the base portion 54 by screws 70. The block 72 has a central slot 73 in which a lever 74 is mounted for oscillating movement on a pin 75. A slot 76 is also provided in the block 72, communicating with the slots 73 and 71. A pin 77 is mounted in the slot 76, having a recess 78 for receiving the end 79 of the lever 74. The pin is operated by the lever into the slot 71, to engage the next adjacent convolution to that on the end of the spring strip, for locking the spring strip in predetermined position on the block 72.

It is to be understood that the bending and twisting head is the same at each side of the machine. The links 74 of these heads are joined by links 81 to one end of bell cranks 82 and 83, respectively. The arm 84 of the bell crank 83 is connected by a link 85 to a bell crank 86. The arm 87 of the bell crank 82 has its end 88 projected into a notch 89 in the arm 84 of the bell crank 83, centrally between the pivots of the bell crank so as to produce the same degree of movement to the levers 74 when the link 85 is actuated.

The cam finger 25 is actuated by a plunger 91, carried by a link 92 pivoted on the bracket 93 by the pin 94. A spring 95 urges the plunger out of the end of the link into abutting relation with the finger 25, limited by a pin 96 which is carried by the plunger and which operates in a slot 97. A rod 98 is attached to the opposite end of the link 92 and projects toward the floor, where it is attached to a foot lever (not shown). The pin 99 which joins the rod 94 to the end of the link 92 projects outwardly, as illustrated in Fig. 1, in a position to engage an arm 101 of the bell crank 86. The projecting pin 99 engages the arm 101 when the foot pedal is released and the rod 98 is urged upwardly by a spring (not illustrated) for moving the links 74 toward each other to thereby retract the locking pins 77 after the bending operation. Springs 102 on the links 74 operate the links in the opposite direction when the pin 99 is moved downwardly with the rod 98 at the beginning of the operation.

This downward movement of the rod 98 raises the clutch finger 25 from the clutch drum 20 an amount sufficient to release the finger 23, after

which the projecting end 103 of the plunger 91 rides over the projecting portion 104 of the clutch finger to permit the spring 28 to immediately return the finger 25 within the drum 20 in position to intercept the projecting finger 23 to retract the plunger after a single revolution of the clutch and shaft 14.

In Fig. 8, a sinuously formed wire strip 106 is illustrated having the end convolution 107 cut off at 108. The convolution 107 is twisted through 90° and bent backward upon the longitudinal axis of the strip, as illustrated at 109. To produce this bending operation, the strip 106 has one or both ends inserted in one or both of the bending heads, as illustrated in Fig. 1, and the foot pedal is then operated to move the rod 98 downwardly. The movement of the rod downwardly releases the support of the bell crank 86, which is rocked in a counter-clockwise direction by the springs 102 to move the lower end of the links 74 away from each other. This moves the pins 77 forwardly to project through the convolution 111 to securely retain or lock the end of the strip in the slot 71 of the block 72, as illustrated in Fig. 5. The movement of the rod downwardly raises the clutch finger 25 to produce the single revolution of the shaft 14 as explained hereinabove. The single rotation of the shaft 14 revolves the eccentric pin 33, which produces the reciprocation of the slide 39 and the rod 43, which in turn reciprocate the rack 45.

The downward movement of the rack 45 rotates the pinion 48, which revolves the yoke 51 on the trunnion 49 and pin 57, to bend the loop end 107 forwardly in the plane of the strip. During this action, the beveled gear 67 is rotated on the stationary beveled gear 59, to twist the end along the axis of the wire at the intersection with the axis of the trunnion 49. This compound bending movement will occur on the centerline of the spring strip since the concentration of both bending forces occur at this point. At the end of the operation, the loop end 107 will be disposed as illustrated in Fig. 8, aligned on the axis of the strip and disposed beneath the plane of the strip. The degree of bending produced to the end loop is adjusted by regulating the throw of the eccentric pin 33, which regulates the degree of movement of the rack 45, which in turn regulates the degree of movement of the yoke 51.

After the bending operation, the release of the foot pedal returns the rod 98 upwardly to rock the link 92 clockwise. The plunger 91 is moved relative to the clutch finger 25, to have the projecting end 103 of the pin 91 engage the projection 104 on the finger. This upward movement of the rod 98 produces the engagement of the projecting pin 99 with the arm 101 of the bell crank 86, which operates the rod 85, the bell cranks 82 and 83 and the links 81 to move the lower ends of the levers 74 toward each other to move the pins 77 out of engagement with the convolution 111 of the spring strip, the strips are then free to be withdrawn from the slot 71 of the block 72.

The motor continues to drive the fly wheel 17 and for each operation of the device the clutch connects the shaft to the fly wheel to rotate it through 360°. The single revolution of the shaft produces the bending of the end convolutions of the spring strips. Both ends of the same strip or an end of two separate strips may be bent in a single operation of the device.

What is claimed is:

1. In a bending machine, means for clamping an element to be bent in fixed position therein, a rotatable member engaging an end of the element and being rotatable about one axis, a revolvable support for said rotatable member and which turns about a second axis, means for revolving said support, and means interconnected to said rotatable member for rotating said member when the support is revolved.

2. In a bending machine, means for supporting an element in position to be bent, means for locking said element in said position, a rotatable member engaging the end of the element and being rotatable about one axis, a support for said member which tilts the member about a second axis and about the point at which the element is to be bent, and means for simultaneously tilting and rotating said member for bending said end.

3. In a machine for bending the end convolution of a wire strip, means for supporting the end of the strip in position to be bent, a rotatable member engaging said convolution and being rotatable about one axis, means for tilting said rotatable member about a second axis and about the point at which the strip is to be bent, and means for simultaneously tilting and rotating said member for bending said convolution.

4. In a machine for bending the end convolution of a sinuous spring strip to form a hook on the end thereof, a support for the end of the strip, means for locking the strip in the support, rotatable means operable about one axis for engaging the convolution, means for tilting said rotatable means about another axis and about the point at which the strip is to be bent, and means for tilting and rotating said means simultaneously.

5. In a machine for bending hooks on the end of spring strips having an open loop which is presenting toward one side of the strip, of means for supporting an end in position to be bent, means for locking said strip in said position, a yoke extending over said strip in position to be tilted in the plane of the strip, a rotatable member carried by the yoke in the plane of the strip having means for engaging said end loop, and means for revolving said yoke and rotating said member simultaneously to twist the loop through 90° as it is bent 90° by the yoke.

6. In a machine for bending hooks on the end of spring strips having an open loop which is presenting toward one side of the strip, of means for supporting an end in position to be bent, means for locking said strip in said position, a yoke extending over said strip in position to be tilted in the plane of the strip, a rotatable member carried by the yoke in the plane of the strip having means for engaging said end loop, a fixed beveled gear, a beveled gear meshing with said fixed gear and secured to the rotatable member, and means for revolving said yoke to tilt said rotatable means while it is rotated by the action of said bevel gears to simultaneously bend the loop as it is twisted.

7. In a device for bending a hook on the end of a spring strip having an open loop which is presenting toward one side of the strip, means for holding the strip in position to be bent, and means engaging said loop for twisting it through 90° as it is bent 90° to the plane of the strip and transversely to the axis about which twisting occurs.

8. In a device for bending a hook on the end of a spring strip having an open loop which is presenting toward one side of the strip, means for holding the strip in position to be bent, rotatable means engaging said loop, a yoke mount-

ed on trunnions supporting said rotatable means, a fixed bevel gear through which the trunnion revolves, a bevel gear on said rotatable means meshed with the fixed bevel gear, and a gear on one of said trunnions by which the yoke is tilted and the rotatable means is rotated.

9. In a device for bending a hook on the end of a spring strip having an open loop which is presenting toward one side of the strip, means for holding the strip in position to be bent, rotatable means engaging said loop, a yoke mounted on trunnions supporting said rotatable means, a fixed bevel gear through which the trunnion revolves, a bevel gear on said rotatable means meshed with the fixed bevel gear, a gear on one of said trunnions by which the yoke is tilted and the rotatable means is rotated, and a rack for rotating said last gear.

10. In a device for bending a hook on the end of a spring strip having an open loop which is presenting toward one side of the strip, means for holding the strip in position to be bent, rotatable means engaging said loop, a yoke mounted on trunnions supporting said rotatable means, a fixed bevel gear through which the trunnion revolves, a bevel gear on said rotatable means meshed with the fixed bevel gear, a gear on one of said trunnions by which the yoke is tilted and the rotatable means is rotated, a rack for rotating said last gear, and an eccentric for driving said rack.

11. In a device for bending a hook on the end of a spring strip having an open loop which is presenting toward one side of the strip, means for holding the strip in position to be bent, rotatable means engaging said loop, a yoke mounted on trunnions supporting said rotatable means, a fixed bevel gear through which the trunnion revolves, a bevel gear on said rotatable means meshed with the fixed bevel gear, a gear on one of said trunnions by which the yoke is tilted and the rotatable means is rotated, a rack for rotating said last gear, an eccentric for driving said rack, a base for supporting a pair of said devices, and driving means for operating the eccentric of each device simultaneously.

FRANK J. HORTON.