J. E. MAYO & T. F. CHARLTON.

WIRE BENDING MACHINE.

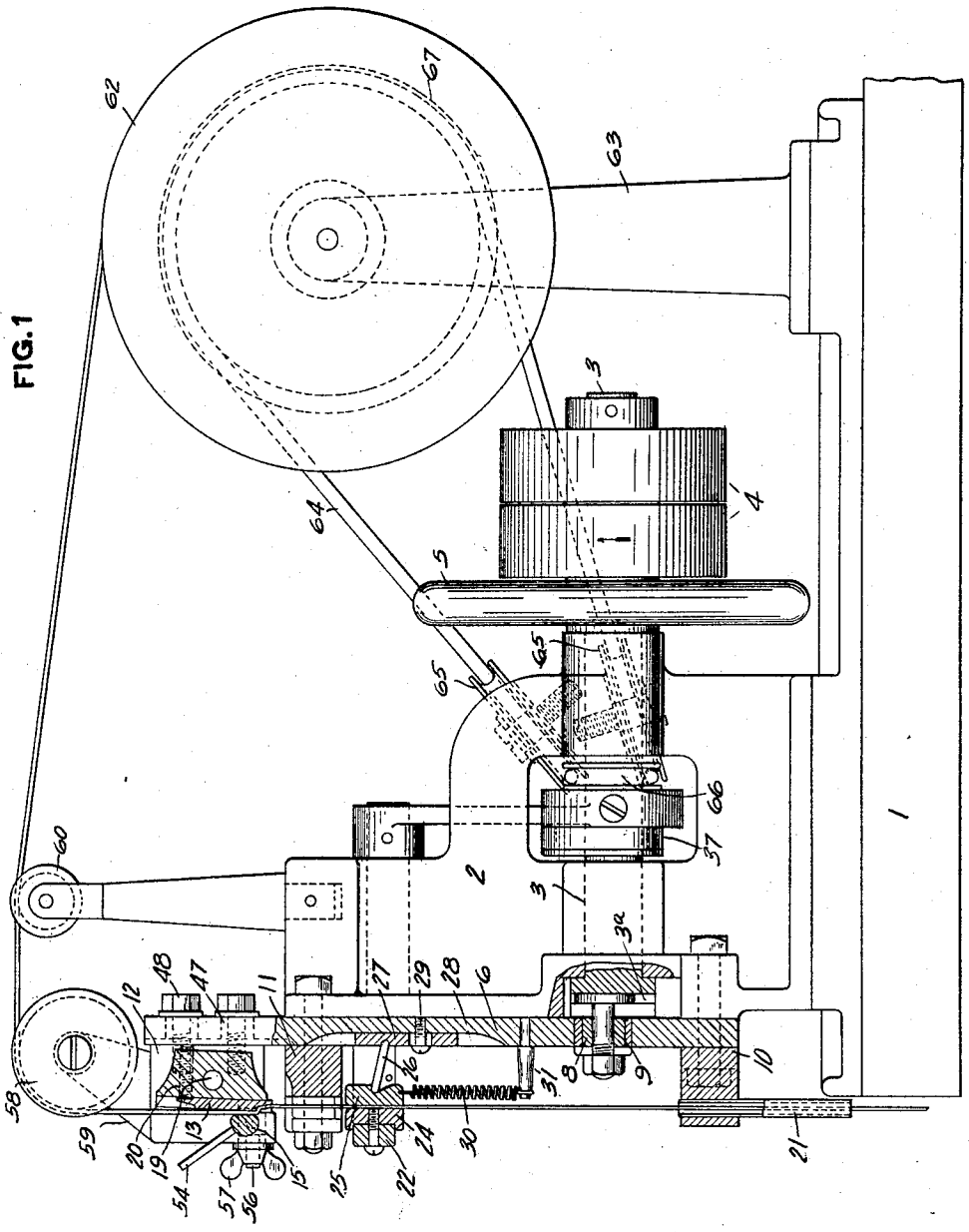
APPLICATION FILED OCT. 10, 1914.

1,205,006.

Patented Nov. 14, 1916.

2 SHEETS—SHEET 1.

FIG. 1



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2 SHEETS—SHEET 2.

FIG.3

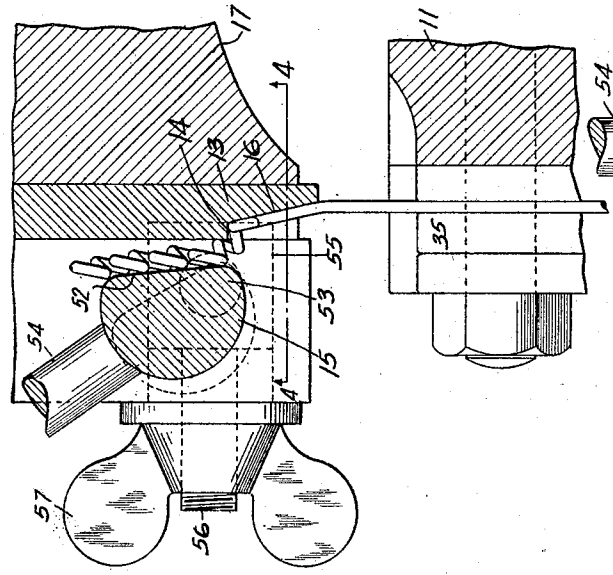


FIG.4

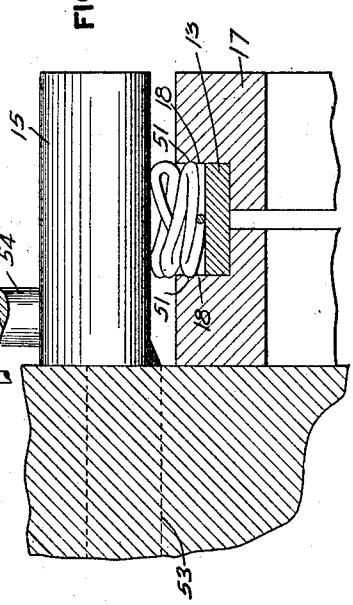
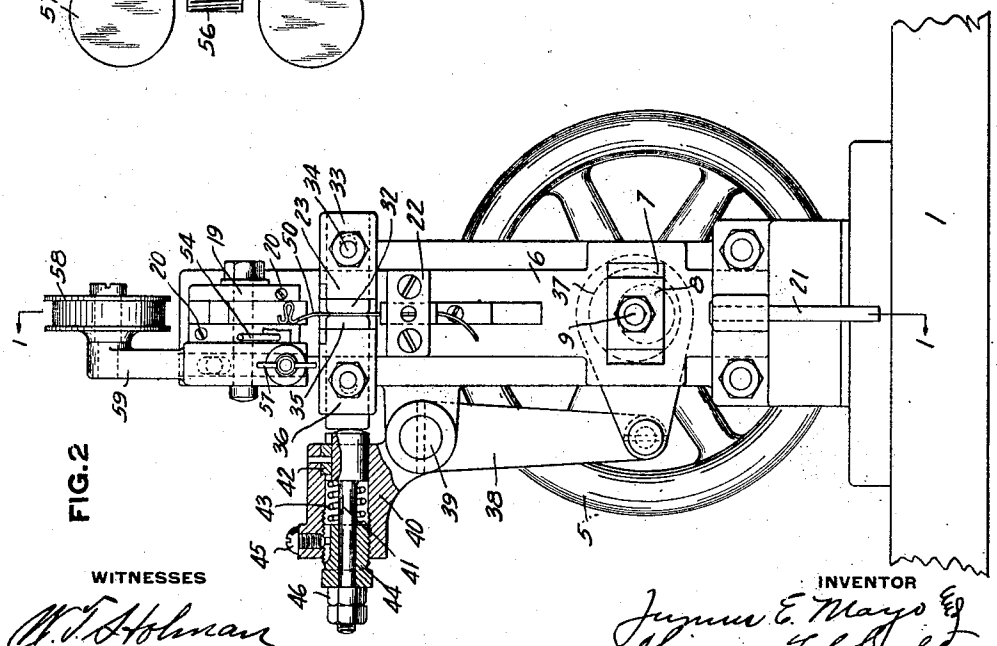


FIG.2



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UNITED STATES PATENT OFFICE.

JUNIUS EMMETT MAYO AND THOMAS F. CHARLTON, OF MEADVILLE, PENNSYLVANIA, ASSIGNORS TO THE SPIRELLA COMPANY, OF MEADVILLE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

WIRE-BENDING MACHINE.

1,205,006. Specification of Letters Patent. Patented Nov. 14, 1916.

Application filed October 10, 1914. Serial No. 866,090.

To all whom it may concern:

Be it known that we, JUNIUS EMMETT MAYO and THOMAS F. CHARLTON, residents of Meadville, in the county of Crawford and State of Pennsylvania, have invented a new and useful Improvement in Wire-Bending Machines, of which the following is a specification.

This invention relates to apparatus for bending wire, and particularly for making wire garment stays or other structures by bending wire or the like at intervals in opposite directions to form a series of oppositely disposed loops or eyes and connecting transverse portions or crossings.

The object of the invention is to provide apparatus whereby the wire is bent back and forth against an abutment or shoulder and, preferably, is confined at both sides in order to limit lateral bending thereof, in order to produce a sinuous structure with even and uniform edges.

Another object of the invention is to provide apparatus embodying an abutment against which the wire is bent and in which said abutment is moved relatively to the wire, the latter being fed endwise step by step in the intervals between bending operations, so that it is bent successively back and forth in opposite directions to form two series of loops or eyes and connecting crossings.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a side elevation partly broken out and in section on the line 1—1, Fig. 2; Fig. 2 is a front view thereof, partly broken out and in section to show a clutch operating member; Fig. 3 is an enlarged detail sectional elevation of the wire bending devices, on the line 1—1, Fig. 2; and Fig. 4 is a detail cross section on the line 4—4, Fig. 3.

The machine may be used for forming sinuous or zigzag structures of various kinds from wire or small rods, and is particularly adapted for forming garment stays from hard steel wire of any suitable cross section, and the machine shown and hereinafter described is adapted for this specific purpose.

The apparatus illustrated comprises a suitable frame or base 1 provided with an upright member 2 having suitable bearings for a driving shaft 3, which may be driven in any suitable manner, such as by a belt running over the fast and loose pulleys 4. Said shaft may also be provided with a suitable hand-wheel 5 for turning the same in adjusting the machine or in threading a wire therethrough. The front portion of the standard forms a support for a vertical slide 6 which is provided with a horizontal slot or opening 7 in which works a sliding block 8 having journaled therein the eccentric crank 9 carried by the front end of the driving shaft 3 and adjustable in a radial slot 3^a therein. The rotation of said shaft reciprocates the slide 6 vertically. Said slide is held against the front portion of the standard 2 by suitable guides 10, 11, which may be bolted directly to the main frame.

On the slide 6 is mounted a head 12, which forms a support for the wire bending devices, and which moves with said slide. The wire bending devices are preferably of the same form shown in a prior application of Junius Emmett Mayo for apparatus for bending wire, filed September 10, 1914, Serial No. 861,108, and as shown comprise an anvil member 13 provided with a shoulder or abutment 14 against which the wire is bent, together with suitable means for controlling the angle which the bent wire assumes as it leaves the abutment, this being shown as a presser foot 15.

The anvil member 13 is formed of hardened steel and has its lower end sloping rearwardly, as at 16, from the abutment or shoulder 14 downwardly. It is held by means of a clamping block 17, which is provided with a groove or channel along its front face to form a seat for the anvil member and provide opposite side walls or cheeks 18 between which the anvil member is clamped by suitable means, such as a bolt 19 extending horizontally through the block and the head 12. This bolt also serves as a pivot about which the clamping block 17 and anvil member 13 can be adjusted so as to slightly move the abutment 14 forwardly and rearwardly, the position being regulated by adjustable screws 20 threaded through the block 17, one near the upper end and the other near the lower end thereof, and at their rearward ends impinging against the slide 6. By turning the screws 20 the clamping block and anvil can be tilted about the pivot bolt

19 to bring the shoulder or abutment 14 into proper position for the most effective action of the bending devices, after which the anvil member and block are fixed readily in position by tightening the bolt 19. This clamping block also permits of readily adjusting the anvil member 13 and also permits the anvil member being removed and replaced by another anvil member of different form or width. Preferably, both ends of the anvil member and clamping block are of the same configuration, so that they can be reversed when worn to present new surfaces to the wire feeding device.

The wire is fed to the machine through a suitable guide 21, which may, for example, be carried by the lower slide guide 10, from which it passes through the wire feeding devices which comprise a movable clutch 22 and a stationary clutch 23. The passes through these clutches are slightly beyond, that is, rearwardly of the rear edge of the abutment or shoulder 13, as shown in Fig. 3, so that the wire contacts with said sloping anvil face 16 and slides thereon as it is bent against the anvil.

The movable clutch 22 is carried by the slide 6, so that it moves in exact unison with the head 12 and the wire bending devices. It comprises a fixed jaw 24 bolted directly to a yoke carried by the slide 6 and a movable jaw 25 whose outer face bears against one end of a toggle member 26 having its outer end seated in a notch in a member 27 adjustable vertically in a groove or slot 28 in the slide 6 and rigidly connected to said slide in any suitable manner, as by a screw 29 passing through an elongated slot in said member. The movable jaw 25 is held against the fixed jaw 24 by a spring 30 having one end connected to the movable jaw and the other to a suitable fixed member carried by the slide 6, such as the stud 31. Whenever the slide 6 rises the jaws 24 and 25 close on the wire and lift it with said slide, so that it is fed upwardly in synchronism with the upward movement of the bending devices. When the slide 6 moves downwardly the wire is released from the jaws which slide downwardly along the wire, the latter at this time being held by the stationary clutch 23, as will be now described.

The stationary clutch 23 is carried by the front portion of the upright or standard 2 on the main frame. The jaws of this clutch are located in a groove or channel in the front portion of the guide 11. One of said jaws, such as the fixed jaw 32, is held solidly in place in its groove by a cap 33 and clamping bolt 34, the latter working in an elongated slot in said jaw to permit it to be adjusted toward and from the wire. The other jaw, marked 35, has a close sliding fit in its groove and is movable underneath a cap 36. This movable jaw is operated to cause the stationary clutch to grip the wire during the time when the slide 6 is traveling downwardly, to thereby hold the wire and bend it back and forth against the abutment into sinuous form. The movable jaw may be operated in any suitable manner. As shown, the driving shaft 3 is provided with a suitable eccentric 37 which operates a lever 38 connected to a shaft 39 provided with a hollow head 40 in which is mounted a plunger 41 which at one end engages the outer end of the movable jaw 35. Said plunger is held from rotation in the head 40 by a key 42 and is forced yieldingly outward from said head toward the jaw 35 by a spring 43, the tension of which may be adjusted by a plug 44 threaded into said head and which may be locked by set-screw 45 projecting into a longitudinal slot therein. The outer end of the plunger 41 is reduced and passes through an opening through said plug and is provided with suitable means, such as the nuts 46, for limiting movement of the plunger inwardly from said head toward the movable jaw.

The distance between the abutment 14 and the stationary clutch 23 is adjustable in order to insure the wire being bent at the proper points, and in the machine illustrated this adjustment is secured by having the head 12 carrying the bending devices adjustable toward and from the stationary clutch, and for this purpose the slide 6 is provided with elongated holes 47 to receive the bolts 48 for clamping the head 12 to said slide and which permit adjusting said block to the desired position and then rigidly securing it by tightening up the clamping bolts. The preferable adjustment of the anvil member is such that when the slide 6, block 12 and bending devices are in their uppermost position the abutment 14 is located from the fixed clutch 23 a distance approximately twice the width of the stay being formed, but this will vary with different diameters of wire and widths of stay. As the slide 6 and abutment 14 move downwardly the wire bends about midway between the abutment and stationary clutch 23, whose operating eccentric 37 closes said clutch on the wire at the moment when the slide 6 begins to move downwardly. This bends the wire approximately at the point marked 50, Fig. 2, and by making the distance between the abutment and the stationary clutch, when the abutment is in its uppermost position, substantially twice the width of the stay, the bends 50 will occur at the proper points.

As the abutment 14 continues to move downwardly with the slide 6 the bend 50 is forced toward one side of the groove in the clamping block 17 and forms a loop or eye in the wire, so that the unformed portion of the wire projects from a position at

one end of the abutment or shoulder 14 to the opening through the stationary clutch 23, which is the position of the parts when the slide 6 reaches its lowest position. As the slide 6 begins to move upwardly the eccentric 37 has turned to such a position that the outer end of the block 44 contacts with the nuts 46 and withdraws the plunger 41 from engagement with the movable jaw 35 of the stationary clutch, which thereupon releases the wire. Slide 6 thereupon moves upwardly and the movable clutch 22 grips and feeds the wire upwardly with the slide, and during the upward movement of the slide the relation of the bent and unformed portions of the wire to the anvil 13 and abutment 14 remains unchanged. When the slide reaches its uppermost position the wire is released by the movable clutch 22 and is again gripped by the stationary clutch 23, whose operating eccentric has again forced the plunger 41 inwardly against the movable jaw 45. Thereupon the unformed portion of the wire again takes a bend substantially midway of its width, but in the opposite direction, which bend is forced over toward the opposite side of the groove in the clamping block 17 and forms another loop or eye at the opposite edge of the stay.

Each of the side or cheek walls 18 is provided with a very shallow inclined groove, shown at 51, into which the ends of the loops or eyes being formed are forced. These grooves are very shallow (being greatly exaggerated in the drawings), but nevertheless suffice to hold the ends of the loops from accidentally springing forwardly and escaping over the abutment or front edge of the shoulder. The continued downward movement of the abutment, however, forces the eye or loop being formed underneath a previously formed loop or eye, with the result that the latter is lifted out of the groove 51 and caused to escape over the front edge of the abutment, and this operation is repeated very rapidly and forms successive loops or eyes as shown. Inasmuch as the pass through the stationary clutch is located slightly beyond the rear edge of the abutment 14, the unformed portion of the wire slides up the incline 16 at the lower end of the anvil member so that each loop or eye as it is being formed is caused to pass underneath a previously formed loop or eye and lift the same toward the front of the machine and upwardly over the edge of the abutment, as described.

The loops or eyes are formed substantially in a vertical plane, as shown in Fig. 3, and as each loop in succession is lifted by means of a succeeding loop, it is tilted out of the vertical plane and into an inclined position, so that the loops in the finished stay are inclined to the general vertical plane of the stay and the latter presents a shingled appearance when viewed edgewise, as shown in Fig. 3.

The presser foot 15 is located in front of the anvil member 13, so that the finished stay travels upwardly between the presser foot and the anvil member, and its purpose is to keep the loops from jumping over the abutment or shoulder 14 before the next loop is properly formed, and also to vary the degree of overlap by controlling the angle at which the bent wire leaves the abutment. This presser foot may be of any suitable form, but is shown as a section of a cylindrical body having its face adjacent the anvil somewhat flattened off, as shown at 52, and being provided with a spindle 53 eccentric to its body and which is journaled in an opening in the head 12. This presser foot is provided with a handle 54 for changing its angular position to vary the distance between its flattened face and the anvil member and also change the angular relation of its flattened face to said anvil member. This presser foot is held in adjusted position by having its spindle passed through an opening in the head 55 of a clamping rod 56 having its outer end threaded and provided with winged nut 57.

When the presser foot is adjusted to the position shown in full lines in Fig. 3, with its flattened face substantially parallel to the upward path of the finished stay, the loops of the stay will be caused to overlap materially, but by adjusting said presser foot so that its flattened face will have a considerable angle with reference to the path of the stay and the front of the anvil block, as shown in dotted lines, Fig. 3, the loops of the stay will have no overlap, and by adjusting the presser foot between these positions any degree of overlap can be secured.

The finished stay, as it leaves the presser foot and anvil block, travels upwardly and over a guide wheel 58, which is carried by the slide 6, and as shown is journaled in a bracket 59, mounted on the head 12. From the guide wheel 58 the stay travels over a stationary guide wheel 60 journaled in an upright on the main frame, the purpose of this stationary roll being to prevent whipping of the stay between the guide wheel 58 and the reel 62, the latter being journaled in a standard 63 at the rear end of the frame. This reel may be driven in any suitable manner, and as shown is operated by a round belt 64 passing over idler pulleys 65 journaled in the frame and a sheave 66 which rotates with the main shaft 3. The belt 64 also passes over a sheave 67, which is connected to drive the reel 62 through friction disks or any other suitable slip connection, so that just sufficient power is transmitted to the reel to

keep a proper tension on the stay and wind it evenly upon the reel.

In starting the machine the wire is passed through the guide 21, and then through the movable and stationary clutches 22 and 23 until it engages one of the side walls or cheeks at the ends of the abutment or shoulder 14, and the shaft 3 is operated by hand until several loops have been formed and passed under the presser foot 15. The driving belt is then shifted, to the fast pulley 4 to operate the machine by power; and the wire is held solidly by the stationary clutch while the abutment moves down, and is fed upwardly by the movable clutch as the abutment moves upwardly, and is thereby bent back and forth into sinuous form between the side walls or cheeks 18 of the block 17, in the manner hereinbefore described.

The mechanism described operates very rapidly and produces a stay with uniform loops and straight side edges and with very little curl or twist, and at a very low labor cost. The absence of curl or twist reduces the labor cost of straightening which has been a very considerable item in prior methods of forming similar stays. The bending is produced by an endwise compressive action on the wire, which has a tendency to strengthen the wire, as compared with prior methods in which the wire has been stretched or subjected to tension around pins or forming members. Furthermore, this compressive action does not abrade or crease the wire nor does it destroy the skin or polish on the outer surface of the wire, as occurred in prior machines in which the bending was done by a stretching operation around pins or similar forming members.

The arrangement is adapted for forming a large variety of articles and from wire or rods of various sizes and cross-sectional shapes. In the machine shown in the drawings the path of the wire during the bending operation is vertical, and the slide 6, abutment 14 and anvil 13 move vertically. It will be understood, however, that the particular arrangement shown is not essential, and that the path of the wire and the direction of movement of the bending devices may be horizontal or may occur in any direction. Such terms as "upper", "front", "rear", etc., referring to locations of various parts of the machine, merely apply to the particular machine shown, and are not to be understood as limiting the invention beyond the scope of the appended claims.

What we claim is:—

1. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, and means for relatively moving the abutment and wire holding means in a straight path.

2. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, and means for relatively moving the abutment and wire holding means in the direction of the length of the wire.

3. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for relatively moving the abutment and wire holding means in a straight path, and means for limiting lateral bending of the wire.

4. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for relatively moving the abutment and wire holding means in the direction of the length of the wire, and means for limiting lateral bending of the wire.

5. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, and means for moving said abutment toward the wire holding means to bend the wire.

6. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, and means for moving said abutment toward and from the wire holding means to bend the wire back and forth against the abutment.

7. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, and means for moving said abutment toward the wire holding means in the direction of the length of the wire to bend the wire against said abutment.

8. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, and means for moving said abutment toward and from the wire holding means in the direction of the length of the wire to bend the wire back and forth against said abutment.

9. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward the wire holding means to bend the wire, and means for limiting lateral bending of the wire.

10. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward and from the wire holding means to bend the wire back and forth against the abutment, and means for limiting lateral bending of the wire.

11. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward the wire hold-

ing means in the direction of the length of the wire to bend the wire against said abutment, and means for limiting lateral bending of the wire.

12. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward and from the wire holding means in the direction of the length of the wire to bend the wire back and forth against said abutment, and means for limiting lateral bending of the wire.

13. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward and from the wire holding means to bend the wire back and forth against the abutment, and means for limiting lateral bending of the wire in both directions.

14. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward and from the wire holding means in the direction of the length of the wire to bend the wire back and forth against said abutment, and means for limiting lateral bending of the wire in both directions.

15. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for relatively moving the abutment and wire holding means in a straight path, and means for feeding the wire.

16. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for relatively moving the abutment and wire holding means in the direction of the length of the wire, and means for feeding the wire.

17. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward the wire holding means to bend the wire, and means for feeding the wire.

18. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment toward and from the wire holding means in a straight path to bend the wire back and forth against the abutment, and means for feeding the wire.

19. Apparatus for bending a wire alternately in opposite directions, comprising an abutment, wire holding means, means for moving said abutment, means for retracting the abutment toward and from the wire, and means movable with said abutment for feeding the wire.

20. Apparatus for bending a wire alternately in opposite directions, comprising a stationary wire holding device, a movable wire feeding device, an abutment arranged to move toward and from the stationary wire holding device, means for closing the stationary wire holding device upon the wire as said abutment approaches the holding device, and means for releasing the wire therefrom as the abutment moves away from the wire holding device.

21. Apparatus for bending a wire alternately in opposite directions, comprising a stationary wire holding device, an abutment movable toward and from the wire holding device, a wire feeding device, and means for causing said feeding device to grip the wire as the abutment is withdrawn from the holding device and for causing it to release the wire as the abutment approaches the holding device.

In testimony whereof, we have hereunto set our hands.

JUNIUS EMMETT MAYO.
THOMAS F. CHARLTON.

Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."