J. E. MAYO.

APPARATUS FOR BENDING WIRE.

APPLICATION FILED SEPT. 10, 1914.

1,205,005.

Patented Nov. 14, 1916.

3 SHEETS—SHEET 1.

FIG. 2

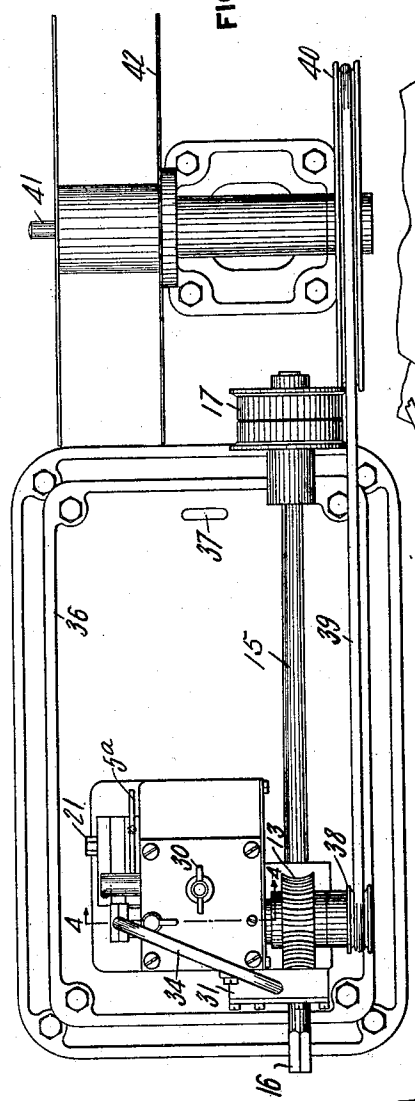


FIG. 1

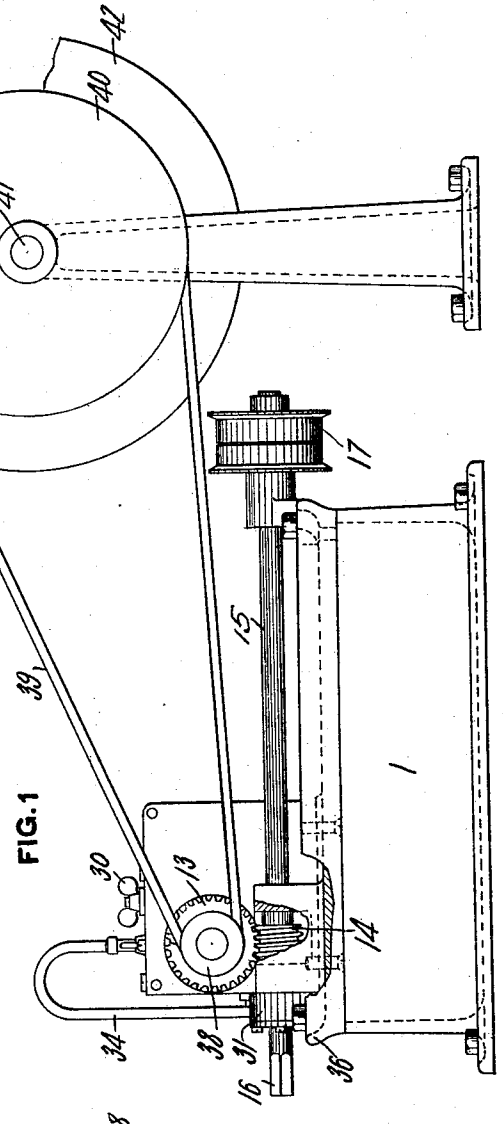


FIG. 10

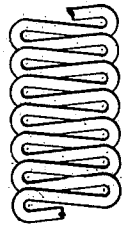
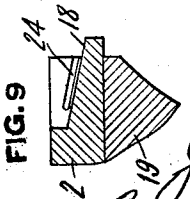


FIG. 9



WITNESSES

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3 SHEETS—SHEET 2.

FIG. 4

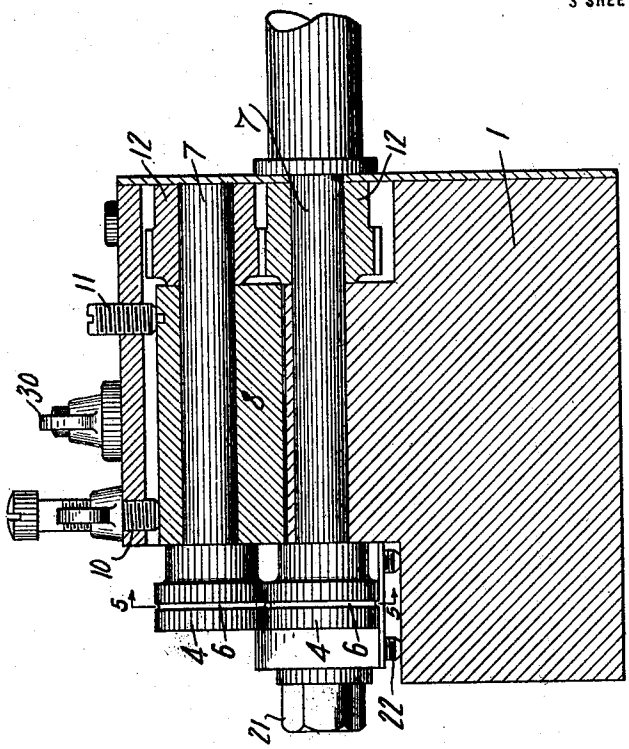
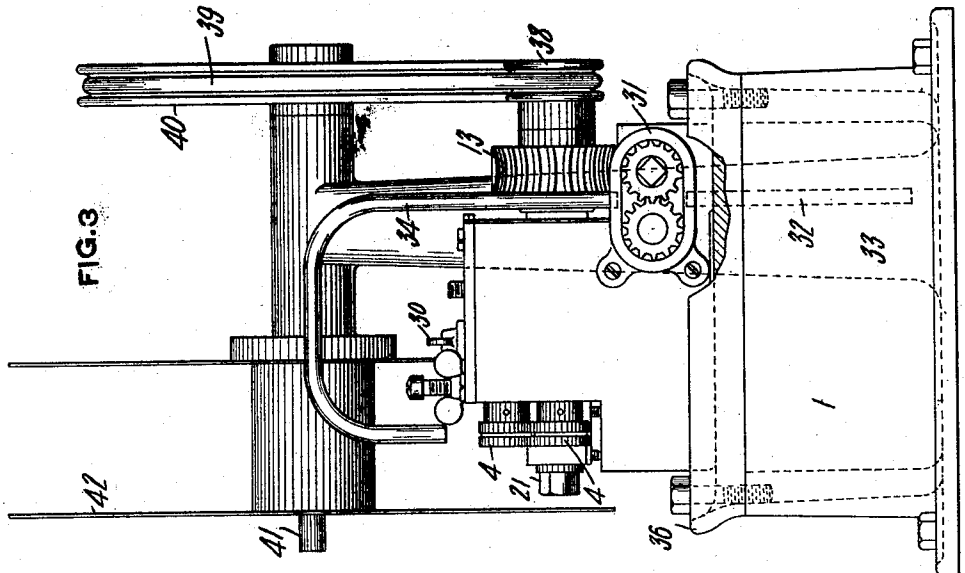


FIG. 3



WITNESSES

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3 SHEETS—SHEET 3.

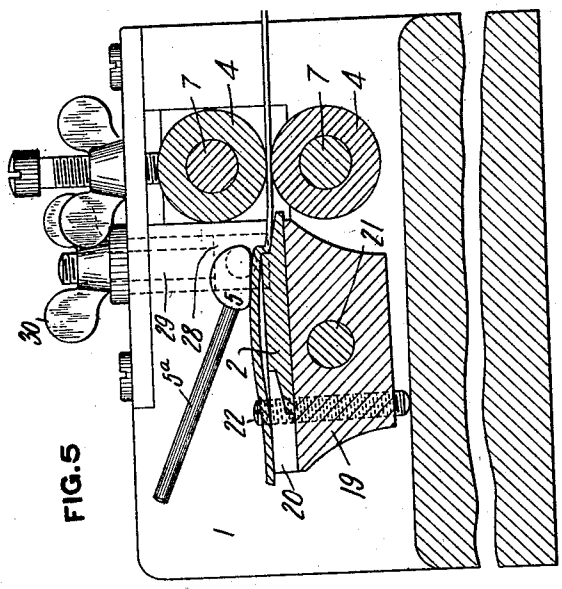

FIG. 5

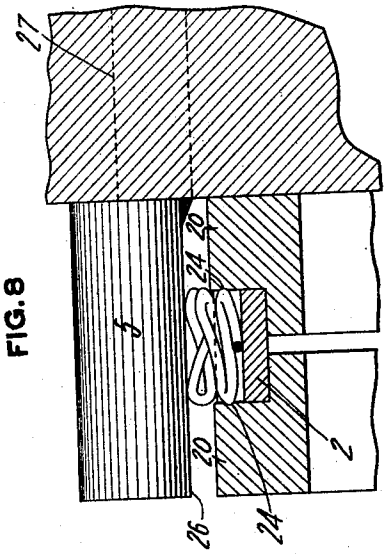

FIG. 8

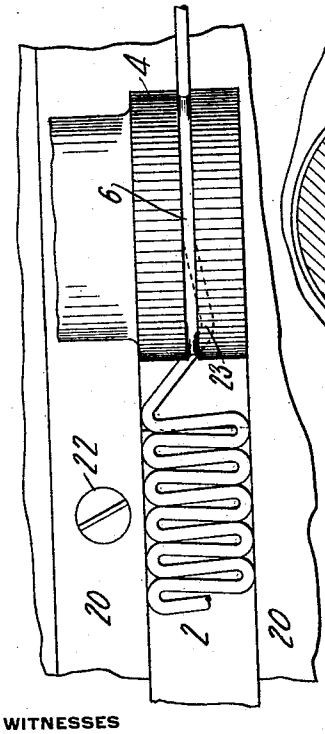

FIG. 7

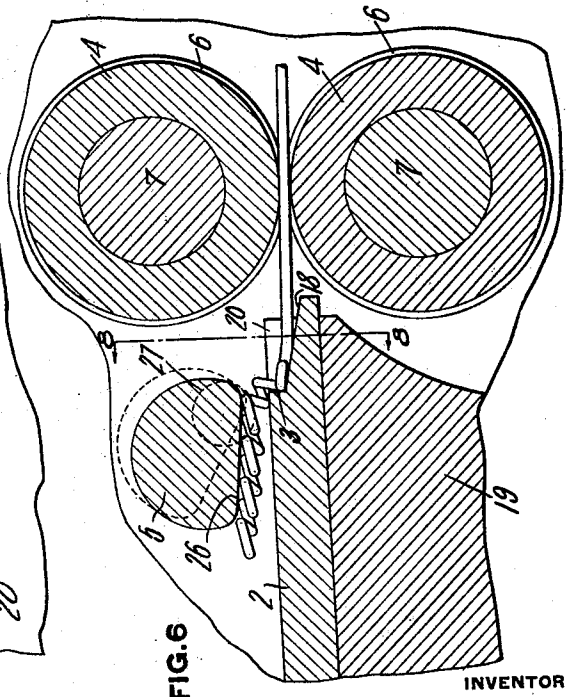

FIG. 6

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UNITED STATES PATENT OFFICE.

JUNIUS EMMETT MAYO, OF MEADVILLE, PENNSYLVANIA, ASSIGNOR TO THE SPIRELLA COMPANY, OF MEADVILLE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

APPARATUS FOR BENDING WIRE.

1,205,005. Specification of Letters Patent. Patented Nov. 14, 1916.

Application filed September 10, 1914. Serial No. 861,108.

To all whom it may concern:

Be it known that I, JUNIUS EMMETT MAYO, a resident of Meadville, in the county of Crawford and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Bending Wire, 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.

One object of the invention is to provide apparatus for forming wire garment stays or the like, by forcing wire endwise against an abutment, thereby causing the wire to bend back and forth into sinuous form and, preferably, confining the wire at both sides in order to produce a structure with even and uniform edges.

Another object of the invention is to provide apparatus by which such sinuous structures can be made much more rapidly than with prior apparatus, and which is less expensive to build and less liable to get out of order than prior apparatus for forming the same character of structures.

A further object of the invention is to provide apparatus for forming such structures, which apparatus is very simple, easy to operate, and which can be adjusted to form stays of any desired width and either with or without an overlap of any desired amount between successive loops or eyes.

In the accompanying drawings, one form of suitable apparatus embodying the invention is illustrated.

In said drawings, Figure 1 is a side elevation of the machine, partly broken out to show the driving means; Fig. 2 is a plan view thereof; Fig. 3 is an end elevation looking from the left in Fig. 2 and on a larger scale and having the pump casing head removed; Fig. 4 is a vertical cross section on the line 4—4, Fig. 2, on an enlarged scale; Fig. 5 is a vertical longitudinal section taken on the line 5—5, Fig. 4, the stay being shown conventionally; Fig. 6 shows a portion of Fig. 5 with the parts on an enlarged scale to illustrate more clearly the bending devices; Fig. 7 is a plan view of the bending devices of Fig. 6 with the presser foot omitted; Fig. 8 is a detail cross sectional view on the line 8—8, Fig. 6; Fig. 9 is a detail view showing the inside face of one of the confining cheek pieces or walls; and Fig. 10 is a plan view showing a modified form of stay.

The invention is applicable 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 in the specification following, the invention will be described as adapted for this specific purpose.

In producing the stay on the apparatus shown the wire is fed endwise by any suitable means and forced against an abutment or shoulder located a suitable distance from the wire feeding means (depending upon the size of stay to be produced), thereby causing the wire to bend alternately in opposite directions, together with means at the ends of the abutment or shoulder to confine the lateral movement of the wire and produce a stay with uniform and even edges. The distance between the abutment or shoulder and the bite or grip of the wire feeding means is substantially double (varying somewhat with the diameter of the wire) the width of the stay to be formed. Each loop as formed is forced beneath a previously formed loop and lifts the latter over the top edge of the abutment, and by varying the angle which the bent wire is allowed to assume as it escapes over the abutment, successive loops or eyes are pushed more or less under each other so as to produce a stay either with or without overlap.

Various forms of mechanism are suitable for producing the stay, one form being shown in the drawings. As illustrated, it comprises a suitable frame or support 1 in which is mounted an anvil member 2 provided with the shoulder or abutment 3 against which the wire is forced endwise by suitable means, shown as a pair of grooved rollers 4; together with suitable means for controlling the angle which the bent wire can assume as it leaves the abutment, this being shown as a presser foot 5.

The wire feeding rolls 4 are provided with grooves 6 conforming in shape to the cross section of the wire being used and are carried by shafts 7 journaled in suitable bear-

ings in the frame 1, and one of which, such as the bearing 8 for the upper shaft 7, is adjustable toward and from the other shaft by suitable means, such as the screw 10 bearing against the block 8 near its inner end and serving to force the top roll toward the bottom roll to grip the wire with sufficient firmness to feed the latter endwise against the abutment 3. A steadying screw 11 bears against the outer end of the block 8.

The shafts 7 are connected to rotate in opposite directions by means of intermeshing gears 12, and one of said shafts at its outer end is provided with suitable driving means, this being shown as a worm gear 13 which is engaged by worm 14 on a longitudinal driving shaft 15 provided at one end with a non-circular portion 16 to which a handle may be secured for rotating the feed rolls manually, and which shaft at its other end is provided with power driving means, such as the fast and loose pulleys 17.

The anvil member 2 is formed of hardened steel and has its forward end sloping downwardly, as at 18, from the abutment or shoulder 3 toward the feeding rolls 4, and the feeding rolls are so adjusted that their pass is slightly below the lower edge of the abutment or shoulder 3, so as to cause the wire to contact said sloping anvil face 18 and slide slightly upwardly thereon. The anvil member 2 is held by means of a clamping block 19, which is provided with a groove or channel along its upper face to form a seat for the anvil member, and provide opposite side walls or cheeks 20 between which the anvil member is clamped by suitable means, such as a bolt 21 extending laterally through the block and threaded into the frame 1. This bolt also serves as a pivot about which the block and anvil member can be adjusted so as to slightly raise and lower the abutment 3, the position being regulated by adjustable screws 22 threaded through the block, one near the forward end and the other near the rearward end, and at their lower ends impinging against the frame 1. By turning the screws 22 the clamping block and anvil member can be readily tilted to bring the shoulder or abutment into proper position for the most effective action of the bending devices, after which the anvil member and block are fixed rigidly in position by tightening the bolt 21. This clamping block also permits of readily adjusting the anvil member 2, and also permits the anvil member 2 being removed and replaced by another anvil member of different form or width. Preferably, both ends of the anvil member 2 and of the clamping block 19 are of the same configuration so that they can be reversed when worn to present new surfaces to the wire feeding device.

The distance between the abutment 3 and the bite of the feeding rolls 4 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 anvil member 2 adjustable toward and from the rolls, and this is effected by merely releasing the bolt 21 and moving the anvil member to the desired position in the clamping block and again tightening the clamping bolt. The preferable adjustment of the anvil member is such that the abutment 3 is located from the bite of the wire feeding rolls a distance approximately equal to twice the width of the stay being formed, but this will vary with different diameters of wire and width of stay. As the wire is forced endwise against the abutment 3 it bends about midway between the bite of the feed rollers and the abutment, approximately at the point marked 23, Fig. 7, and by making the distance between the abutment and the bite of the rollers substantially twice the width of the stay the bends 23 will occur at the proper points. As the wire is continued to be fed forward this bend is forced toward the opposite side of the groove in the clamping block 19 and forms a loop or eye, so that the unformed portion of the wire projects from a position at one end of the abutment or shoulder 3 to the bite of the rollers, and again takes a bend substantially midway of its length, but in the opposite direction, which bend is forced over toward the opposite side of the groove in the clamping block and forms another loop or eye at the opposite edge of the stay. Each of the side or cheek walls 20 is provided with a very shallow inclined groove, shown at 24, 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 upwardly and escaping over the abutment or top of the shoulder. The continued feeding forwardly of the wire, 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 grooves 24 and caused to escape over the upper edge of the abutment, and this operation is repeated very rapidly and forms successive loops or eyes as shown. Inasmuch as the pass in the feed rollers is located slightly below the lower edge of abutment 3, the unformed portion of the wire slides up the incline 18 at the 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 as described.

The loops or eyes are formed substantially in a horizontal plane, as shown in Fig. 6, and as each loop in succession is lifted by means of a succeeding loop, it is tilted out of the horizontal plane and into an inclined posi-

tion, so that the loops in the finished stay are inclined to the general plane of the stay and the latter presents a shingled appearance when viewed edgewise, as shown in Fig. 6.

The presser foot 5 is located above the anvil member 2 and its purpose is to keep the loops from jumping over the abutment or shoulder 3 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 suitable form but is shown as a section of a cylindrical body having its lower face somewhat flattened off, as shown at 26, and being provided with a spindle 27 eccentric to its body and which is journaled in an opening in the frame 1. This presser foot is provided with a handle 5^a for changing its angular position to vary the distance between its lower face and the anvil member and also change the angular relation of said lower face to the anvil member. This presser foot is held in its adjusted position by having its spindle passed through an opening in the head 28 of a clamping rod 29 having its upper end threaded and provided with winged nut 30.

When the presser foot is adjusted to the position shown in full lines in Fig. 6, with its lower face substantially parallel to the top of the anvil member, the loops of the stay will have little or no overlap, but by adjusting said presser foot so its lower face will have a considerable angle with reference to the anvil block, as shown in dotted lines in Fig. 6, the loops of the stay will have a material overlap, as shown in Fig. 10, and by adjusting the presser foot between these positions any degree of overlap can be secured. Suitable means are also preferably provided for lubricating, cleaning and cooling the wire and the feed rolls. In the drawings, the driving shaft 15 is arranged to operate an oil pump 31, which is provided with a suction pipe 32 communicating with a reservoir 33 in the base of the frame 1, and with a discharge pipe 34 having its outlet directly above the rolls, so that whenever the machine is running the pump delivers a continuous stream of oil to the feed rolls which cools and lubricates the wire and the rolls. The oil from the feeding rolls discharges upon the bed of the machine, which is provided with a rim or wall 36 which forms in effect a tray and from which the oil flows through an opening 37 back to the reservoir 33. One of the spindles or shafts 7 also carries at its outer end a pulley 38 which is connected by a band or belt 39 to a pulley 40 upon a shaft 41 carrying a reel 42, which is in line with the path of the stay through the machine and upon which the stay is reeled as fast as formed. Both the lubricating device and the reel may be omitted if desired, or replaced by devices of entirely different character for doing the same work.

In starting the machine the wire is passed between the feed rolls until it engages one of the side walls or cheeks at the ends of the abutment or shoulder 3, and the shaft 15 is operated by hand until several loops have been formed and passed under the presser foot 5. The driving belt is then shifted to the fast pulley 17 to operate the machine by power, and the feeding rollers 4 then force the wire rapidly and positively against the abutment 3 which causes it to bend back and forth into sinuous form between the side walls 20, 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 does this very rapidly 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 compressing 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 compressing 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 with prior machines in which the bending was done by a stretching operation around pins or similar forming members.

The apparatus may be varied within very wide limits. For instance, instead of forcing the wire endwise against the abutment, the abutment can be forced endwise against the wire, this being a mere reversal of the arrangement illustrated. Furthermore, the arrangement is adapted for forming a large variety of articles and from wire or rods of various sizes and cross-sectional shapes.

What I claim is:—

1. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment to thereby cause it to bend laterally first to one side and then to the other, and means for limiting lateral bending of the wire.

2. Apparatus for bending wire alternately in opposite directions, comprising an abutment, friction devices for forcing the wire endwise against said abutment. to thereby cause it to bend laterally first to one side and then to the other, and means for limiting lateral bending of the wire.

3. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire against

said abutment, and side plates for limiting lateral bending of the wire in both directions.

4. Apparatus for bending wire alternately in opposite directions, comprising an abutment, friction devices for forcing the wire endwise against said abutment, and side plates for limiting lateral bending of the wire.

5. Apparatus for bending wire alternately in opposite directions, comprising an abutment, coöperating wire feeding rollers for forcing the wire against said abutment, and side plates for limiting lateral bending of the wire.

6. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, and means for controlling the angle at which the bent wire structure leaves said abutment.

7. Apparatus for bending wire alternately in opposite directions, comprising an abutment, friction devices for forcing the wire endwise against said abutment, and means for controlling the angle at which the bent wire structure leaves said abutment.

8. Apparatus for bending wire alternately in opposite directions, comprising an abutment, coöperating wire feeding rollers for forcing the wire endwise against said abutment, and means for controlling the angle at which the bent wire structure leaves said abutment.

9. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, means for limiting lateral bending of the wire, and means for controlling the angle at which the bent wire structure leaves said abutment.

10. Apparatus for bending wire alternately in opposite directions, comprising an abutment, friction devices for forcing the wire endwise against said abutment, means for limiting lateral bending of the wire, and means for controlling the angle at which the bent wire structure leaves said abutment.

11. Apparatus for bending wire alternately in opposite directions, comprising an abutment, coöperating feeding rollers for forcing the wire endwise against said abutment, means for limiting lateral bending of the wire, and means for controlling the angle at which the bent wire structure leaves said abutment.

12. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, and means for adjusting said abutment and wire forcing means toward and from each other.

13. Apparatus for bending wire alternately in opposite directions, comprising an abutment, friction devices for forcing the wire endwise against said abutment, and means for varying the distance between said abutment and friction devices.

14. Apparatus for bending wire alternately in opposite directions, comprising a frame, wire feeding devices carried by said frame, an abutment against which the wire is fed by said devices, and means for adjusting said abutment relatively to the frame.

15. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, side plates for limiting lateral bending of the wire, and means for adjusting said abutment and wire forcing means relatively to each other.

16. Apparatus for bending wire alternately in opposite directions, comprising side clamping plates, an anvil having an abutment held therebetween, and means for forcing the wire endwise against said abutment.

17. Apparatus for bending wire alternately in opposite directions, comprising side clamping plates, an anvil having an abutment held therebetween, and means for forcing the wire endwise against said abutment, said side plates serving to limit lateral bending of the wire.

18. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, and adjustable means for controlling the angle at which the bent wire structure leaves said abutment.

19. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, means for limiting lateral bending of the wire, and adjustable means for controlling the angle at which the bent wire structure leaves said abutment.

20. Apparatus for bending wire alternately in opposite directions, comprising wire feeding devices, and an anvil having an abutment against which the wire is forced by said wire feeding devices and provided with an inclined face sloping toward the same.

21. Apparatus for bending wire alternately in opposite directions, comprising wire feeding devices, an anvil having an abutment against which the wire is forced by said wire feeding devices and provided with an inclined face sloping toward the same, and means for limiting lateral bending of the wire.

22. Apparatus for bending wire alternately in opposite directions, comprising a frame, side clamping plates carried thereby, an anvil having an abutment held be-

tween said side plates, and wire feeding devices arranged to feed the wire endwise against said abutment.

23. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for forcing the wire endwise against said abutment, and a presser foot located adjacent to said abutment and arranged to control the angle at which the bent wire structure leaves said abutment.

24. Apparatus for bending wire alternately in opposite directions, comprising an abutment, means for feeding wire endwise against said abutment, and an adjustable presser foot arranged to control the angle at which the bent wire structure leaves said abutment.

25. Apparatus for bending wire alternately in opposite directions, comprising wire feeding devices, clamping means located adjacent thereto and provided with a longitudinal groove forming a seat, and an anvil held in said seat and adjustable toward and from the wire feeding devices and having an abutment against which the wire is forced thereby.

26. Apparatus for bending wire alternately in opposite directions, comprising wire feeding devices, clamping means located adjacent thereto and provided with a longitudinal groove forming a seat, an anvil held in said seat and adjustable toward and from the wire feeding devices and having an abutment against which the wire is forced thereby, and means for adjusting said clamping means relatively to the wire feeding devices.

27. Apparatus for bending wire alternately in opposite directions, comprising wire feeding devices, clamping means located adjacent thereto and provided with a longitudinal groove forming a seat, an anvil held in said seat and adjustable toward and from the wire feeding devices and having an abutment against which the wire is forced thereby, and a presser foot located above said clamping means and arranged to control the angle at which the bent wire structure leaves said abutment.

28. Apparatus for bending wire alternately in opposite directions, comprising wire feeding devices, clamping means located adjacent thereto and provided with a longitudinal groove forming a seat, an anvil held in said seat and adjustable toward and from the wire feeding devices and having an abutment against which the wire is forced thereby, means for adjusting said clamping means relatively to the wire feeding devices, and a presser foot located above said clamping means and arranged to control the angle at which the bent wire structure leaves said abutment.

29. Apparatus for bending wire alternately in opposite directions, comprising an abutment, wire feeding rollers arranged to force the wire endwise against said abutment, means for operating said wire feeding rollers, and means driven by said operating means and arranged to discharge a stream of lubricating material upon said wire feeding rollers.

30. Apparatus for bending wire alternately in opposite directions, comprising an abutment, wire feeding rollers for forcing the wire endwise against said abutment, a pump arranged to discharge a stream of lubricant upon said wire feeding rollers, and means for rotating said rollers and operating said pump.

31. Apparatus for bending wire alternately in opposite directions at equal intervals along its length, comprising an abutment, and means engaging the wire at a distance from the abutment and arranged to force the same endwise against said abutment to thereby cause it to bend laterally first to one side and then to the other.

32. Apparatus for bending wire alternately in opposite directions at equal intervals along its length, comprising an abutment, and means engaging the wire a distance from the abutment substantially double the width of the product to be formed and arranged to force the wire endwise against said abutment to thereby cause it to bend laterally first to one side and then to the other.

33. Apparatus for bending wire alternately in opposite directions at equal intervals along its length, comprising an abutment, means engaging the wire at a distance from the abutment and arranged to continuously force the wire endwise against said abutment to thereby cause it to bend laterally first to one side and then to the other.

34. Apparatus for bending wire alternately in opposite directions at equal intervals along its length, comprising an abutment, means engaging the wire a distance from the abutment and arranged to force the wire endwise against the abutment to thereby cause it to bend laterally first to one side and then to the other, and means for limiting lateral bending of the wire.

In testimony whereof, I have hereunto set my hand.

JUNIUS EMMETT MAYO.

Witnesses:
T. F. CHARLTON,
W. S. SMITH.