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H. N. VELEY

2,361,983

MACHINE FOR FORMING RESISTOR LEADS

Filed June 2, 1942

3 Sheets-Sheet 1

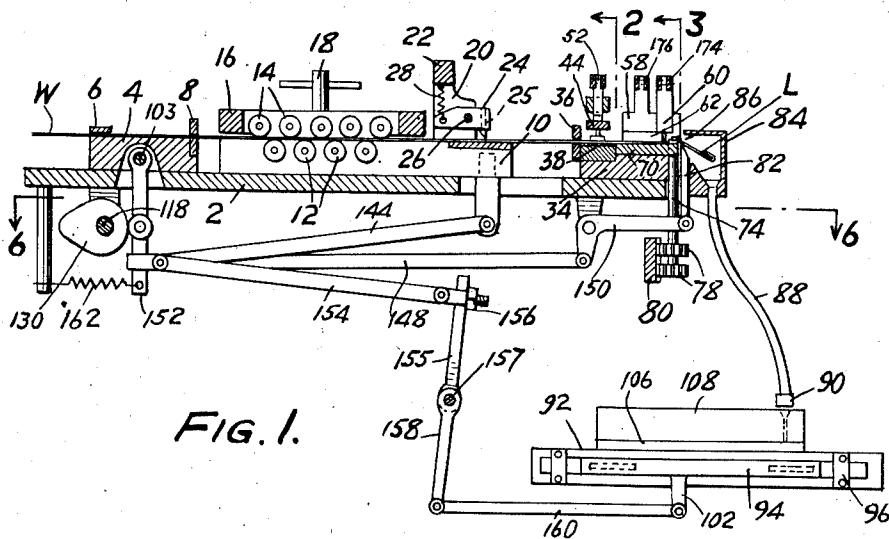


FIG. 1.

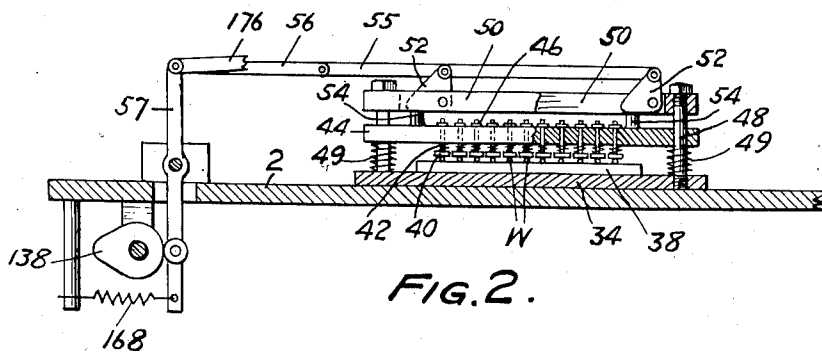


FIG. 2.

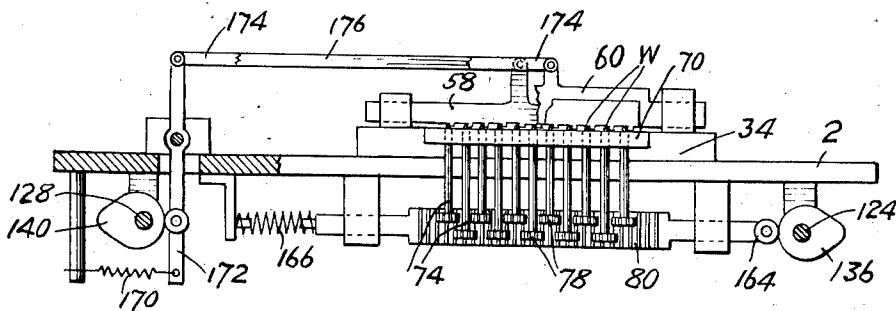


FIG. 3.

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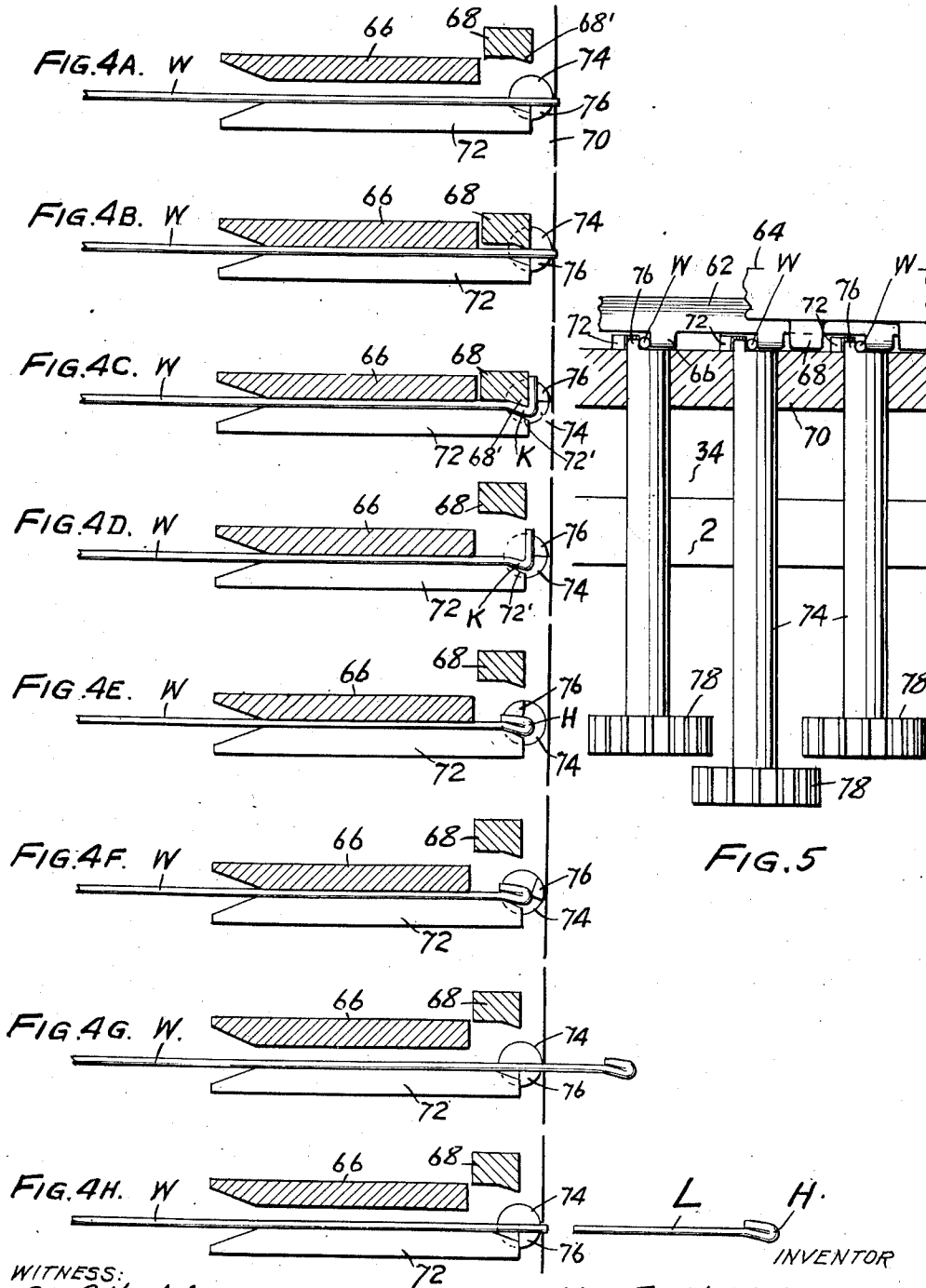
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3 Sheets-Sheet 2



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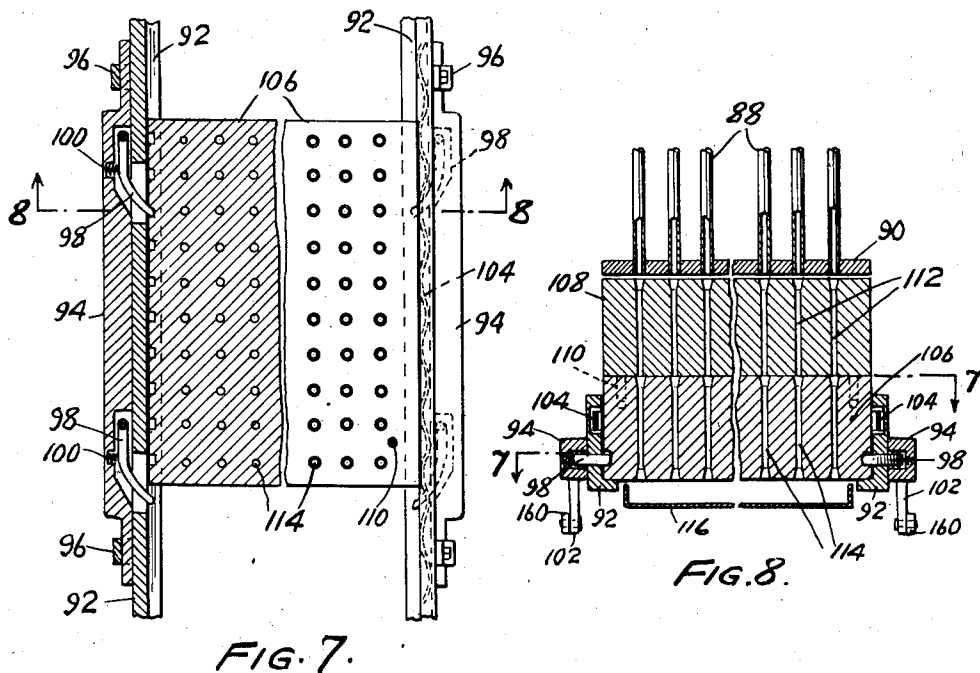
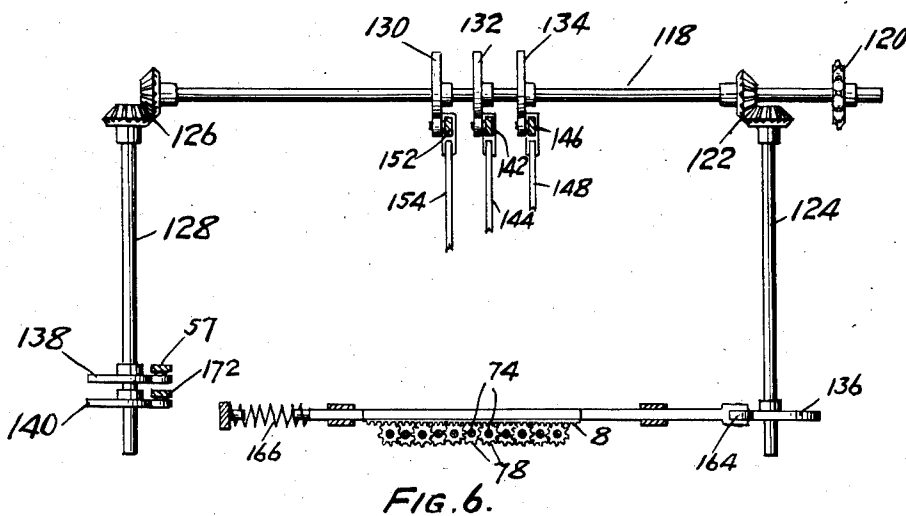
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MACHINE FOR FORMING RESISTOR LEADS

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3 Sheets-Sheet 3



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2,361,983

MACHINE FOR FORMING RESISTOR LEADS

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Application June 2, 1942, Serial No. 445,460

15 Claims. (Cl. 140—71)

This invention relates to a machine for making lead wires particularly for use in molded type resistors.

Molded type resistors of the type largely used in radio apparatus are composed of bodies of thermoplastic material including conductive material to give rise to various resistances ranging from a few ohms to several megohms. These resistors, whether of insulated or uninsulated type, are provided with lead wires generally of tinned copper embedded in the ends thereof and projecting in such fashion as to be connectible in electrical circuits. In order to achieve the necessary strength of construction the embedded heads of these leads are enlarged in some fashion, preferably by being bent so as not to be easily pulled out of the resistor body.

It is the general object of the present invention to provide a machine for automatically forming such leads from continuous wires in such fashion as to secure uniformity with the ultimate object of having the final resistors as uniform as possible in resistance values.

A further object of the invention is to provide in a machine of this character means for so arranging the formed leads that they may be conveniently located in molding apparatus without the necessity for their individual handling.

Still another object of the invention is provision of such leads of a particular advantageous shape to secure the maximum strength of the final resistor and uniform projection of the leads into the resistance material.

These and other objects of the invention particularly relating to details of construction and operation of the machine will become apparent from the following description read in conjunction with the accompanying drawings in which:

Figure 1 is a vertical section through a machine constituting a preferred embodiment of the invention, this figure as well as others being diagrammatic in omitting certain irrelevant supporting parts;

Figure 2 is a vertical section showing the upper portion of the machine and taken on the plane the trace of which is indicated at 2 in Figure 1;

Figure 3 is a section similar to that of Figure 2 but taken on the plane indicated at 3 in Figure 1;

Figures 4A to 4H inclusive are a series of diagrammatic sectional views particularly showing the successive steps in the formation of a lead;

Figure 5 is an enlarged section taken also substantially on the plane indicated at 3 in Figure 1 and showing the elements for forming the bent heads of the leads;

Figure 6 is a horizontal sectional view diagrammatic in form showing the operating means for the various parts of the machine;

Figure 7 is a horizontal section taken on the broken plane indicated at 7—7 of Figure 8 and showing the receiving means for the leads; and

Figure 8 is a vertical section taken on the plane indicated at 8—8 in Figure 7.

The machine comprises a table 2 supporting the various operating parts, including a support (not shown) for spools supplying wires from which the leads are to be formed. The wires from these spools, indicated at W, pass beneath a guiding bar 6 and above a supporting block 4, which carries the bar 6. The supporting block 4 carries a guide member 8, provided with openings through which the various wires W extend and beyond which they lie in substantial parallelism through the handling and severing mechanisms.

In front of the block 4 there is located a slide 10 guided for forward and backward movement on the table 2. Journalled in the slide 10 are a plurality of rollers 12 provided with circumferential grooves, one for each wire. Arranged to cooperate with the rollers 12 are similar upper rollers 14 also provided with circumferential grooves to receive the wires and arranged to alternate with the lower rollers 12, the rollers 14 being carried by a support 16, which is secured to the slide 10 by means of screw clamping means indicated at 18. The rollers 14 are so arranged as to extend slightly downwardly below the tops of the rollers 12 to such extent that the wires engaging alternately the upper and lower rollers must take a slightly wavy path in the grooves thereof.

Beyond these rollers the wires W extend over a horizontal plane portion of the slide 10, where they are engaged by blocks 24, which are pivoted on a rod 26 extending between upstanding brackets 20 carried by the slide 10 and carry feeding pawls 25 provided with sharpened beveled lower points engageable individually with the wires. The pivoted blocks 24 are urged in a clockwise direction, as viewed in Figure 1, by means of individual springs 28 connected between them and a cross-bar 22 carried by the brackets 20.

From the position of engagement by the feeding pawls 25, the wires extend forwardly through a guide bar 36 provided with individual openings for the wires and carried by a supporting member 34 secured fixedly to the table 2. After passing from the openings in the guide 36, the wires pass over a clamping member 38 provided with a serrated upper surface above which, and

adapted to clamp the wires, are individual wire clamping elements 40, urged individually downwardly by springs 42 and guided in a cross-bar 44, the members 40 being provided with heads 46 arranged to limit their downward movements. The bar 44 is guided at its ends upon studs 48 and is urged upwardly by springs 49 surrounding these studs. Connecting the upper ends of the studs 48 are cross-members 50 to which are pivoted cams 52 adapted to engage lugs 54 extending upwardly from the bar 44. Above their pivots these cams 52 are pivoted to a link 55, which is connected through a link 56 with the upper end of a lever 57 operated as described hereafter.

Suitably guided for sliding movement across the front of the machine are a pair of slides 58 and 60. The former of these slides carries at its lower surface a plate 62, on which are formed a series of presser members 66 corresponding individually to the wires W, these taking the form of ribs extending parallel to the direction of extent of the wires. The slide 60 has secured thereto a member 64, which also carries a group of presser elements 68 in front of the elements 66. Both the elements 66 and 68 slide on a plate 70 secured to the support 34. This plate 70 is also provided with clamping elements 72 extending upwardly therefrom in the form of ribs parallel to the direction of extent of the wires adjacent the clamping elements 66 and 68, forming with them spaces between which the wires may move and in which the wires are, at suitable times, clamped. A group of pins 74, also corresponding individually to the wires, are journaled in openings in the plate 70 at their upper ends and are suitably mounted in bearings at their lower ends. Each of these pins is provided with a lug 76 adapted to form a hook on each lead as described hereafter. These lugs 76 take the form illustrated in Figures 4A and 5. Each of the pins 74 is provided with a driving pinion 78, these pinions 78 being vertically staggered as indicated in the drawings for the purpose of saving transverse space on the machine. The pinions are designed to be rotated at proper times by means of a rack 80 slidable transversely across the front of the machine by cam means hereafter described.

A vertically guided knife 82 is provided with a horizontal cutting edge which, in its idle position, extends just below the upper surface of the plate 70 over which the wires extend. When the knife is moved upwardly to effect a wire cutting action, it cooperates with the front surface of the member 64, which thereby serves as a cooperating blade. This knife is actuated by cams in a fashion hereafter indicated.

The formed and severed leads are arranged to be received and guided by a member 84, which extends across the front of the machine and is provided with receiving openings 86, individual to the wires, which serve to cause the wires to enter individual tubes 88 communicating at their lower ends with openings in a transverse bar 90, located below the level of the table at the front of the machine. Below the location of the bar 90 are forwardly extending tracks 92 along the outside of each of which there is guided for reciprocatory motion a slide 94, the guiding being effected by metal straps 96 embracing the ends of the slide and secured to the tracks. Each of the slides 94 is provided with a pair of pawls 98 urged inwardly by springs 100 and having their operating ends projecting through slots formed

in the walls of the tracks. Each of the slides is provided with a depending lug 102, connected for the actuation of the slides as described hereafter.

Above the location of the slots through which the pawls work, the tracks are provided with spring members 104 of wavy form adapted to impose friction upon removable blocks 106 arranged to be guided for movement in the tracks. These blocks 106 are associated with upper guide blocks 108 with which they are properly aligned by means of pins and holes, indicated at 110, so that lead wire receiving openings 114 of the blocks 106 are axially aligned with corresponding holes 112 in the guide blocks 108. Each of the blocks 106 has secured thereto a pan member 116 arranged to keep the finished leads from dropping out of the openings 114.

Operating motions are applied to the various parts of the machine from a series of shafts 118, 124 and 128, the shafts 118 and 124 being connected by bevel gearing 122 while the shafts 118 and 128 are connected by bevel gearing 126. The shaft 118 carries a sprocket 120 through which it is rotated from a motor through reduction gearing (not shown). The shaft 118 carries three cams 130, 132 and 134, the shaft 124 carries a cam 136, and the shaft 128 carries a pair of cams 138 and 140, all of suitable shape to provide the various proper motions as will be hereafter described.

The cam 132 acts on a follower carried by a lever 142 which is connected through a link 144 to an arm depending from the slide 10.

The cam 134 acts similarly on a follower carried by an arm 146 which is connected through a link 148 and bell crank 150 to actuate the knife 82.

The cam 130 acts in similar fashion upon a follower carried by a lever 152 which is connected through a link 154 to an adjustable block 156 clamped upon an arm 155 secured to a rock shaft 157 which carries a pair of levers 158 connected by individual links 160 to the lugs 102 depending from the slides 94. The various levers 142, 146 and 152 are pivoted upon a common pin 103 and are urged so that their followers engage the respective cams by springs 162.

The rack 80 is urged toward the right as viewed in Figure 3 by a compression spring 166 to cause a follower roller 164 to engage and follow the cam 136.

The cam 138 engages a follower carried by the lever 57 previously referred to, which follower is held in contact with the cam by means of spring 168. The upper end of the lever 57 is not only connected to the link 56 previously described but is also connected through a second link 176 to the slide 58.

The cam 140 engages a follower carried by the depending arm of a lever 172 which is urged in clockwise direction as viewed in Figure 3 by a spring 170. The upper end of this lever 172 is connected by a link 174 with the slide 60.

In the operation of the machine the various parts are so timed by the proper design of the cams to effect the feed of the wires W, straightening of the wires, formation of heads H, severance of leads L, and the location of these leads in the openings 114 of the block 106. For this purpose the slide 10 is reciprocated back and forth, having a backward movement at a time when the wires W are clamped by the individual clamping heads 40. Under these conditions the rollers 12 and 14 ride over the stationary wires

W imparting a progressive wave of slight amount therein to straighten them against any tendency toward curvature which may result from their reeling on the supply reels. During this rearward movement of the slide 10 the gripping pawls 25 merely slide on the wires.

In the subsequent forward movement of the slide, i. e., to the right as viewed in Figure 1, the sharpened ends of the pawls grip the wires and feed them forwardly, the wires being released at this time.

During the time when the wires are clamped by the members 40 and the slide 10 is moving rearwardly the heads H are formed by the successive sequential operations indicated in Figures 4A to 4H, inclusive. In Figure 4A the parts are shown in the conditions assumed immediately after a severing operation which follows the completion of the forward movement of the slide 10. At this time the clamps 40 are about to be engaged and the wire W is disengaged by both the ribs 66 and the presser elements 68, extending along the clamping surfaces of the ribs 72.

The next step illustrated in Figure 4B is the clamping of the wires by the ribs 66 against the ribs 72 while the clamping elements 68 are also brought into engagement with the wires as illustrated in that figure. Up to this point in the operation the lug 76 lies at one side of the wire as illustrated in the figure.

The next step in the operation involves a rotation through approximately 90 degrees of the various pins 74, the lugs of which bend the ends of the wires as illustrated in Figure 4C while each presser element 68 moves slightly further toward clamping position to provide in the end of each wire a slight deflection indicated at K this being caused by reason of the provision of a slight projection 68' of the presser element 68 cooperating with the bevel edge 72' of each rib 72.

Following this operation the various presser elements 68 are withdrawn as indicated in Figure 4D, and thereafter, as indicated in 4E, the pins 74 rotate approximately through a further 90 degrees beyond the original right angle bend to bend the end of the wire to complete the formation of the hook H as indicated.

The pins 74 are then reversely rotated through 180 degrees to their original positions, this rotation being indicated in progress in Figure 4F. When they reach their final positions illustrated in Figure 4G the wire is caused to be released by both the ribs 66 and the clamps 40 and is fed forwardly by the movement of the slide 10 as indicated in that figure. When a proper length of lead has been fed forwardly the forward motion of the slide 10 ceases and the knife 82 is moved upwardly to sever the completed leads which fall head first into the corresponding tubes 88 to be guided into the row of openings 112 in the upper block 108 and thence fall into the openings 114 of the lower block 106 to be arrested by the pan 116. At this time the blocks are in stationary position, being moved step by step to align successive rows of openings 112 with the tubes 88 during the head forming operations previously described.

It will be evident that thus the various leads are automatically formed and filled into the block 106 which is removed from the machine and used to locate the leads in plungers carrying central openings and arranged to form parts of molds to produce resistors in accordance with the application of Herrick and Velej, Serial No. 370,010,

filed December 13, 1940. The machine may continuously run without attention save for the location of new pairs of receiving blocks 106 and 108 in the tracks 92 into which they are placed by an operator. By the provision of the pair of pawls 98 it will be evident that these blocks are fed in succession below the tubes 88, overrun in the feeding being prevented by the wavy springs 104 which supply the necessary friction.

It will be clear that the mechanism disclosed herein is merely illustrative and that the principles of the invention may be carried out in various ways within the scope of the following claims.

What I claim is:

1. In combination, a pair of clamp elements, means for feeding a wire between said clamp elements, means for effecting engagement of the wire by said clamp elements, a third clamp element cooperating with one of the first mentioned clamp elements to deflect a portion of the wire to one side of the portion located between the first mentioned clamp elements, means for engaging the end of the wire beyond said third clamp element to bend the same in a direction opposite said deflection effected by the third clamp element, and means for controlling the third clamp element and the last mentioned means to effect in sequence said deflection and completion of the bending.

2. In combination, a pair of clamp elements, means for effecting engagement of a wire by said clamp elements, a third clamp element cooperating with one of the first mentioned clamp elements to deflect a portion of the wire to one side of the portion located between the first mentioned clamp elements, means for engaging the end of the wire beyond said third clamp element to bend the same in a direction opposite said deflection effected by the third clamp element, and means for controlling the third clamp element and the last mentioned means to effect in sequence said deflection and completion of the bending.

3. In combination, means for feeding a wire in the direction of the length, means for severing sections from said wire, means for forming bent heads on said sections, a receiver having openings for said sections, and means for distributing said sections in the openings of said receiver, the last named means including devices for imparting step by step advancing motions to said receiver to bring various openings therein in position to receive said sections.

4. In combination, means for feeding a wire in the direction of the length, means for severing sections from said wire, means for forming bent heads on said sections, a receiver having openings for said sections, and means for distributing said sections in the openings of said receiver, the last named means including devices for imparting step by step advancing motions to said receiver to bring various openings therein in position to receive said sections, and means for frictionally restraining said receiver from overrunning movements.

5. In combination, a pair of clamp elements, means for feeding a wire between said clamp elements, means for effecting engagement of the wire by said clamp elements, a third clamp element cooperating with one of the first mentioned clamp elements, means for engaging the end of the wire beyond said third clamp element to bend the same about an edge of the third clamp element, and means for moving the third clamp element away from the wire to clear the end of

the wire being bent while the engaging means effects bending beyond a right angle.

6. In combination, a plurality of clamping means, means for feeding a wire thereto, means for effecting engagement of the wire by both of said clamping means, means for engaging an unclamped end of the wire to bend the same about an edge of one of said clamping means, and means for moving the last mentioned clamping means away from the wire to clear the end of the wire being bent while the engaging means effects bending beyond a right angle.

7. In combination, clamping means, means for feeding a wire thereto, means for engaging an unclamped end of the wire and means for effecting, in sequence, clamping of the wire by said clamping means, bending of the end of the wire by said engaging means about an edge of the clamping means, release of the clamping means from the wire, and further bending of the end through a region previously occupied by the clamping means while clamping the wire.

8. In combination, means for feeding a wire in the direction of its length, means for severing sections from said wire, means for forming bent ends on said sections, means for restraining said wire against reverse movement after a feeding operation, and means movable rearwardly along the wire after a feeding operation and while it is restrained against reverse movement for straightening the wire.

9. In combination, means for feeding a wire in the direction of its length, means for severing sections from said wire, means for forming bent ends on said sections, means for restraining said wire against reverse movement after a feeding operation, and means movable rearwardly along the wire after a feeding operation and while it is restrained against reverse movement for straightening the wire, the last mentioned means being arranged, during movement relative to the wire, to form waves therein progressing along the wire.

10. In combination, means for feeding a wire in the direction of its length, means for severing sections from said wire, means for forming bent ends on said sections, means for restraining said wire against reverse movement after a feeding operation, and means movable rearwardly along the wire after a feeding operation and while it is restrained against reverse movement for straightening the wire, the last mentioned means being movable with the wire during the feeding operation.

11. In combination, means for simultaneously feeding a plurality of wires along parallel lines in the direction of their lengths, means for severing sections from the wires, means for forming bent ends on said sections, and means for clamping the wires, the last means comprising a pair of relatively movable members each provided with a plurality of ribs extending parallel to the direction of movement of the wires.

12. In combination, means for feeding a wire, means for severing sections from the wire, and means for forming a bent end on the wire adjacent the point of severance of a preceding section, the last named means comprising means for effecting bending of the free end of the wire through substantially 180° into contact with the portion of the wire inside the bent end.

13. In combination, means for feeding a wire, means for severing sections from the wire, and means for forming a bent end on the wire adjacent the point of severance of a preceding section, the last named means comprising means for deflecting out of line with the main portion of the wire an end portion thereof, and means for forming a bend of substantially 180° in said deflected portion to bring two parts thereof into contact.

14. In combination, means for feeding a wire, means for forming bent ends on sections of the wire, means for severing said sections from the wire, a receiver having a plurality of openings therein, a tubular guide for directing severed sections to the openings of said receiver, and means for intermittently moving said receiver in timed relationship with the operation of the severing means to present the openings successively in receiving relationship with said guide.

15. In combination, means for feeding a plurality of wires, means for forming bent ends in sections of the wires, means for severing said sections from the wires, a receiver having a plurality of sets of openings therein, the openings of each set being adapted to receive sections from the various wires, tubular guides, one for each wire, for directing severed sections to the openings of said receiver, and means for intermittently moving said receiver in timed relationship with the operation of the severing means to present successive sets of openings in receiving relationship with said guides.

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