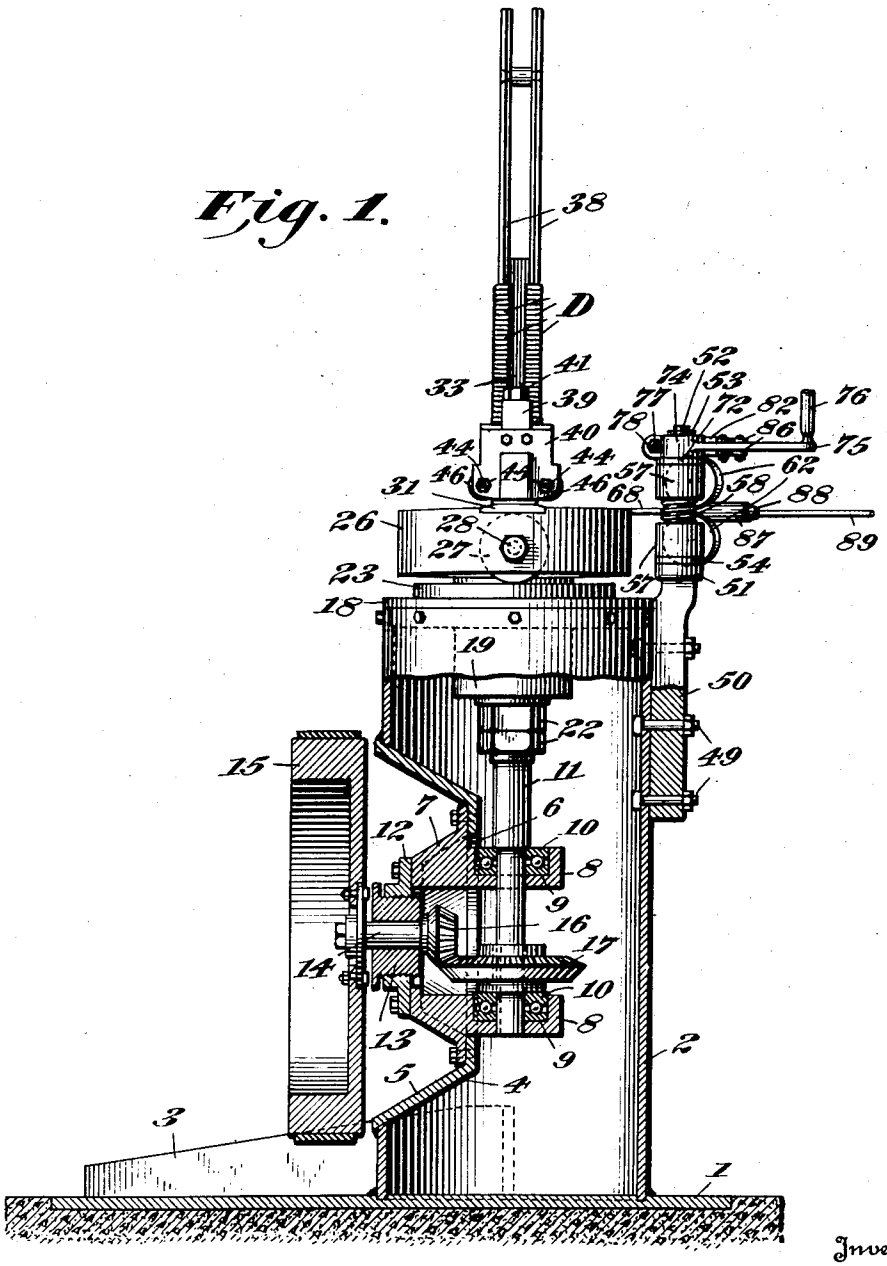
Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 1

Fig. 1.



Inventor

Harry R. Geer.

By R. S. & E. Dougherty.

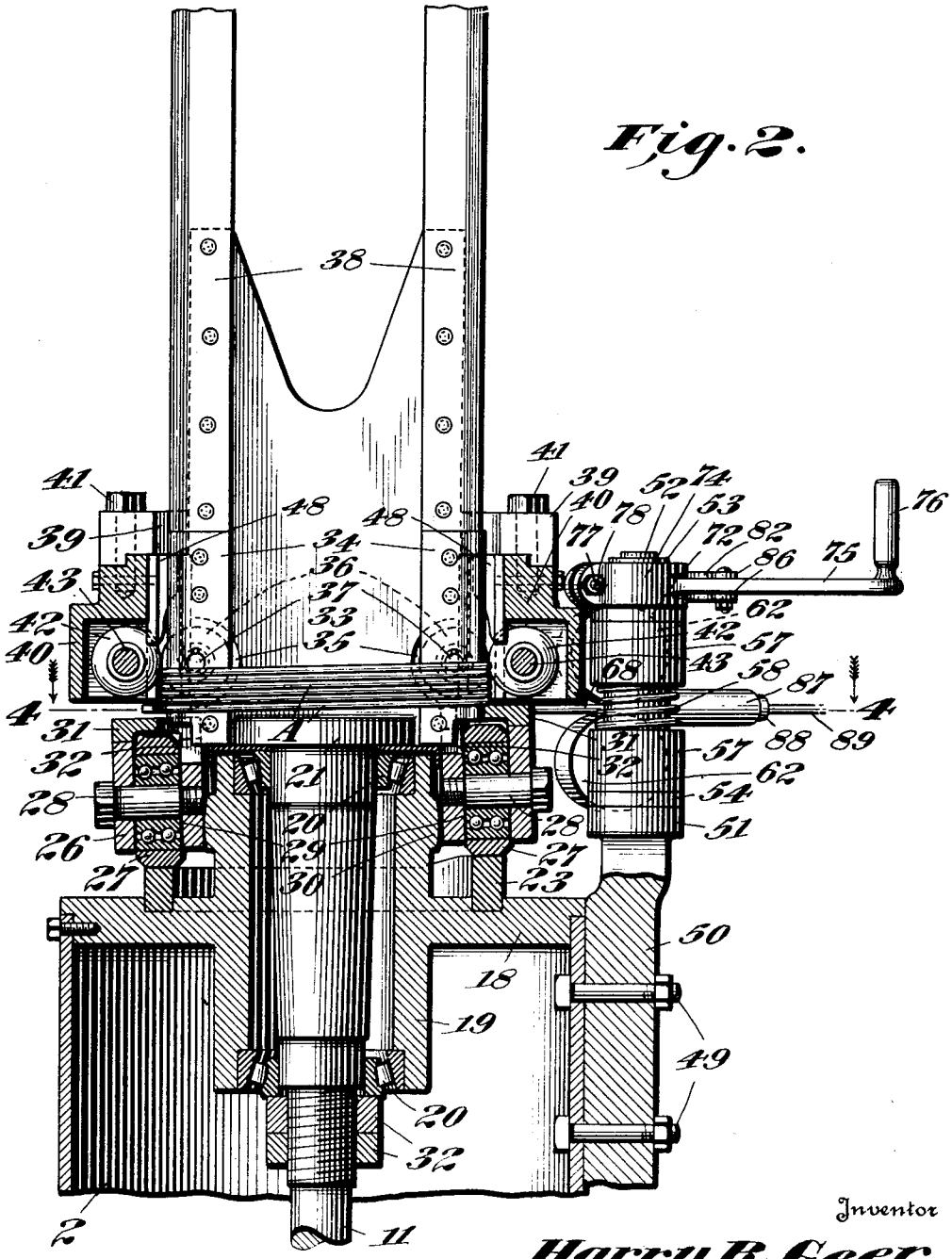
Attorneys

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 2

Fig. 2.



Inventor

Harry R. Geer.

By R. S. & A. Dougherty

Attorneys

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 3

Fig. 3.

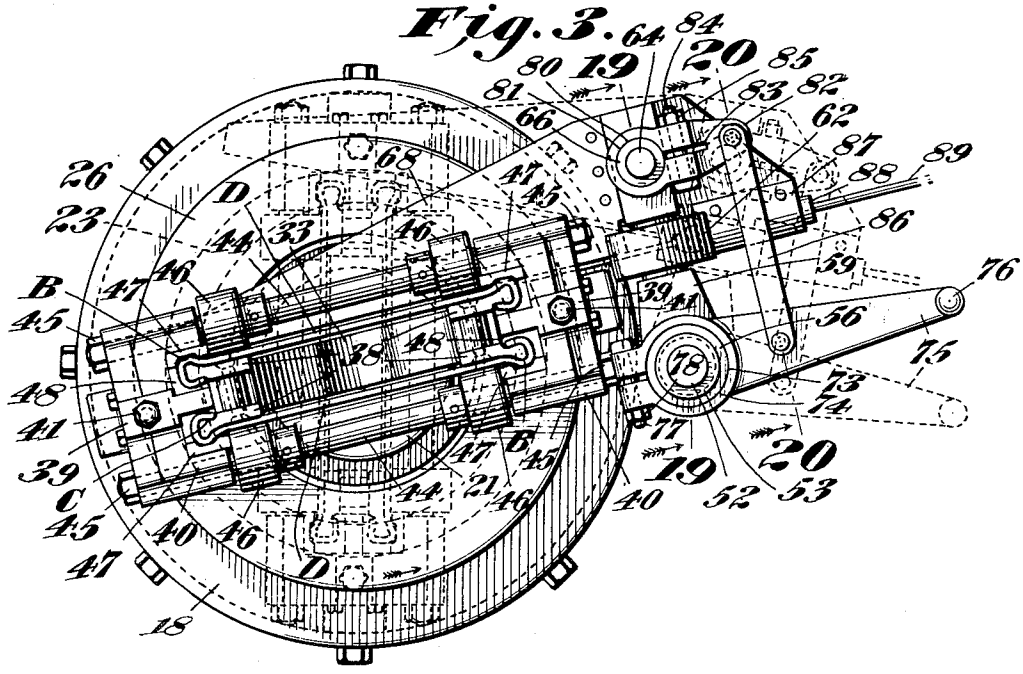
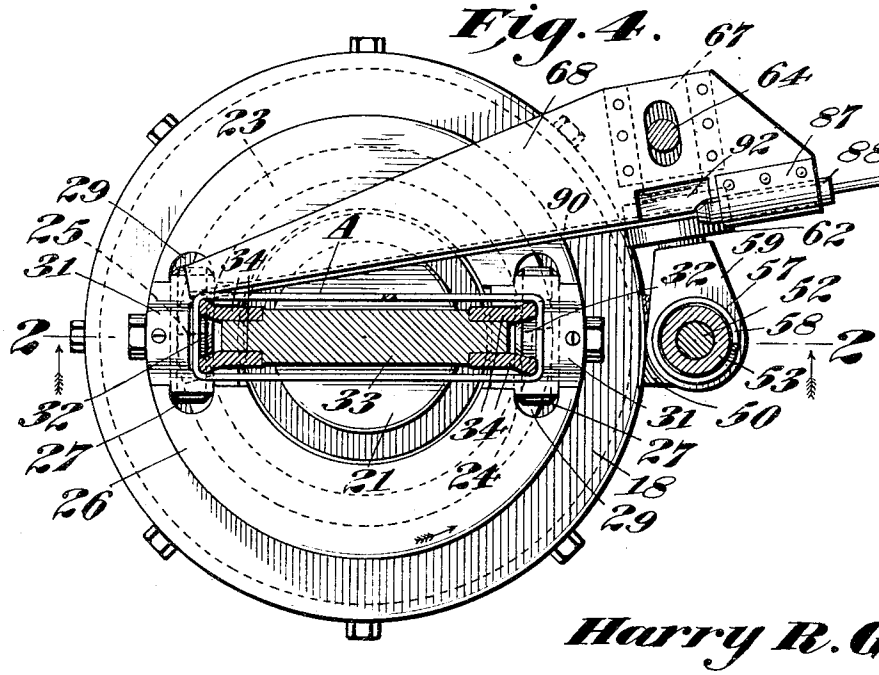


Fig. 4.



Inventor

Harry R. Geer.

By R. S. A. Houghtaly

Attorney

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 4

Fig. 5.

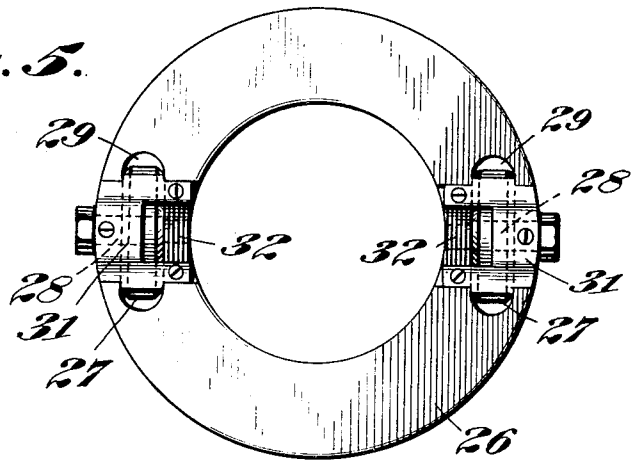


Fig. 6.

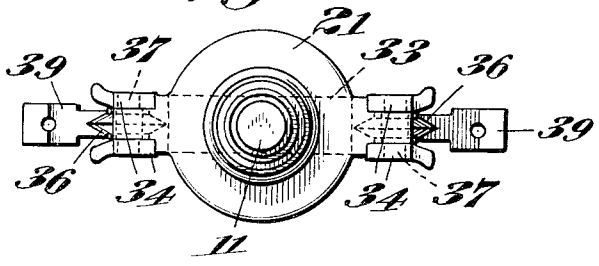
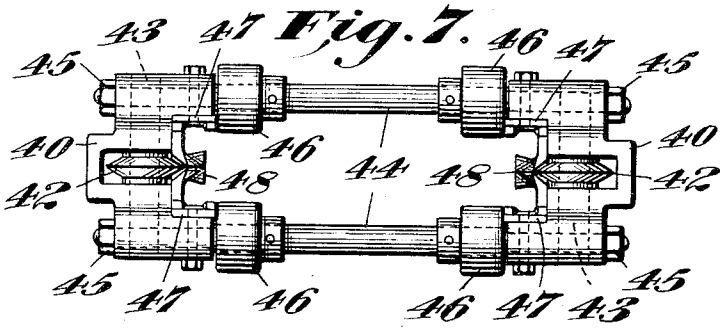


Fig. 7.



Inventor

Harry R. Geer.

By R. S. & A. Dougherty

Attorneys

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 5

Fig. 8.

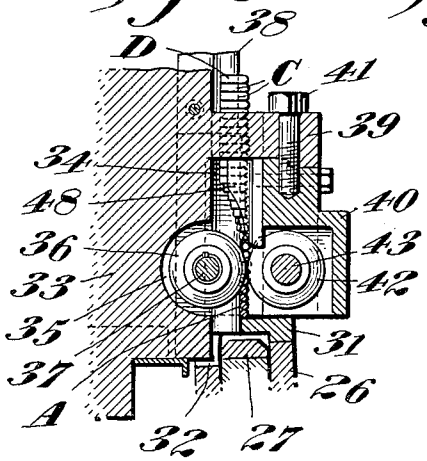


Fig. 11.

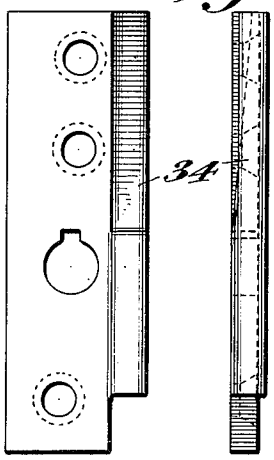


Fig. 12.

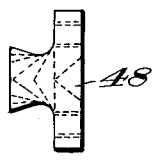


Fig. 13.

Fig. 14.

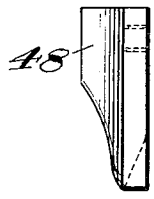


Fig. 9.

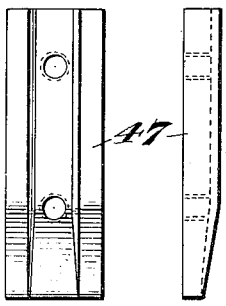


Fig. 10.

Fig. 15.

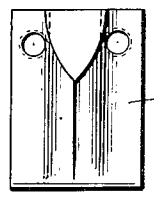


Fig. 16.

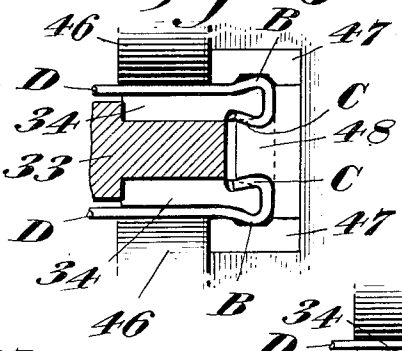


Fig. 17.

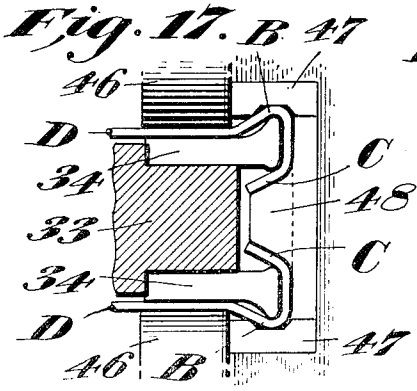
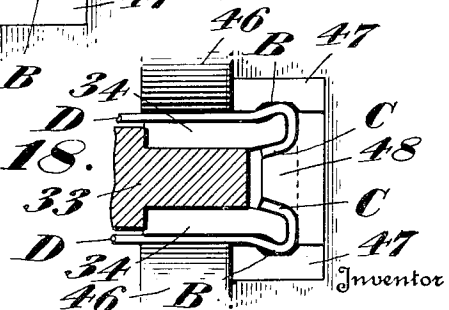


Fig. 18.



Inventor

Harry R. Geer.

By R. S. & Houghertz.

Attorney

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 6

Fig. 19.

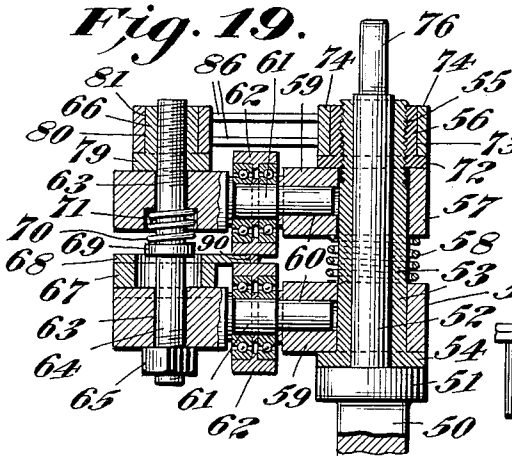


Fig. 20.

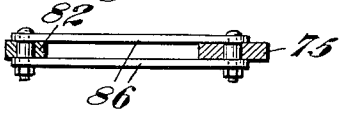


Fig. 21.

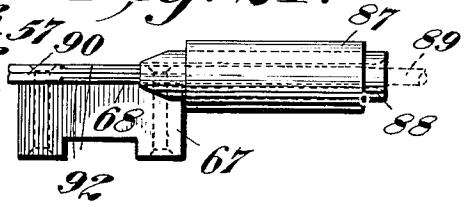


Fig. 22.

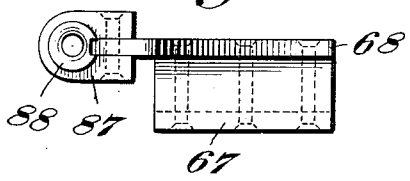


Fig. 23.

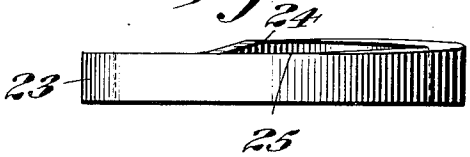


Fig. 24.

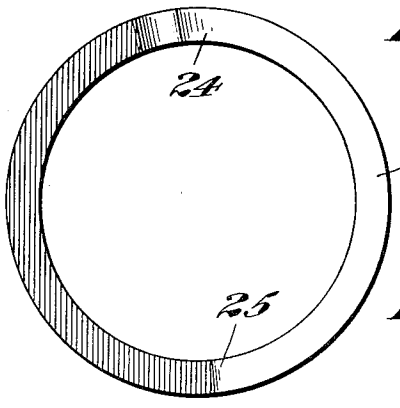


Fig. 25.

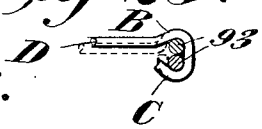


Fig. 26.

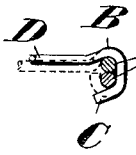


Fig. 27.

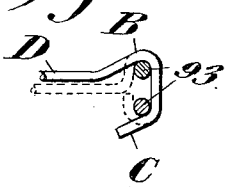


Fig. 28.



Inventor

Harry R. Geer:

By R. S. A. Dougherty

Attorney

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 7

Fig. 29.

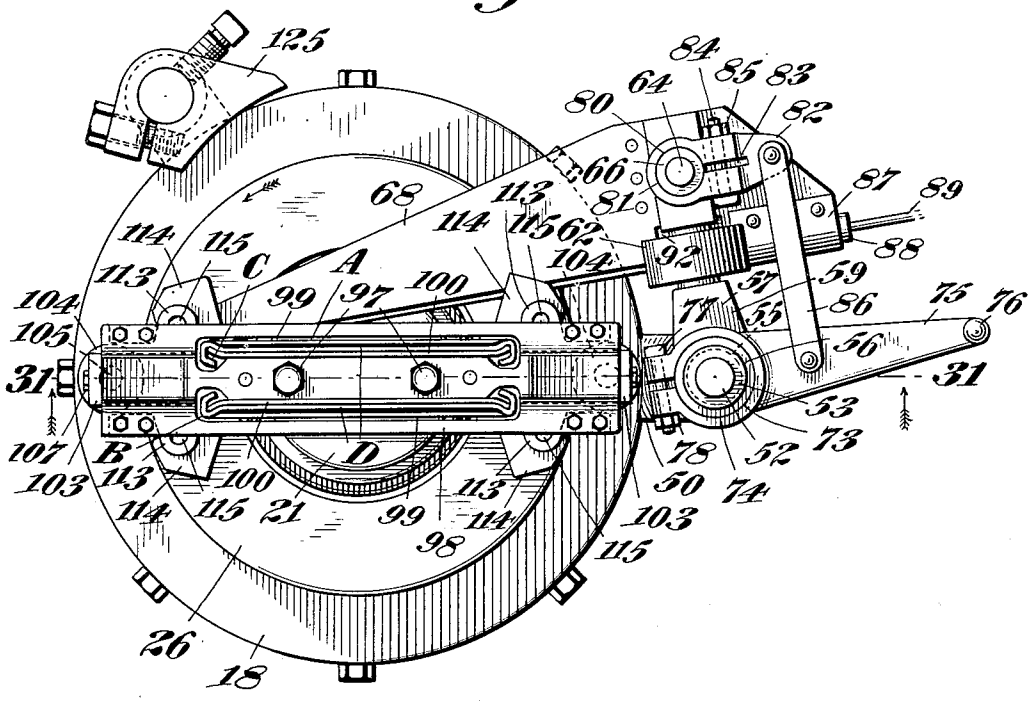
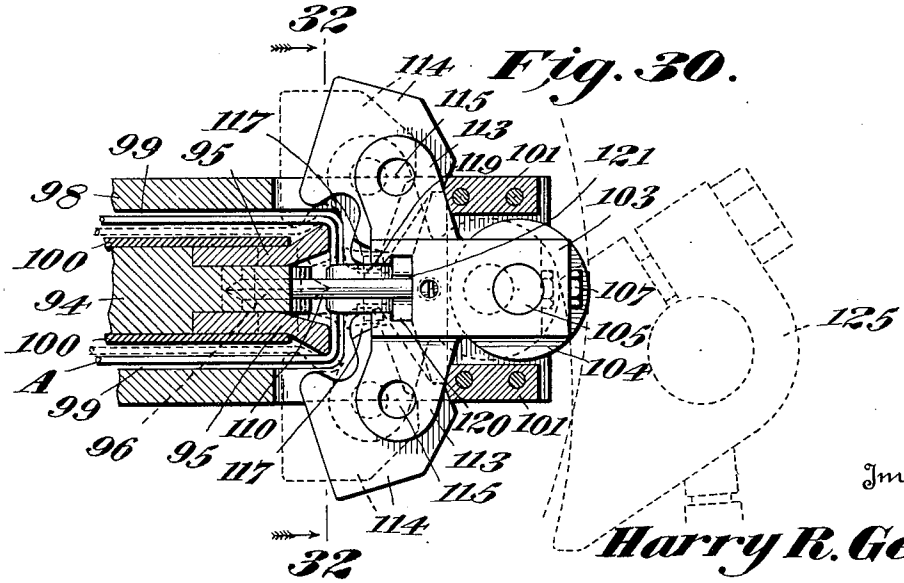


Fig. 30.



Inventor

Harry R. Geer.

By P. S. & A. Dougherty

Attorneys

Jan. 8, 1935. H. R. GEER 1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Filed Nov. 23, 1933 8 Sheets-Sheet 8

Fig. 31.

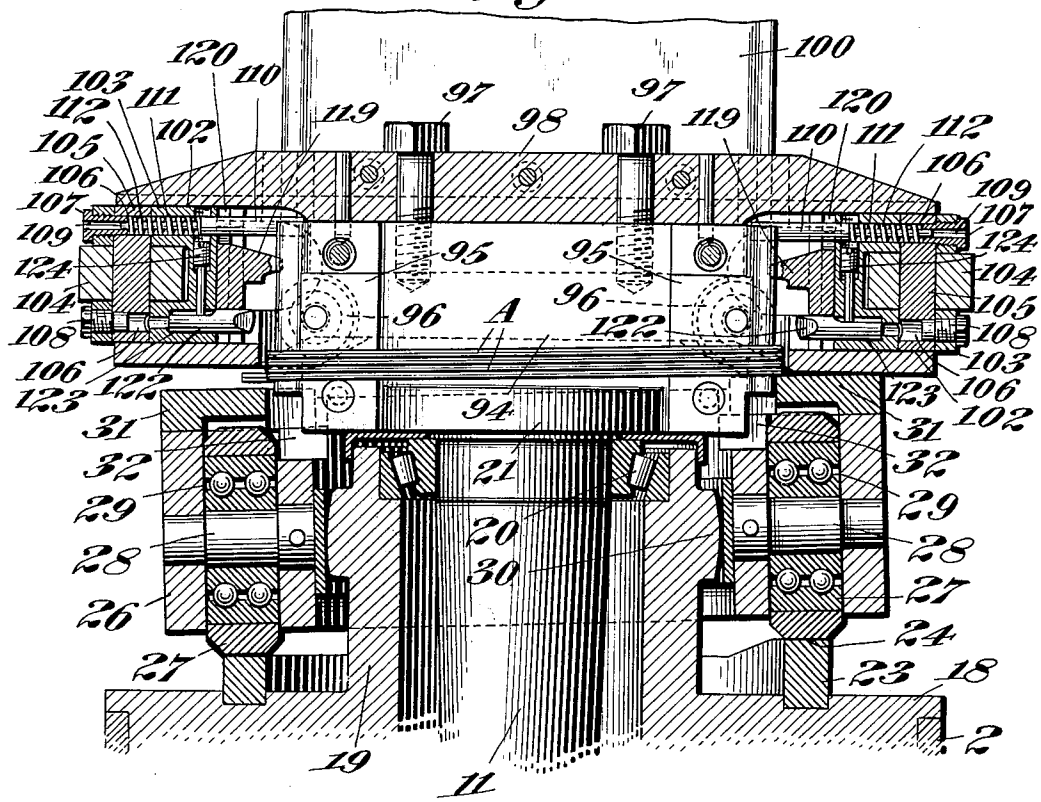


Fig. 32.

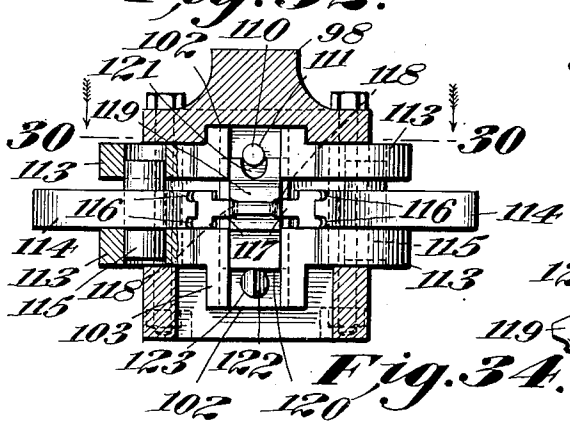


Fig. 34.

Fig. 33.

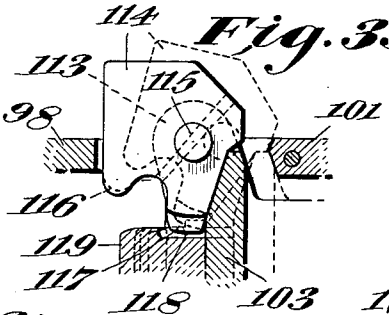


Fig. 35.



Inventor

Harry R. Geer.

By R. S. A. Dougherty.

Attorney

Patented Jan. 8, 1935 1,987,333

UNITED STATES PATENT OFFICE

1,987,333

MACHINE FOR BENDING WIRE AND THE LIKE

Harry R. Geer, Westmont, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania

Application November 23, 1933, Serial No. 699,338

42 Claims. (Cl. 140—92.2)

My invention relates to forming rods with hooked ends and more especially to the manufacture of tie-rods which form the core members for reels or spools similar to the type used upon which wire, barbed wire fencing or the like material is reeled or coiled into bundles for convenience in storage and shipment.

One of the objects of my invention relates to continuously wrapping a rod or wire on a substantially rectangular mandrel in such a manner that it can be sheared on opposite sides of the mandrel, the hooked ends formed and the tie-rods automatically advanced simultaneously on opposite sides of the mandrel.

Another object of my invention relates to the mechanism for rolling and guiding the wire directly to the mandrel from a suitable source of supply.

A further object of the invention relates to the means for cutting the wire on opposite sides of the mandrel.

Another object of the invention relates to the manner of forming the hooks on the ends of the tie-rods.

A still further object of my invention relates to the mechanism for simultaneously advancing the wrapped wire and tie-rods on the mandrel.

Other objects of my invention will appear hereinafter.

Having thus given a general description of my invention, I will now in order to make the same more clear refer to the annexed eight sheets of drawings forming a part of this specification and in which like characters of reference refer to like parts.

Fig. 1 is a front elevation of the machine with parts shown in section to more clearly illustrate the driving mechanism;

Fig. 2 is a vertical section through the top portion of the machine, taken on line 2—2 of Fig. 4 with the mandrel shown in elevation, the figure being drawn on a larger scale than that shown in Fig. 1;

Fig. 3 is a top plan view;

Fig. 4 is a transverse section taken on line 4—4 of Fig. 2;

Fig. 5 is a top plan view of the thrust-ring;

Fig. 6 is a bottom plan view of the spindle and mandrel;

Fig. 7 is a bottom plan view of the cutter-boxes and the adjacent parts attached thereto;

Fig. 8 is a detail section taken on the line 2—2 of Fig. 4;

Fig. 9 is a front elevation of one of the back-form-plates;

Fig. 10 is an edge view of the back-form-plate shown in Fig. 9;

Fig. 11 is a side elevation of one of the hook-form-plates;

Fig. 12 is a front elevation of the hook-form-plate shown in Fig. 11;

Fig. 13 is a top plan view of one of the stationary bending-dies used in one form of my invention;

Figs. 14 and 15 show a side and front elevation respectively of the bending-die shown in Fig. 13;

Figs. 16, 17, and 18 are detail views illustrating the manner of bending different forms of hooks;

Fig. 19 is a detail vertical section through the wire feeding mechanism taken on the line 19—19 of Fig. 3;

Fig. 20 is a detail section of the link connection between the adjusting-arm and the crank-arm taken on the line 20—20 of Fig. 3;

Fig. 21 is a front elevation of the rear portion of the guiding-arm and parts attached thereto;

Fig. 22 is a rear end elevation of guiding-arm and parts attached thereto as shown in Fig. 21;

Figs. 23 and 24 are detail side elevations and top plans respectively of the cam-ring;

Figs. 25, 26, and 27 are details illustrating how the hooks are clenched on the spool ends;

Fig. 28 is a transverse section of the rod or wire from which the tie-rods are made after it has passed between the pair of tension rolls.

Fig. 29 is a top plan view of a modified form of the machine;

Fig. 30 is a detail longitudinal sectional view of the modified form of the machine taken on the line 30—30 of Fig. 32;

Fig. 31 is a vertical section view taken on the line 31—31 of Fig. 29 with the mandrel and spindle shown in elevation;

Fig. 32 is a transverse section through the flier-head taken on the line 32—32 of Fig. 30;

Fig. 33 is a detail illustrating the movement of one of the pivoted side bending-dies;

Fig. 34 is a detail side elevation of one of the hook bending-dies used in the modified form of the machine, and

Fig. 35 is a top plan view of the hook bending-die shown in Fig. 34.

Referring now to the characters of reference on the various drawings which form part of this specification, and first to Figs. 1 to 28 inclusive, the numeral 1 indicates the base plate of the machine to which is welded or otherwise secured the lower end of a tubular pedestal 2, the two being further braced and connected together by means of reinforcing plates 3. The pedestal is formed

with a trough shaped opening 4 at one side at an intermediate point to which is welded a trough shaped plate 5, having an opening therein as at 6. A casting 7 is attached to the face of the trough shaped plate 5, having a pair of brackets 8 extending inwardly therefrom through the opening 6, each provided with a socket 9 for receiving roller bearings 10 for supporting the lower end of a spindle 11. A face plate 12 is secured to the outer face of the casting 7, having a journal bearing 13 secured therein for supporting a drive-shaft 14 which is provided with a pulley 15 on its outer end adapted to be driven in any approved manner as by a motor, said drive-shaft having a beveled pinion 16 on its inner end meshing with a beveled gear 17 mounted on the spindle 11 between the brackets 8.

A table 18 is mounted on the top end of the pedestal 2 and secured thereto having a tubular central portion 19 adapted to form a housing for a pair of Timken bearings 20 in which the top end of the spindle 11 is journaled and held in position by the head 21 of the spindle engaging one of the Timken bearings and adjusting nuts 22 engaging the opposite bearing.

Mounted on the top of the table 18 at an intermediate point between its outer edge and the upwardly extending portion of the central tubular housing 19 is a cam-ring 23 having a cam surface extending from the high surface at 24 to low surface at 25 or substantially half the circumference of the cam-ring as indicated in Figs. 4, 23, and 24. A thrust-ring 26 provided with rollers 27 rotating on axles 28 in elongated openings 29 is tiltably mounted on the cam-ring 23 and held against lateral displacement by the annular shoulder 30 on the tubular housing 19 engaging the inner surface of the thrust-ring. A contact plate 31 provided with beveled edges is attached to the thrust-ring over each roller 27, each having a notch or recess formed therein adapted to register with notches formed in the thrust-ring as indicated at 32 for receiving the lower end of a mandrel 33 which is attached to or formed integral with the head 21 of the spindle 11. In this manner the thrust-ring is keyed to the mandrel but is allowed a vertical tilting movement as it passes over the cam-ring when the spindle and mandrel are rotated.

The mandrel 33 is of rectangular or oblong outline in cross-section having hook-form-plates 34 arranged in pairs on its opposite side edges between each pair of which are formed in the mandrel 33, arc-shaped recesses 35 for receiving rotary cutters 36 mounted on pins 37 having their ends supported and keyed to the hook-form-plates 34. In vertical alignment with the hook-form-plates 34 are receiving bars or ways 38 of slightly less width and thickness than that of the hook-form-plates. This allows the formed tie-bars to more easily advance or be removed from the machine.

Extending outwardly from each side of mandrel 33 at an intermediate point near the upper ends of each pair of hook-form-plates 34 is a flange 39 for supporting cutter-boxes 40 which are bolted thereto as at 41. A rotary cutter 42 on shaft 43 is mounted in each cutter-box adapted to coact with the cutters attached to the mandrel. The cutter-boxes are further connected together by means of the shafts 44 having nuts on their outer ends as at 45. Bending rollers 46 are mounted on the shafts 44 and are adapted to assist in forming offset bends on the back of the hooked ends of the tie-bars. The cutter-boxes also carry the back-form-plates 47 for engaging the back of the hooks and a bending die 48, the latter being mounted over each pair of rotary cutters which progressively bends the end of the hook inwardly to the desired angle as the tie-bar members are advanced on the mandrel.

Attached to the side of the pedestal 2 near its top end by means of bolts 49 is a post 50, flanged as at 51 and having an upwardly extending reduced portion 52 upon which is mounted a sleeve 53 flanged at its lower end as at 54 and threaded on its upper end as at 55 to receive an adjusting-nut 56. Two collars 57 are mounted on the sleeve 53, the lower one engaging the flange is made to fit tight on the sleeve, while the upper one is slidably mounted and held against the base of the adjusting-nut 56 by an interposed spring 58 on the sleeve. The collars 57 each have boss extensions 59 having cylindrical perforations 60 formed therein for supporting one end of each of the axles 61 for tension rolls 62. These axles each have squared heads perforated vertically as at 63 for receiving a bolt 64 which is screw-threaded on its lower end to receive a nut 65 for engaging the bottom side of the squared head of the lower axle, and for vertical adjustment. The bolt 64 is screw-threaded on its upper end to receive an adjusting-nut 66. A bearing-block 67, having a guiding-arm 68 attached thereto is mounted on the top side of the squared head by the lower axle, the two being slotted for the passage of the bolt 64 to allow the guiding-arm to be laterally adjusted. The bolt 64 also has at an intermediate point an annular flange 69, the lower surface of which engages and is held in clamped relation with the top surface of the guiding-arm 68. A spring 70 is mounted on the bolt 64, interposed between the flange 69 and a socket 71 formed in the lower face of the squared head of the upper axle for the top roll to hold the squared head of said axle at all times against the lower face of the adjusting-nut 66.

The nut 56 which is threaded on the upper end of the sleeve 53 has a bottom flange 72 and a cylindrical outer face 73 for receiving the clamping-jaws 74 of a crank-arm 75 which is provided with a handle 76 for operating the same. The clamping-jaws being tightened or loosened on the cylindrical outer face of the nut 56 by means of a bolt 77 and nut 78. The nut 66 threaded on the top end of the bolt 64 has a flange 79 at its lower end and a cylindrical side face 80 adapted to be clamped in the eye 81 of an adjusting-arm 82, split as at 83 and having a clamping bolt 84 extending transversely of the arm through the split, and a nut 85 for increasing or decreasing frictional engagement between the eye 81 and the cylindrical side face 80 of the nut 66. It will be understood that the thread 55 on the top end of the sleeve 53 and the thread on the upper end of the bolt 64 are of the same size and pitch, and it is desirable in adjusting the width between the tension-roll 62 to adjust the nuts 56 and 66 simultaneously. This is accomplished by connecting links 86, the pivotal point of the links on the crank-arm 75 being the same distance from the center of the reduced portion 52 of the post as the pivotal point on the adjusting-arm 82 is to the center of the bolt 64. In this manner when the crank-arm is rotated in either direction the adjusting nuts 56 and 66 will be simultaneously rotated thereby increasing or decreasing the space between the tension-rolls, as may be required by the operator.

A guide-holder 87 is attached to the rear face

of the guiding-arm 68 having a cylindrical opening therein for receiving a guide 88 for the rod or wire 89 received from any suitable source of supply. This rod or wire 89 after passing through the guide and between a pair of tension-rolls 62 is received in the V-shaped grooved edge face 90 of a guiding-arm 68. As it is desirable to flatten the rod or wire slightly as indicated at 91 in Fig. 28 the guiding-arm 68 is reduced in thickness between the pair of tension-rolls as indicated at 92. This flattening of the sides of the wire causes the wire to be pulled taut between the tension-rolls and the mandrel and also prevents the turns of wire and formed tie-bar from overlapping or climbing over each other on the mandrel.

It will be noted by referring to Figs. 3 and 4 of the drawings, that the rolling and guiding mechanism for the rod or wire are pivoted and adapted to rotate around the reduced portion 52 of the post 50 so that the guiding-arm 68 will always be held against the outer surface of the wire at the point where it is being wound on the mandrel, in this manner the wire is held in the V-shaped groove face 90 of the guiding-arm 68 thereby guiding it directly to the side of the mandrel. As the mandrel rotates in a counter clockwise direction the wire will also be pulled between the tension-rolls by the rotation of the mandrel and straightened.

In Figs. 16, 17, and 18 I have shown three different types of hooked ends for tie-rods, these shapes may be altered if desired by changing the hook-form-plates 34 and bending-dies 48. In Figs. 25, 26, and 27 I have illustrated how the hooked ends of the tie-rods are first applied to a reel end 93 or the like in full lines, and indicating in dotted lines how the ends of the tie-rods appear after they have been clenched on the reel ends.

The operation of my invention is as follows: Assuming that the parts of the machine are in the position shown in Figs. 2 and 4 and power having been applied to the machine and the spindle 11 and mandrel 33 rotating in a counter clockwise direction and wire being advanced to the machine from a suitable source of supply by the rotation of the mandrel and coiled thereon. The wire to the mandrel passes through the guide 88 and between the tension-rolls 62 where the opposite sides of the wire are slightly flattened. This rolling action on the wire as it is pulled between the rolls by the rotation of the mandrel causes a tension on the wire between the rolls and the mandrel when it is received in the V-shaped groove 90 of the guiding-arm 68 where it is conducted directly to the upper left hand corner of the mandrel 33, the side of the thrust-ring 26 at this point being in its lowered position, while the opposite side of the thrust-ring is raised by means of the cam-ring 23 to its highest position, as the mandrel and thrust-ring continue to rotate until the mandrel and guiding-arm are in the position indicated in full lines in Fig. 3. At this point the roller 27 of the thrust-ring on the right hand side of the figure will have passed over the high portion of the cam onto the horizontal flat face and be in its lower position, while the roller on the opposite side of the thrust-ring will start to rise by engaging the long inclined portion of the cam. As the mandrel continues to rotate the guiding-arm will swing from the extreme inner position shown in full lines in Fig. 3 to the extreme outer position indicated in dotted lines in this figure. After the mandrel 33 and thrust-ring 26 have been rotated half a revolution the left hand side of the thrust-ring shown in Fig. 2 will be by means of its rollers engaging the cam-ring rotated to the position shown on the opposite side of the thrust-ring and in so doing the contact plate 31 on that top side of the thrust-ring will engage the under side of the wire just wrapped on the mandrel and advance the wrapped wire at this point a distance corresponding to the thickness of the wire. This operation is then repeated. After a plurality of coils of wire as indicated at A have been wrapped around the oblong mandrel 33 and advanced thereon by means of the thrust-ring a width of a coil for each rotation of the mandrel, they are passed between the bending-rolls 46 and the outer side faces of each of the hook-form-plates which offsets the coils at these points, as at B, by pressing the opposite long side portions of the coils inwardly. The coils are then advanced between the rotary-cutters and severed on the opposite short sides of the mandrel between each pair of hook-form-plates. As the severed tie-bar members continue to advance on the mandrel the cut end portions are progressively bent inwardly until the desired angle C is secured by engaging the bending dies 48, as indicated in Fig. 8. The formed tie-bars D are then advanced in two stacks on the receiving-bars or ways 38 on opposite sides of the mandrel, where a plurality of them may be removed from time to time manually or they may be automatically discharged from the end of the receiving-bars into a hopper or chute.

Referring now to the modification illustrated in Figs. 29 to 35 inclusive, the spindle, table, rolling mechanism, cam-ring and thrust-ring are similar in construction to those described above for Figures 1 to 28 and the same reference numerals and description will apply thereto.

The mandrel 94 which extends upwardly from the head 21 of the spindle 11 have the hook-form-plates 95 and rotary-cutters 96 also arranged in substantially the same manner as those in the former structure. In this construction however the shearing of the coils and the bending means for forming the hooked ends of the tie-bars are accomplished in a somewhat different manner.

Attached to the flat upper face of the mandrel 94 by means of bolts 97 is a flier-head 98 having slots with enlargements at their ends as at 99 for the passage of the wrapped wire on the mandrel and the formed tie-bars and receiving-bars or plates 100. The ends of the flier-head are bifurcated and connected together at each side by means of bolts and separators 101. A slide-way 102 is formed in each of the bifurcated ends of the flier-head 98, each adapted to receive a carriage 103. As these carriages and parts carried thereby are of the same construction a description of one will apply to both. A roller 104 is mounted on an axle 105 which is journaled in the carriage, the said axle being transversely perforated near each end as at 106 and adapted to receive the reduced ends of screws 107 and 108. The screw 107 being perforated longitudinally as at 109 to receive the reduced end of a plunger 110, slidably mounted in a perforation 111 formed in the carriage in alignment with the screw 107. The plunger 110 is projected inwardly by means of a spring 112 until its inner end engages the side of the mandrel 94. This plunger normally projects the carriage outwardly until the ears 113 engage the separators. The ears 113 are arranged in pairs on each side of the carriage, each pair having a side-bending-die 114 pivoted there-

to by means of a pin 115. The space between each pair of ears being greater than the thickness of the side bending-dies to allow the dies to adjust themselves when engaging and bending the wire. As shown in the drawings these side bending-dies are made with double grooves 116 for engaging and bending the back of the hooked ends of the tie-bars so they can be reversed and used on either side of the carriage. Each side bending-die is provided with a projecting toe 117 which extends into the recesses 118 formed in the opposite sides of a bending-die 119, said bending-die being mounted in a slide-way 120 and adapted for slight vertical movement to adjust itself in engaging the wrapped wire with the side bending-dies. The bending-die 119 is also notched as at 121 for the passage of the plunger 110.

A shear-blade 122 is mounted in a socket 123 formed in the carrier and held in position by means of a set-screw 124. The socket 123 being in alignment and communicating with the opening in the lower portion of the axle 105. When it is desired to adjust or remove this shear-blade 122 the screw 108 can be removed and a tool inserted through the openings for the purpose of aiding in the adjustment or removal of the same.

In the modification shown in Figs. 29 to 35 inclusive, the feeding, winding, and advancing the wire on the mandrel is accomplished in the same manner as heretofore described. As the flier-head rotates the centrifugal force will hold the side bending-dies 114 open in the position shown in full lines in Fig. 30. When one of the rollers 104 comes in contact with the cam-block 125 it forces the carriage 103 with the shear-blade 122, bending-die 119 and side bending-dies 114 inwardly until they assume the position indicated in dotted lines in Fig. 30, thereby shearing one of the coils on that side of the mandrel and forming hooked ends on two of the tie-bars. After the roller 104 passes over the cam-block 125 the spring plunger 110 returns the carriage to its original position with the ears 113 engaging the separators 101. This operation is repeated every time a roller 104 comes in contact with the cam-block 125.

Although I have described and illustrated my invention in considerable detail, I do not wish to be limited to the exact and specific details thereof, as shown and described but may use such modifications in, substitutions for, or equivalents thereof, as are embraced within the scope of my invention, or as pointed out in the claims.

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

1. In a machine of the character described, a continuously rotating mandrel, means for guiding and coiling a wire on the mandrel, means for engaging opposite sides of the coils whereby they are advanced on the mandrel, and means for cutting the advancing coils of wire on both sides of the mandrel.

2. In a machine of the character described, a mandrel, pivoted means for guiding a wire under tension to the mandrel, means for rotating the mandrel to form coils of wire thereon, a thrust-ring for engaging opposite sides of the coils whereby they are advanced on the mandrel, means for cutting each coil of wire on opposite sides of the mandrel, and bending-dies for forming hooks on the cut end portions of the coils.

3. In a machine of the character described, a mandrel, means for rotating the mandrel, pivoted means for continuously advancing a wire to the mandrel to form coils thereon, cutting means at opposite sides of the mandrel adapted to travel therewith, and means for advancing and cutting each coil of wire on opposite sides of the mandrel.

4. In a machine of the character described, a mandrel rectangular in cross-section adapted to form coils of wire thereon, cutting means at opposite sides of the mandrel adapted to travel therewith, means for advancing and cutting each coil of wire on opposite sides of the mandrel, and means for bending the cut end portions of each coil to form hooks.

5. In a machine of the character described, a rotating mandrel for forming coils of wire thereon, cutters mounted at each side of the mandrel adapted to travel therewith for cutting each coil of wire on opposite sides thereof, means for bending the cut end portion of each coil to form hooks, and means for advancing the coils of wire on the mandrel between the cutting and bending mechanism.

6. In a machine of the character described, a mandrel oblong in cross-section, means for rotating the mandrel to draw a wire from a source of supply through pressure and guiding means and coil the wire about the mandrel, cutters mounted at the opposite short sides of the mandrel and adapted to travel therewith for cutting each of the coils of wire at opposite sides of the mandrel, means for bending the cut end portions of each coil to form hooks, and means for engaging each coil to advance it on the mandrel.

7. In a machine of the character described, a mandrel rectangular in cross-section, means for rotating the mandrel to draw a wire from a source of supply through guiding mechanism and form a plurality of coils on the mandrel, means for advancing the coils on the mandrel, means for cutting the opposite sides of each coil as it is advanced on the mandrel, and means for bending into hook form the cut end portions of each coil.

8. In a machine of the character described, a mandrel, means for rotating the mandrel to draw a wire from a source of supply between pressure-rolls and guiding mechanism and form a plurality of coils about the mandrel, a tilting thrust-ring adapted to engage each coil as it is formed and progressively advancing the plurality of coils on the mandrel, means for cutting diametrical opposite sides of each coil as it is advanced on the mandrel, and dies traveling with the mandrel for bending inwardly the cut end portions of each coil.

9. In a machine of the character described, a mandrel oblong in cross-section, means for rotating the mandrel to form coils of wire thereon, pivoted swinging means coacting with the mandrel for guiding the wire thereto, means for advancing the coils on the mandrel, and means for cutting the advancing coils on opposite sides of the mandrel.

10. In a machine of the character described, a mandrel oblong in cross-section, means for rotating the mandrel to form coils of wire thereon, pivoted swinging means actuated by the wire being coiled on the mandrel for rolling and guiding the wire, means for advancing the coils on the mandrel, and means for cutting the coils on opposite sides of the mandrel.

11. In a machine of the character described, a mandrel, means for rotating the mandrel to form coils of wire thereon, swinging means actuated by the wire being coiled on the mandrel for rolling and guiding the wire, a thrust-ring for

advancing the coils of wire on the mandrel, means for cutting the coils on opposite sides of the mandrel, and hook forming dies for bending the cut ends of each coil portion.

12. In a machine of the character described, comprising a mandrel rectangular in cross-section, means for rotating the mandrel to form coils of wire thereon, pivoted means actuated by the wire being coiled on the mandrel for rolling and guiding the wire, a thrust-ring rotatable with the mandrel, means for tilting the thrust-ring to engage the opposite sides of each coil on the mandrel to advance the coils thereon, means for cutting each coil on opposite sides of the mandrel, and hook forming dies for bending inwardly the cut ends of each coil portion.

13. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, swinging means pivotally mounted and actuated by the wire being coiled on the mandrel for rolling and guiding the wire, a thrust-ring keyed to the mandrel and rotatable therewith, a cam-ring for tilting the opposite sides of the thrust-ring into engagement with the opposite side of each coil whereby they are advanced on the mandrel, cutters traveling with mandrel for severing each coil on opposite sides of the mandrel, and hook forming dies mounted adjacent to the cutters for bending the cut ends of each coil portion.

14. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for rolling and guiding the wire as it is advanced to the mandrel, a thrust-ring keyed to the mandrel and rotatable therewith, rollers journaled in the thrust-ring, a cam-ring mounted on the machine, for engaging the rollers and adapted to tilt the thrust-ring into engagement with the opposite sides of each coil whereby they are advanced on the mandrel, cutters traveling with the mandrel for severing each coil on opposite sides of the mandrel, hook forming dies mounted adjacent to the cutters for bending the cut ends of each coil portion, and receiving-bars for holding the formed coil portions.

15. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for rolling and guiding the wire actuated by the rotation of the mandrel, cutters journaled in opposite sides of the mandrel each coacting with a cutter mounted adjacent thereto, means mounted on opposite sides of the mandrel for offsetting portions of each coil, means for advancing the coils on the mandrel between each pair of coacting cutters to sever each coil on opposite sides of the mandrel, hook forming dies mounted adjacent to the cutters for bending the cut ends of each coil portion, and receiving-bars for holding the formed coil portions.

16. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, a rolling and guiding device pivotally mounted on the frame of the machine between the source of supply and the mandrel and cooperating therewith, means for advancing and cutting the coils on the mandrel, and bending-dies adapted to form hooks on the cut ends of the coils.

17. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, coacting rolling and guiding devices pivotally mounted on the frame of the machine between the source of supply and the mandrel and cooperating therewith, means for adjusting the rolling and guiding devices, means for advancing and cutting the coils on opposite sides of the mandrel, and bending-dies adapted to form hooks on the cut end portions of the coils.

18. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for rolling the wire pivotally mounted on the frame of the machine between the source of supply and the mandrel, means for increasing or decreasing the rolling action on the wire, means coacting with the rolling means for guiding the wire to the mandrel, means for advancing and cutting the coils on opposite sides of the mandrel, and bending-dies on opposite sides of the mandrel adapted to form hooks on each of the cut end portions of the coils.

19. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rolls rotatably and pivotally mounted between the source of supply and the mandrel for receiving and rolling the wire, means for adjusting the space between the rolls for increasing or decreasing the rolling action on the wire, means on opposite sides of the rolls coacting therewith for guiding the wire to the mandrel, means for advancing and cutting the coils on opposite sides of the mandrel, and bending-dies on opposite sides of the mandrel and rotatable therewith adapted to form hooks on each end of the cut end portions of the coils.

20. In a machine of the character described, a mandrel adapted to form coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rolls rotatably and pivotally mounted between the source of supply and the mandrel adapted to roll the wire, means for adjusting the space between the rolls for increasing or decreasing the rolling action on the wire, a guiding-arm extending between the rolls and the side of the mandrel, a groove formed in the edge of the guiding-arm adapted to receive the wire from the rolls and guide it directly to the side of the mandrel, means for advancing and cutting the coils on opposite sides of the mandrel, and bending-dies on opposite sides of the mandrel rotatable therewith adapted to form hooks on each of the cut end portions of the coils.

21. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, rolls rotatably and pivotally mounted on the machine, means for rotating the mandrel to draw a wire from a source of supply between the rolls, means for adjusting the space between the rolls for increasing or decreasing the rolling action on the wire, an adjustable guiding-arm extending between the rolls and the side of the mandrel, a groove formed in the edge of the guiding-arm adapted to receive the wire from the rolls and guide it directly to the side of the mandrel, means for advancing and cutting the coils on diametrically opposite sides of the mandrel and bending-dies on opposite sides of the mandrel rotatable therewith adapted to form hooks on each end of the cut end portions of the coils.

22. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rolls rotatably and pivotally mounted on the machine adapted to hold the wire taut between said rolls and the mandrel, means for adjusting the space between the rolls for increasing or decreasing the rolling action on the wire, an adjustable guiding-arm coacting with the rolls adapted to extend between the rolls and the side of the mandrel, means for advancing and cutting the coils on opposite sides of the mandrel, and bending-dies on opposite sides of the mandrel coacting therewith adapted to form hooks on each of the cut end portions of the coils.

23. In a machine of the character described, a mandrel adapted to form rectangular coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, a thrust-ring mounted to rotate with the mandrel, means for tilting the opposite sides of the thrust-ring into engagement with the coils and advance the said coils on the mandrel, means for cutting the coils on opposite sides of the mandrel, and means for forming hooks on the cut end portions of the coils as they are advanced on the mandrel.

24. In a machine of the character described, a mandrel rectangular in cross-section adapted to form coils of wire thereon, hook-form-plates secured to each corner of the mandrel, a cutter on opposite sides of the mandrel between the hook-form-plates, a coacting cutter mounted adjacent to each cutter in the mandrel, a thrust-ring rotatable with the mandrel, means for tilting opposite sides of the thrust-ring to advance the coils on the mandrel between the cutters, and a bending-die mounted above each pair of cutters adapted to form a hook on each cut end portion of the coils as they are advanced on the mandrel.

25. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for offsetting the long sides of the coils, means for cutting the short sides of the coils, means for forming hooks on the cut end portions of the coils, and means for advancing the coils and hooked formed members simultaneously on the mandrel.

26. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, bending-rolls for offsetting the opposite long sides of the coils on the mandrel coacting cutters on each short side of the mandrel for shearing the coils, bending-dies above the cutters adapted to form hooks on the cut end portions of the coils, and a tilting thrust-ring adapted to intermittently engage opposite sides of the coil and advance the coils on the mandrel between the cutters and bending-dies.

27. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, a pair of hook-form-plates on each side of the mandrel, a cutter mounted between each pair of hook-form-plates, a coacting cutter mounted adjacent to each cutter mounted between the hook-form-plates, a bending-die mounted above each pair of cutters, rollers at the sides of the mandrel for offsetting the sides of the coils, a thrust-ring adapted to rotate with the mandrel and engage the coils on opposite sides of the mandrel, and a cam-ring for actuating the thrust-ring to advance the coils on the mandrel.

28. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, a pair of hook-form-plates on each side of the mandrel, a cutter mounted between each pair of hook-form-plates, a cutter-box mounted opposite each pair of hook-form-plates and supported by the mandrel, a cutter in each cutter-box coacting with the cutters mounted between the hook-form-plates, a bending-die secured to each cutter-box above each pair of cutters, tie-shafts at the sides of the mandrel connecting the cutter-boxes together, rollers on the tie-shafts for offsetting the sides of the coils, a thrust-ring adapted to rotate with the mandrel and engage the coils on opposite sides of the mandrel, and a cam-ring for actuating the thrust-ring to advance the coils on the mandrel the width of a coil for each rotation of the mandrel.

29. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for advancing the coils on the mandrel the width of a coil for each rotation of the mandrel, means for cutting the coils of wire on opposite sides of the mandrel, and means for forming hooks on the cut ends of the coil portions.

30. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for rolling and guiding the wire to the mandrel, a tilting thrust-ring for advancing the coils on the mandrel the width of a coil for each rotation of the mandrel, means for cutting the coils of wire on opposite sides of the mandrel, and means for forming hooks on the cut ends of the coil portions.

31. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for guiding the wire to the mandrel, a tilting thrust-ring adapted to engage opposite sides of the coils for advancing the coils on the mandrel the width of a coil for each rotation of the mandrel, a cutter mounted in opposite sides of the mandrel, a flier-head mounted on the mandrel, a slide-way formed in the ends of the flier-head, a carriage mounted in each slide-way, a shear-blade carried by each carriage coacting with the cutters mounted in the mandrel, bending-dies mounted on each carriage, and means for reciprocating the carriages.

32. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for guiding the wire to the mandrel, means for rolling and guiding the wire as it is advanced to the mandrel, a thrust-ring rotatable with the mandrel adapted to tilt and engage opposite sides of the coils for advancing the coils thereon the width of a coil for each rotation of the mandrel, a cutter mounted in opposite sides of the mandrel, a flier-head mounted on the mandrel, a slide-way formed in the ends of the flier-head, a carriage mounted in each slide-way, a shear-blade carried by each carriage coacting with the cutters mounted in the mandrel, side bending-dies pivoted to each side of the carriage, a vertical slide-way formed in each carriage between the pivoted side bending-dies, a bending-die mounted in each slide-way

of the carriages coacting with the pivoted side bending-dies and means for reciprocating the carriages.

33. In a machine for forming tie-bars provided with hooked ends, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rollers for holding the wire under tension while being wrapped on the mandrel, an arm for guiding the wire from the rollers directly to the side of the mandrel, a thrust-ring rotatably with the mandrel, a cam-ring for tilting the opposite sides of the thrust-ring into engagement with the coils and advance them a width of a coil for each rotation of the mandrel, means for cutting each coil on opposite sides of the mandrel, and bending-dies rotatable with the mandrel adapted to form a hook on each cut end portion of the coil.

34. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for guiding the wire under tension to the mandrel, a tilting thrust-ring adapted to engage opposite sides of the coils and advance them a width of a coil for each rotation of the mandrel, a cutter mounted in opposite sides of the mandrel, a flier-head mounted on the mandrel, a slide-way formed in each end of the flier-head, a carriage mounted in each slide-way, a shear-blade carried by each carriage coacting with the cutters mounted in the mandrel, adapted to shear each coil on opposite sides of the mandrel, pivoted bending-dies on opposite sides of each carriage for offsetting the sides of the coils, a vertical slide-way formed in each carriage between the side bending-dies, a bending-die mounted in each slide-way of the carriages coacting with and vertically movable with the pivoted side bending-dies, and means for reciprocating the carriage.

35. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for guiding the wire under tension to the mandrel, a tilting thrust-ring adapted to engage opposite sides of the coils and advance them the width of a coil for each rotation of the mandrel, a cutter mounted in opposite sides of the mandrel, a flier-head mounted on the mandrel, a slide-way formed in each end of the flier-head, a carriage mounted in each slide-way, a shear-blade carried by each carriage coacting with the cutters mounted in the mandrel adapted to shear each coil on opposite sides of the mandrel as it is advancing thereon, bending-dies pivoted to opposite sides of each carriage for offsetting the sides of the coils, a vertical slide-way formed in each carriage between the side bending-dies, a bending-die mounted in each slide-way of the carriages coacting with and vertically movable with the pivoted side bending-dies, a roller journaled in each carriage, a cam-block for engaging the roller to advance the carriages and bending-dies carried thereby, and spring pressed plungers for retracting the carriages.

36. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for rolling and guiding the wire under tension to the mandrel, means for advancing the wrapped wire thereon a width of a coil for each rotation of the mandrel, means for cutting the coils of wire on opposite sides of the mandrel, and means for bending inwardly the cut end portions of the coils to form hooks.

37. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, means for rolling and guiding the wire under tension to the mandrel, a thrust-ring mounted to rotate with the mandrel, means for tilting the thrust-ring into engagement with opposite sides of the coil for advancing the wrapped wire thereon a width of a coil for each rotation of the mandrel, means for cutting each coil on opposite sides as they are advanced on the mandrel, and dies for bending inwardly the cut end portions of the coils to form hooks.

38. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rollers for flattening the opposite sides of the wire, an arm for guiding the wire under tension to the mandrel, a rotary-cutter mounted in opposite sides of the mandrel, rotary-cutters mounted opposite and coacting with the cutters mounted in the mandrel, bending-dies mounted above each pair of rotary-cutters, and a tilting thrust-ring keyed to the mandrel adapted to advance the wrapped wire between the cutters and bending-dies.

39. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rollers rotatably and pivotally mounted on the machine adapted to flatten the opposite sides of the wire, an arm coacting with the rollers having a groove formed therein adapted to receive the wire under tension from the rollers and guide it directly to the side of the mandrel, a rotary-cutter mounted in opposite sides of the mandrel, rotary-cutters mounted opposite and coacting with the cutters mounted in the mandrel, bending-dies mounted above each pair of rotary-cutters, a tilting thrust-ring keyed to the mandrel adapted to advance the wrapped wire thereon the width of a coil between the cutters and the bending-dies on each rotation of the mandrel.

40. In a machine of the character described, a mandrel adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, rollers rotatably and pivotally mounted on the machine adapted to flatten the opposite sides of the wire, means for adjusting the space between the roller to increase or decrease the rolling action on the wire, a swinging arm coacting with the rollers having a grooved edge face adapted to receive the wire under tension from the roller and guide it directly to the sides of the mandrel, a rotary-cutter mounted in opposite sides of the mandrel, rotary-cutters mounted opposite and coacting with the cutters mounted in the mandrel, bending-dies mounted above each pair of rotary-cutters, a thrust-ring keyed to the mandrel and rotatable therewith, a cam-ring for supporting the thrust-ring adapted to tilt the thrust-ring into engagement with opposite sides of of the coils to advance the wrapped wire on the mandrel the width of a coil between the cutters and the bending-dies on each rotation of the mandrel.

41. In a machine of the character described for forming tie-rods for reels or the like, a mandrel oblong in cross-section adapted to form oblong coils of wire thereon, means for cutting the coils

on opposite sides of the mandrel, means for forming hooks on the cut end portions of the coils to form tie-rods, a thrust-ring mounted to rotate with the mandrel, means for tilting the opposite sides of the thrust-ring into engagement with the coils and tie-rods whereby they are advanced simultaneously on the mandrel, and means for receiving the advancing tie-rods in stacks on opposite sides of the mandrel.

42. In a machine of the character described for forming tie-rods for reels or the like, a mandrel oblong in cross-section adapted to form oblong coils of wire thereon, means for rotating the mandrel to draw a wire from a source of supply, hook-form-plates at each corner of the mandrel, means for cutting the coils between a pair of the hook-form-plates at opposite sides of the mandrel, a bending-die coacting with each pair of the hook-form-plates adapted to form hooks on the cut end portions of each coil to form tie-rods, receiving bars in alignment with the hook-form-plates, and means for advancing the coils and the tie-rods simultaneously on the mandrel whereby the tie-rods are advanced on the receiving bars in stacks on the opposite sides of the mandrel.

HARRY R. GEER.