

R. J. DARNELL.
MACHINE FOR MAKING WIRE BALE TIE LOOPS.
APPLICATION FILED APR. 8, 1912.

1,048,049.

Patented Dec. 24, 1912.

3 SHEETS—SHEET 1.

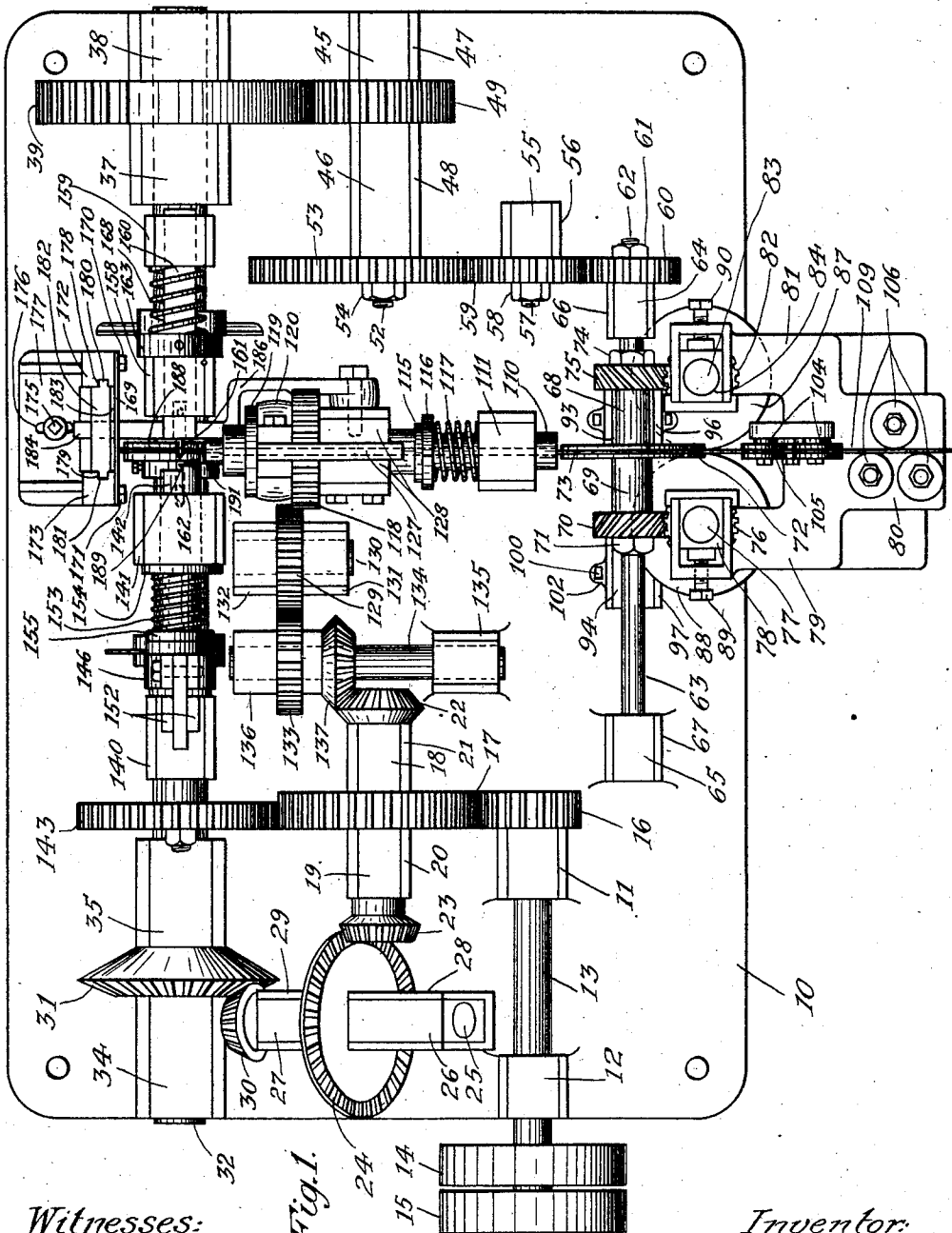


Fig. 1.

Witnesses:
Theo. Leggard.
Alfred Hagen

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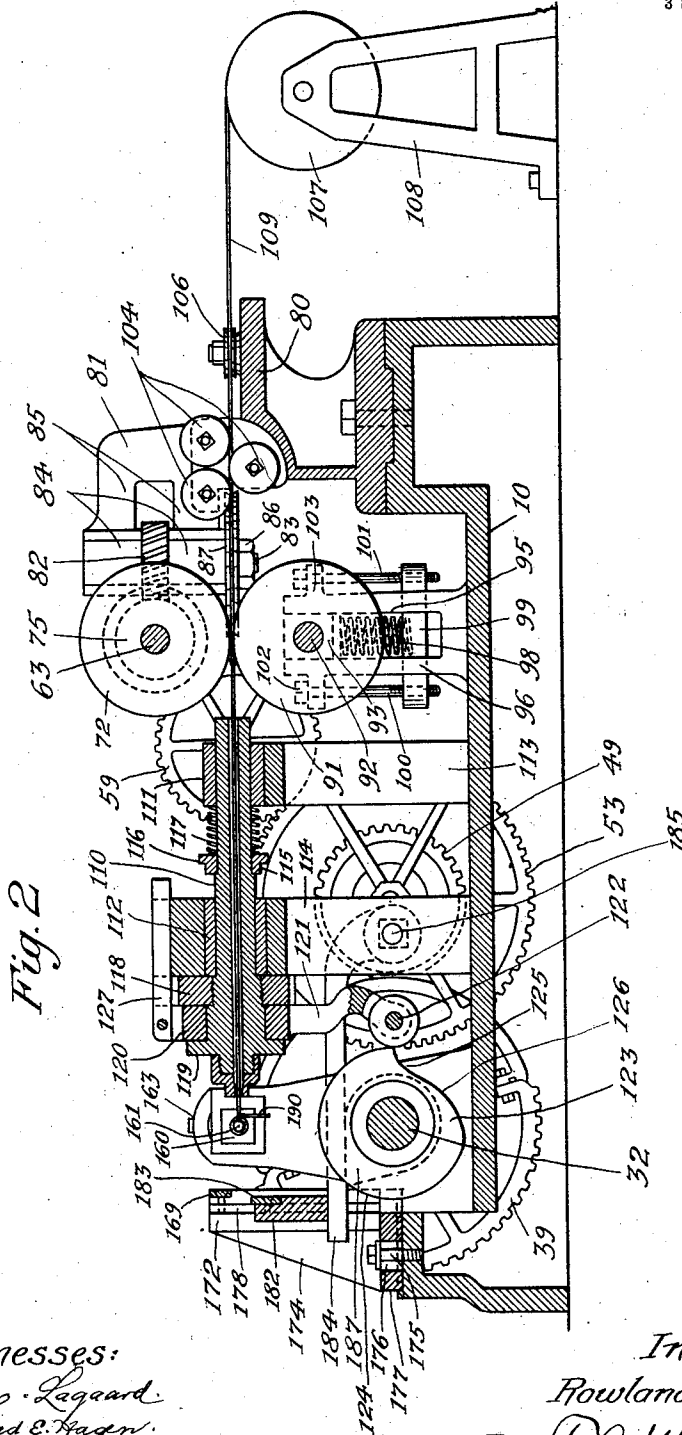


Fig. 2

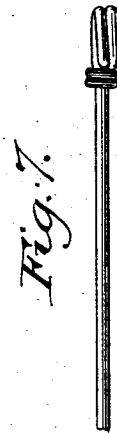


Fig. 7

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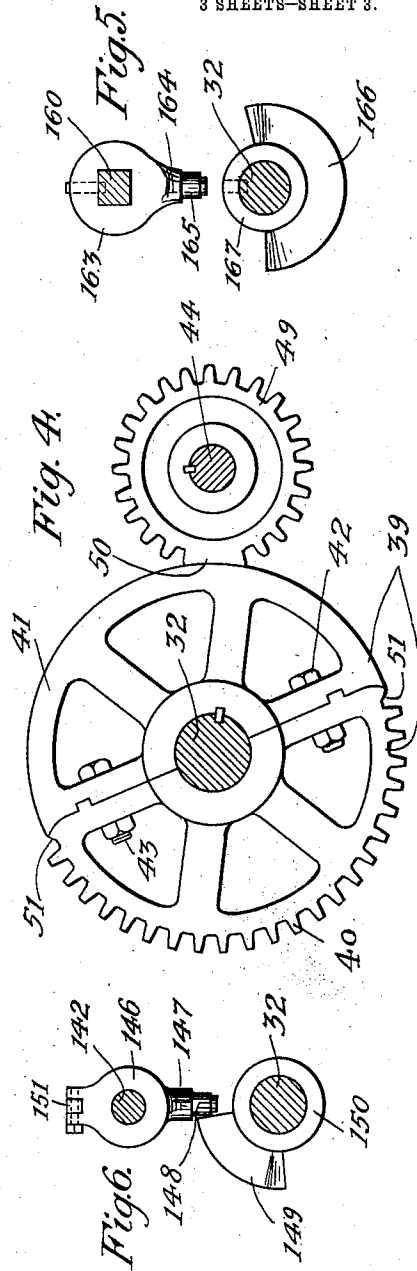
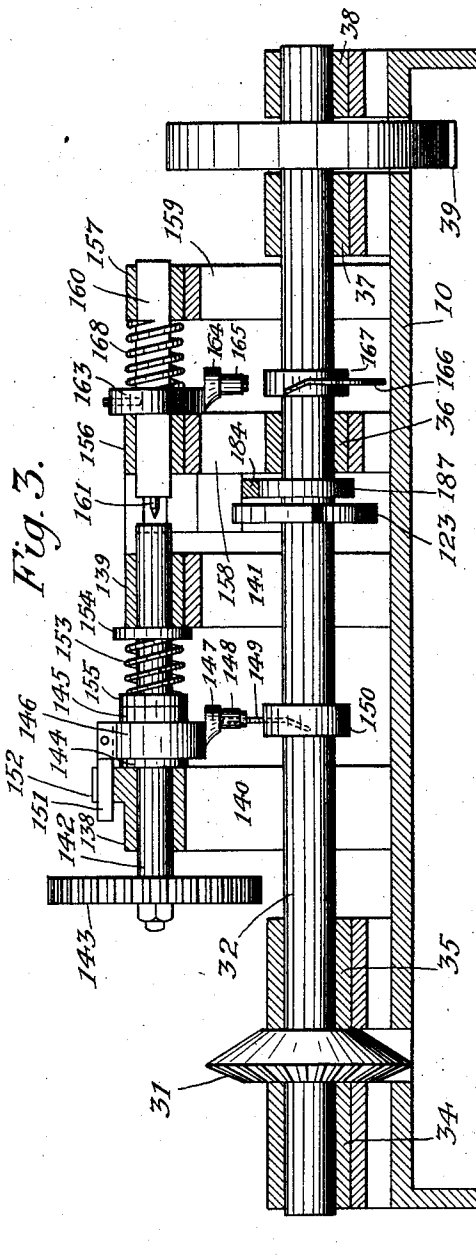
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3 SHEETS-SHEET 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

ROWLAND J. DARNELL, OF MEMPHIS, TENNESSEE.

MACHINE FOR MAKING WIRE-BALE-TIE LOOPS.

1,048,049.

Specification of Letters Patent.

Patented Dec. 24, 1912.

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To all whom it may concern:

Be it known that I, ROWLAND J. DARNELL, a citizen of the United States, residing at Memphis, in the county of Shelby and State of Tennessee, have invented certain new and useful Improvements in Machines for Making Wire-Bale-Tie Loops, of which the following is a specification.

My invention relates to a machine for making wire bale-tie loops, more especially to such a machine in which the wire shall be fed in automatically the required length, cut, a loop formed on the end of the wire from which the piece has been cut, then the wire further fed into the machine the required distance and again cut, repeating the operations in successive cycles of the machine's action.

It is an especial object of my invention to provide a looping device which shall form on the end of the wire a double coil loop, said loop being finished by wrapping the end of the wire cleanly several times about the wire shank, in combination with means for actuating the looping mechanism and thereafter actuating feeding and cutting mechanism so that the series of operations is automatic, correlated, and continuous, and a high speed in the manufacture of the loops may be attained.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and are particularly pointed out in the claims.

In the drawings, illustrating the application of my invention in one form,—Figure 1 is a plan view of my machine. Fig. 2 is a longitudinal section from front to rear thereof. Fig. 3 is a transverse sectional view of a portion of the machine showing the cam shaft and related parts viewed toward the front of the machine. Fig. 4 is a detail view of the intermittent gear feed mechanism. Figs. 5 and 6 are views of wing-cams and cooperating shifting members actuated thereby. Fig. 7 is a view of a completed bale-tie made on my machine.

In the practice of the art to which my invention relates, it has been customary to form loops by twisting together the return end of the wire and the shank of the wire, both members being twisted or coiled about the other. This involves a weakened point

in the wire shank itself which may break under excessive strain. Loops have been formed in somewhat the manner in which I form my loops by mechanism operated largely by hand, entirely so as regards the feed of the wires into the machine. In machines of this type where the wires have to be fed in by hand, they must be cut into the proper lengths in advance of such feeding, and the operation of feeding them in one at a time by hand is necessarily slow and produces imperfect results. One of the primary advantages of my machine resides in the fact that the feed of the wire is from a coil as it comes from the factory and is absolutely continuous so that the loops are formed, the wires fed forward the proper distance and then cut off and delivered from the machine by an automatic and continuous series of operations. The machine, therefore, can be driven at a high rate of speed and will operate to loop and deliver a maximum of near one hundred bale-ties per minute. I provide means for varying the rate of feed in this mechanism which enables bale-ties of different lengths to be manufactured.

The frame of my machine comprises preferably a single casting formed of a base member 10 and a series of vertical bearing posts or standards which will be described in connection with the parts supported thereby. In bearings 11 and 12 formed in two such posts is journaled a shaft 13 provided with fast and loose pulleys 14 and 15 by which the mechanism of the machine is driven. A spur gear 16 on the end of shaft 13 meshes with a spur gear on a short shaft held in bearings 18 and 19 in the tops of vertical standards 20 and 21 positioned in such proximity as to leave space between them only for the gear 17. The shaft in bearings 18 and 19 has formed on opposite ends thereof and extending just outside of bearings 18 and 19, bevel gears 22 and 23, respectively. The bevel gear 23 meshes with a bevel gear 24 on an oblique shaft 25 held in oblique bearings 26 and 27 in the ends of standards 28 and 29. Upon the lower end of shaft 25 is a bevel gear 30 meshing with a bevel gear 31 on a shaft 32 mounted in bearings 34, 35, 36, 37, and 38 formed in short standards provided for that pur-

pose, the shaft 32 extending transversely entirely across the machine near the front or delivery end thereof. Between bearings 37 and 38 near the end of shaft 32 farthest removed from gear 31 is a segment gear 39, formed, as shown in Fig. 4, of a gear segment proper 40 and an untoothed section 41, said sections being shown as cast separately and secured together by means of bolts 42 and 43 although it is obvious that the gear may be cast in one piece, the form shown being somewhat simpler in finishing. A short shaft 44 is mounted in bearings 45 and 46 in upright standards 47 and 48, said shaft having thereon between said standards a spur gear 49 provided with a long tooth 50, said long tooth having a circular face adapted to engage the face of the section 41 of mutilated gear 39 which thereby holds gear 49 and shaft 44 in a definitely fixed position. When the teeth on section 40 come around to said wide tooth 50 they will be caused to mesh with the teeth on gear 49 and said gear and shaft 44 will be turned a complete revolution by the gear segment 40, the peripheral extent of the toothed portions of both gears 39 and 49 being equal. The rim is cut away as indicated at 51 in Fig. 4 to permit the tooth 50 to pass from locking engagement with the straight rim of section 41. Shaft 44 is extended beyond bearing 46 as indicated at 52 and upon such extended portion a spur gear 53 is removably secured by means of a nut 54. In a bearing 55 in the top of a standard 56 is journaled a short shaft 57 having removably secured thereto by means of nut 58 an idler spur gear 59 meshing with spur gear 53 and also with a spur gear 60 removably secured by a nut 61 on the extended end 62 of a shaft 63 mounted in bearings 64 and 65 in the tops of standards 66 and 67.

The shaft 63 is the main feed shaft of the machine and it will be noted that this shaft is driven from the cam shaft 32, which cam shaft controls the movements of the loop-forming mechanisms. The cam shaft 32 is constantly driven from shaft 25, but the shaft 63 being actuated by the segment gear 39 on shaft 32 is intermittently driven, the combination being such that shaft 63 will be rotated while shaft 32 is making one-half revolution, the other half of the revolution of shaft 32 being occupied in actuating the loop-forming and cutting mechanisms hereinafter described. As the gears 53, 59 and 60 are all removable, it will be obvious that by changing these gears the extent of revolution of shaft 63 for each actuating semi-rotation of shaft 32 may be varied as desired for feeding different lengths of bale-ties. The shaft 63 is formed with an enlarged shouldered portion 68. Secured against the shoulders of the enlarged portion 68 by means of a washer sleeve 69 spiral

gear 70 and nut 71 on shaft 63 is a feeding disk 72 provided with a peripheral groove 73 which will preferably be V-shaped so as to grip the wire as it is fed through. Secured against the other shoulder of the enlarged portion 68 by means of a nut 74 on shaft 63 is a spiral gear 75 similar to spiral gear 70. Spiral gear 70 meshes with a spiral gear 76 on a vertical shaft 77 held in bearings 78 on each side of gear 76 in horizontally projecting brackets on one arm 79 of a stand 80 secured to base member 10, the arm 79 being similar to the other of said arms 81 shown in elevation in Fig. 2. The gear 75 meshes with a gear 82 on a shaft 83 held in bearings 84 in the horizontal brackets 85 of the arm 81, as clearly shown in Fig. 2. Secured to shaft 83, so as to have rotation in a vertical plane, by means of a nut 86 is a grooved disk 87 similar to the disk 72, a grooved disk 88 being secured to shaft 77 in exactly the same manner that disk 87 is secured to shaft 83. The bearing blocks 78 and 84 are secured in position by means of set screws 89 and 90 as clearly shown in Fig. 1. The feed disks 87 and 88 extend in a common horizontal plane at right angles to the plane of the disk 72, and have their peripheries movable in such close proximity as to firmly grip a wire between the walls of the V-shaped grooves in the peripheries of these members, the set bolts 89 and 90 permitting adjustment of these feeding disks relatively to accommodate them to wires of different sizes. As shown in Fig. 2, a cooperating feed disk 91 similar to and in the same plane with the disk 72 is mounted upon a shaft 92 in movable bearings 93 and 94 slidable in ways 95 formed in standards 96 and 97 extending upwardly from the base member 10, the bearings 93 being forced upwardly so as to cause the periphery of feed disk 91 yieldingly to engage the periphery of feed disks 72 by means of springs 98 seated between said bearing blocks and a supporting block 99 adjustably carried by bolts 100 and 101 extending through lugs 102-103 on standards 96 and threaded through the extended ends of block 99. By screwing up on bolts 100 and 101 the pressure of the feed disk 91 against feed disk 72 may be varied to accommodate the feeding device to the character of wire being fed through. Secured in a vertical plane to the side of the standard arm 81 are a series of three straightening guide disks 104 which are formed with edge grooves 105 as clearly indicated in Fig. 1. Upon a horizontal platform on the stand 80 are secured so as to rotate in a common horizontal plane a similar series of straightening feed rollers 106. The wire coming from reel 107 on stand 108, therefore, must first pass between rollers 106 which straighten it in a horizontal plane and guide it between rollers 104 which

straighten it in a vertical plane and in turn guide it between feed disks 87 and 88 positively rotated to grip the wire in a horizontal plane and forward it between feed disks 72 and 91, where the wire is gripped in a vertical plane, disk 72 being positively rotated and by reason of the spring contact therewith correspondingly rotating disk 91, so that the wire is positively gripped and fed in both horizontal and vertical planes, which taken in connection with the V-shaped form of the peripheral groove 73 with which all of the feed disks are provided, positively feeds the wire forward without any slippage exactly the same distance at each cycle of operation regardless of the speed at which the machine is being driven. It is the special object of this feature of my invention that the wire which comes from the coil and is always more or less bent and kinked shall be straightened, fed, and cut off in fixed lengths while permitting the machine to run at high speed. For instance, when this machine is operating to make from sixty to seventy bale-ties per minute, the wire while being fed may travel at a rate of over a mile a minute. It will be apparent that nothing excepting an absolutely positive and reliable feed can be depended upon to measure the lengths of wire accurately, which is absolutely essential in an efficient machine for the purpose, this being especially true when it is called to mind that the feeding device is intermittent, its momentum being checked and gained at each cycle of operation, at which time there would be great liability of slippage and irregularity.

The cam shaft 32 has thereon a series of cams which will later be described for automatically presenting the loop-forming mechanisms to the proper point for performing their functions during the time feeding is not taking place. This arrangement, therefore, strictly correlates the feeding of the length of wire, the cutting of the same which also is operated from cam shaft 32, and forming of the loop, the complete cycle of operations always taking place at each full revolution of cam shaft 32. That is every time that cam shaft 32 is rotated once a bale-tie is looped, drawn out, cut off and discharged from the machine.

As the wire 109 comes from the last set of feed disks 72 and 91, it is passed through a hollow mandrel or shaft 110 which is supported longitudinally of the machine in bearings 111 and 112 formed in upright standards 113 and 114. The hollow shaft 110 has thereon a collar 115 engaged by a washer 116 between which and bearing 111 is a spiral spring 117 which will push the shaft 110 into its outward position in which collar 115 will engage bearing 112 unless the said shaft is forced back against the

pressure of spring 117 by means provided for that purpose. A spur gear 118 is rotatably secured to the shaft 110, and between said spur gear and a collar 119 adjacent the end of the shaft is journaled the ring 120 of a floating shifter 121 provided at its lower depending end with a roller 122 engaged by a face cam 123 on the shaft 32. The cam 123, as shown in Fig. 2, has for the major part of its circumference a cylindrical face 124 of sufficient height to hold the shifter 121 and with it the shaft 110 in their rearward position, as indicated in Fig. 2. A cam drop 125 is provided which permits spring 117 to force shaft 110 and the parts carried thereby forward for a purpose later to be described. The drop face 125 extends into a gradually ascending cam face 126 which progressively pushes back shaft 110, the reason for which will be hereinafter stated. To prevent floating shifter 121 turning with shaft 110 there is secured to the said shifter above the ring 120 a bar arm 127 adapted to slide between lugs 128 on the top of standard 114. It is obvious that securing bar 127 to standard 114 so as to extend between lugs on the top of shifter 121 and permitting the shifter to slide along the bar would serve the same purpose. The spur gear 118 is preferably a wide gear in mesh with an idler 129 carried by a short shaft 130 journaled in bearings in the ends of two standards 131, 132, the idler 129 in turn meshing with a spur gear 133 on a shaft 134 journaled in bearings in the ends of similar upright standards 135, 136, the shaft 134 having thereon intermediate the said uprights a bevel gear 137 meshing with bevel gear 22. Through this arrangement of gearing, therefore, the hollow shaft 110 is constantly driven from the bevel gear 22, the movement of the shaft longitudinally, above described, being along the spur gear connection and, therefore, in no way interfering with the continuous drive of shaft 110.

Journaled in bearings 138 and 139 in upright standards 140 and 141 so as to extend parallel with and directly above the cam shaft 32 is a shaft 142 having secured on the end thereof a spur gear 143 in mesh with the spur gear 17, said gear 17 being sufficiently wide to permit longitudinal movement of shaft 142 to the desired extent without breaking the meshing engagement thereof. The shaft 142 is provided with collars 144 and 145 between which is journaled the ring 146 of a shifter 147 having on the end thereof a roller 148 adapted to be engaged by a wing cam 149 secured by a collar 150 to the cam shaft 32. To the upper part of shifter 147 is secured a bar 151 extending between lugs 152 so as to slide freely therebetween and hold the shifter from turning with the shaft. A spring 153 extends be-

tween washers 154 and 155 loose on shaft 142 and normally presses the shaft so as to hold the same in the position shown in Fig. 3. The wing cam 149 is shown most clearly in Fig. 6 and is adapted through shifter 147 to force shaft 142 forward the desired extent during a little less than one-fourth of the revolution of cam shaft 32.

Mounted to slide in bearings 156, 157 on the ends of upright standards 158, 159 is a square shaft 160 having on the end thereof a mandrel pin 161. The shafts 160 and 142 are held in alinement and the mandrel 161 aligns with a central hole 162 in the end of shaft 142 so that when both the shaft 160 and the shaft 142 are brought to their most forward position the mandrel 161 will be positioned in the hole 162. Keyed to the shaft 160 is the ring 163 of a shifter 164 having thereon a roller 165 positioned to be engaged by wing cam 166 carried by a collar 167 fast on cam shaft 32. As shown most clearly in Fig. 5, the wing cam 166 is of such extent as to engage roller 165 and hold shaft 160 and mandrel 161 in retracted position for slightly more than one-half of a complete revolution of cam shaft 32, and when the shaft 160 is not so retracted it is held in its forward position by means of a spring 168 positioned between the collar 163 and the bearing 157.

As clearly shown in Fig. 2, the wire after passing through hollow shaft 110 extends beneath the point of mandrel 161 and beneath a stationary shear blade 169 removably secured by bolts 170, 171 to upright posts 172, 173 carried by a frame 174 adjustably secured to base member 10 by means of a bolt 175 extending through a slot 176 in the horizontal base 177 of said frame member. The posts or standards 172 and 173 each has on the inner face thereof a groove 178 and 179, respectively, in which slide correspondingly shaped projections 180 and 181 on a block 182. Removably secured to the block 182 is a shear blade 183 adapted to cooperate with the stationary shear blade 169. Extending beneath block 182 is the end of a lever 184 which is pivotally connected at 185 to the standard 114 being bent as indicated at 186 to carry the lever above a cam 187 on the cam shaft 32 adjacent cam 123 and between standards 141 and 158. The shape of cam 187 is indicated in dotted lines in Fig. 2 and is such that the lever 184 is forced up carrying with it block 182 and causing shears 169 and 183 to cut the wire immediately after the feeding action produced by gear segment 40 on shaft 32 has been terminated.

The complete automatic operation of my device is as follows. Supposing the looping action to have just been completed and the gear segment 40 on shaft 32 to be just engaging the side of tooth 50 on gear 49,

during the succeeding half revolution of shaft 32, through gears 49 and 53, idler 59, spur gear 60 and spiral gears 70 and 75 on shaft 63 and spiral gears 76 and 82 on shafts 77 and 83, the feed disks 87 and 88, the feed disk 72 and with it feed disk 91 will be positively rotated to measure and feed forward a piece of wire to form a bale tie of the length desired. As cam shaft 32 has been revolved the high part on cam 187 is brought into engagement with arm 184 by which block 182 is lifted to shear the wire just at the moment when the last tooth of gear segment 40 has left gear 49 and feeding action is stopped by engagement of gear tooth 50 with the untoothed rim of segment 41. At the same time wing cam 166 will have been taken from engagement with roller 165 on shifter 164 so that spring 168 will force shaft 160 and mandrel 161 inwardly above the wire 109. There will then be a short section of wire 188 extending from mandrel 161 to the point where the wire was sheared adjacent shear member 169. Upon the end of shaft 142 is a hook 189 which as shown in Fig. 1 is at the bottom of the shaft so that when the shaft is pushed forward said hook will come beneath the wire section 188 and rotation of the hook will wrap the wire about the mandrel 161. The cam shaft 132 will immediately after the wire is cut and mandrel 161 is projected bring wing cam 149 into engagement with roller 148 and through shifter 147 will force shaft 142 inwardly against the pressure of spring 153 until mandrel 161 enters hole 162 and hook 189 comes beneath wire end 188. The wing cam 149 is of such size and is so timed in action relative to the drive of shaft 142 that the hook 189 will make two complete turns before the cam 149 passes off of roller 148 and the shaft 142 is retracted by spring 153. Two full loops of wire, therefore, are laid upon the mandrel 161 and as the hook 189 is retracted from the mandrel the remaining end of the wire will be left extending at an angle outwardly from mandrel 161 as indicated at 190 in Fig. 2. By this time cam shaft 32 will have rotated to the position shown in Fig. 2 and a slight further rotation will bring roller 122 opposite the low portion 125 which will permit spring 117 to force shaft 110 inwardly. As shown in Fig. 1, a hook 191 similar to hook 189 is formed on the end of shaft 110. When, therefore, the shaft is pressed forward this hook will engage the end 190 of the wire extending at approximately right angles to the main shank of wire 109 and wrap said end several times about the main shank of wire 109. The adjustment of the stand 174 by means of bolt 175 in slot 176 will have been such that this last wrapping movement will completely use up the end 188 origi-

nally left extending beyond mandrel 189 at this moment in the cycle of operation. While the wrapping is being effected by the hook 191 the long cam surface 126 will be gradually pushing back the shaft 110 so that the wrapping of the wire will extend progressively along the shank. At this point in the cycle of operations wing cam 166 will engage roller 165 and through shifter 164 push back the square shaft 160 withdrawing the mandrel 161 from the double coil of wire formed thereabout, and immediately after said withdrawal gear segment 40 will again have come into engagement with tooth 50 on gear 49 and the feeding action of another cycle of operations will be begun.

From the above it will be seen that the hooks 189 and 191 which perform looping operation are constantly rotated, but the control of said hooks for positioning them to effect their function and also the control of the mandrel 161 for positioning it to receive the loop and for withdrawing it from said loop is effected entirely by the rotation of cam shaft 32 which at the same time through the toothed and non-toothed segments 40 and 41 determines the feed of the wire in absolutely coördinated relation to the looping mechanism and the shearing device, which is also controlled from the cam shaft 32. A single member, therefore, is provided for automatically controlling the operations for projecting the mandrel, forming the loop on the mandrel, wrapping the end of the wire about the shank of the wire, measuring and feeding the wire of the proper length through the machine and then shearing the same. In view of the positiveness and accuracy of the feed and the above indicated unitary control of all of the operations of the machine, the machine is not only rendered automatic in the fullest sense of the term but is automatic to such an extent as to require practically no attention from an operator and to need merely an unskilled attendant for removing and caring for the bale-ties as formed and setting up a new roll of wire as the preceding wire is used up. Economies in operation of the machine will be apparent and in view of the results obtained, the machine is simple in structure and economical to build.

I claim:

1. A machine for making bale-ties from a continuous strand of wire, comprising a mandrel, a continuously rotating looping spindle axially alined therewith, a continuously rotating wrapping spindle at right angles therewith, and automatic means for moving said spindles in timed succession for causing the looping spindle to lay a coil of wire around the mandrel and the wrapping spindle thereafter to wrap the end of the wire about the shank.

2. A machine for making bale-ties from a

continuous strand of wire, comprising means for forming a loop near the end of the wire, a continuously rotating wrapping spindle concentric with said wire to catch the free end and wrap it around the body of said wire, and automatic means to bring the looping means and wrapping spindle in timed succession into position to effect their functions.

3. A machine for making bale-ties from a continuous strand of wire comprising means for forming a loop near the end of the wire, a continuously rotating spindle extending parallel with the wire, a hook on said spindle to catch the free end and wrap it around the body of the wire, and automatic means to bring said looping means and hook in timed succession into position to effect their functions.

4. A machine for making bale-ties from a continuous strand of wire comprising means for forming a loop near the end of the wire, a continuously rotating wrapping spindle concentric with said wire, a hook on said spindle to catch the free end and wrap it around the body of said wire after the loop is formed, automatic means to bring the looping means and the wrapping spindle in timed succession into position to effect their functions, and means for thereafter withdrawing them to release the loop.

5. A machine for making bale-ties from a continuous strand of wire comprising means for forming a loop near the end of the wire, a continuously rotating wrapping spindle concentric with said wire, a hook on said spindle to catch the free end and wrap it around the body of said wire after the loop is formed, automatic means to bring the looping means and the wrapping spindle in timed succession into position to effect their functions, means for thereafter withdrawing them to release the loop, and means for measuring and cutting off the bale-tie after the loop is formed.

6. A machine for making bale-ties from a continuous strand of wire comprising means for forming a loop near the end of the wire, a continuously rotating wrapping spindle concentric with said wire to catch the free end and wrap it around the body of said wire, automatic means to bring the looping means and wrapping spindle in timed succession into position to effect their functions, and means for measuring and cutting off the bale-tie after the loop is formed.

7. A machine for making bale-ties from a continuous strand of wire, comprising a mandrel and an alined loop forming member, the ends of the mandrel and loop former being spaced apart on each side of the line of feed of the wire, automatic means for moving the mandrel into the vertical plane of the wire and for moving the looper so as to

engage said wire and loop the same about the mandrel, means thereafter to wrap the end of the wire around the shank of the same, means for returning each of the parts to initial position after the loop has been formed, and means controlling the movements thereof so that they effect their functions in successively timed order.

8. A machine for making bale-ties from a continuous strand of wire, comprising a mandrel and an alined loop forming member, the ends of the mandrel and loop former being spaced apart on each side of the line of feed of the wire, automatic means for moving the mandrel into the plane of the wire and for moving the looper so as to engage said wire and loop the same about the mandrel, means thereafter to wrap the end of the wire around the shank of the same, means for returning each of the parts to initial position after the loop has been formed, means thereafter for measuring and cutting off the bale-ties, and means controlling the movements of all said parts so that they effect their functions in successively timed order.

9. A machine for making bale-ties from a continuous strand of wire, comprising a mandrel and a looping spindle axially alined therewith, a hollow wrapping spindle at right angles thereto through which the strand of wire extends, automatic means for moving the mandrel, the looping spindle, and the wrapping spindle in timed succession into position to form and complete a loop, means for returning the parts to initial position after the loop is formed, and means thereafter for measuring and cutting off the bale-ties, said measuring device comprising means for clamping and holding the wire fixed while the loop is being formed.

10. A machine for making bale-ties from a continuous strand of wire comprising an axially fixed mandrel to act as a loop-center, a constantly rotating looping member mounted axially in line therewith, means for moving the mandrel into position to receive the wire, means for moving the looping member into position to engage the wire and loop the same about the mandrel, means thereafter for wrapping the end of the wire about itself, and means for controlling the movements of said parts so that they are successively timed automatically to complete the loop.

11. A machine for making bale-ties from a continuous strand of wire comprising an axially fixed mandrel to act as a loop-center, a constantly rotating looping member mounted axially in line therewith, means for moving the mandrel into position to receive the wire, means for moving the looping member into position to engage the wire and loop the same about the mandrel, means thereafter for wrapping the end of the wire

about itself, means for controlling the movements of said parts so that they are successively timed automatically to complete the loop, and means for measuring and cutting off the bale-tie after the loop is formed.

12. A machine for making bale-ties from a continuous strand of wire comprising a mandrel, a constantly rotated looping spindle axially alined therewith, a constantly rotating hollow wrapping spindle within which the strand of wire is positioned, means for projecting and retracting the mandrel, means for projecting and retracting the looping spindle, means for projecting and retracting the wrapping spindle, and means for coördinating the movements of the parts in timed succession to form the completed loop.

13. A machine for making bale-ties from a continuous strand of wire comprising a mandrel, a constantly rotated looping spindle axially alined therewith, a constantly rotating hollow wrapping spindle within which the strand of wire is positioned, means for projecting and retracting the mandrel, means for projecting and retracting the looping spindle, means for projecting and retracting the wrapping spindle, means for coördinating the movements of the parts in timed succession to form the completed loop, and means for measuring and cutting off the bale-tie after the loop is formed.

14. A machine for making bale-ties from a continuous strand of wire comprising loop forming means, feeding and measuring means and means to cut off the bale-ties, a shaft, and means on said shaft for controlling the loop forming means to cause the same to complete the formation of a loop during a half revolution of the shaft, and other means on the shaft for controlling the measuring and cutting means during the succeeding half revolution of the shaft.

15. A machine for making bale-ties from a continuous strand of wire comprising means for forming a loop at the free end of the wire, means for thereafter measuring and means for cutting off the bale-tie, a shaft, a series of cams on the shaft for controlling the operations of the loop forming means and cutting means, said cams being differentially positioned so as to effect such control during a half revolution of the shaft, and a mutilated semi-gear on the shaft for actuating the feeding and measuring means during the succeeding half revolution of the shaft.

16. A machine for making bale-ties from a continuous strand of wire comprising an axially movable constantly rotating looper, a mandrel axially movable in alinement with the looper, a constantly rotating wrapping spindle axially movable at right angles to the mandrel and looper, springs for holding said parts in one position, shifters for

each of the parts, and a cam shaft and cams thereon engageable with each of said shifters whereby rotation of said cam shaft will control the movements of said parts to and from active position in properly timed succession.

17. A machine for making bale-ties from a continuous strand of wire comprising an axially movable constantly rotating looper, a mandrel axially movable in alinement with the looper, a constantly rotating wrapping spindle axially movable at right angles to the mandrel and looper, springs for holding said parts in one position, shifters for each of the parts, a cam shaft, a face cam thereon engageable with the shifter on the wrapping spindle, and wing cams engageable with the shifters for the mandrel and the looper, whereby rotation of said cam shaft will control the movements of said parts to and from active position in properly timed succession.

18. A machine for making bale-ties from a continuous strand of wire comprising a shaft mounted for longitudinal movement, a looping device on the end of said shaft, a constantly driven wide gear, a gear on the shaft in mesh with the wide gear, and means for moving the shaft axially to bring the looping device to and from working position.

19. A machine for making bale-ties from a continuous strand of wire comprising a shaft mounted for longitudinal movement, a looping device on the end of said shaft, a constantly driven wide gear, a gear on the shaft in mesh with the wide gear, a spring for holding the shaft in retracted position, a shifter on the shaft and within which the shaft rotates, and a cam engageable with the shifter for controlling the movements of the shaft to bring the looping device to and from working position.

20. A machine for making bale-ties from a continuous strand of wire comprising a longitudinally movable constantly rotating shaft, a looping device on the end of the shaft, and means for moving the shaft longitudinally including a floating shifter journaled on the shaft, and a bar on the shifter parallel and slidable with the shaft in fixed bearings for holding the shifter from rotation with the shaft.

21. A machine for making bale-ties from a continuous strand of wire comprising two pairs of disks, each pair having feeding grooves in relatively angularly disposed planes for gripping opposite portions of the wires, means to positively rotate said disks at uniform speed, means to actuate said rotating means intermittently, and means to adjust the actuating means to vary the extent of peripheral travel of the disks during such intermittent actuation.

22. A machine for making bale-ties from

a continuous strand of wire, comprising a controlling shaft, a gear segment on said shaft, a mutilated gear meshing with said gear segment and intermittently operated at each revolution of the shaft, wire feeding means, and a train of gearing having operative connection with said mutilated gear for driving the feeding means.

23. A machine for making bale-ties from a continuous strand of wire, comprising a controlling shaft, a gear segment on said shaft, a mutilated gear meshing with said gear segment and intermittently operated at each revolution of the shaft, wire feeding means, and a train of gearing having operative connection with said mutilated gear for driving the feeding means, said train of gearing comprising removable and interchangeable gears whereby action of the feeding means may be varied.

24. A machine for making bale-ties from a continuous strand of wire, comprising a driven shaft, a feed disk thereon, a similar disk spring-pressed in the plane of and against the first-named disk for feeding action on the wire, a pair of cooperating disks disposed in a plane at an angle to that of the first pair of disks, and means for positively driving said last pair of disks from the shaft.

25. A machine for making bale-ties from a continuous strand of wire, comprising a driven shaft, a pair of oppositely turned spiral gears on the shaft, a pair of shafts at right angles to the first shaft having thereon spiral gears meshing with said first sets of spiral gears, and feeding disks operative in intersecting planes secured to the driven shaft and the right-angled shafts, respectively, for gripping a wire in a plurality of separated places for feeding the same positively.

26. A machine for making bale-ties from a continuous strand of wire, comprising a series of straightening rollers operative in a horizontal plane, a series of straightening rollers operative in a vertical plane to which the wire is guided from the first series of said rollers, a set of feeding disks operative in a horizontal plane for receiving and feeding the wire from the second straightening rollers, a set of feeding disks operative in a vertical plane for receiving and feeding the wire from the first set of feeding disks, and means for positively rotating the feeding disks at a fixed peripheral speed.

27. A machine for making bale-ties from a continuous strand of wire, comprising a series of straightening rollers operative in a horizontal plane, a series of straightening rollers operative in a vertical plane to which the wire is guided from the first series of said rollers, a set of feeding disks operative in a horizontal plane for receiving

ing and feeding the wire from the second
straightening rollers, a set of feeding disks
operative in a vertical plane for receiving
and feeding the wire from the first set of
5 feeding disks, and means intermittently op-
erated for positively rotating the feeding
disks at a fixed peripheral speed.

In testimony whereof I affix my signa-
ture in presence of two witnesses.

ROWLAND J. DARNELL.

Witnesses:

J. A. O'DONNELL,

T. R. MERRIAM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
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