Jan. 13, 1959 C. L. ELLIS 2,868,239

WIRE TYING MACHINE

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Fig. 1

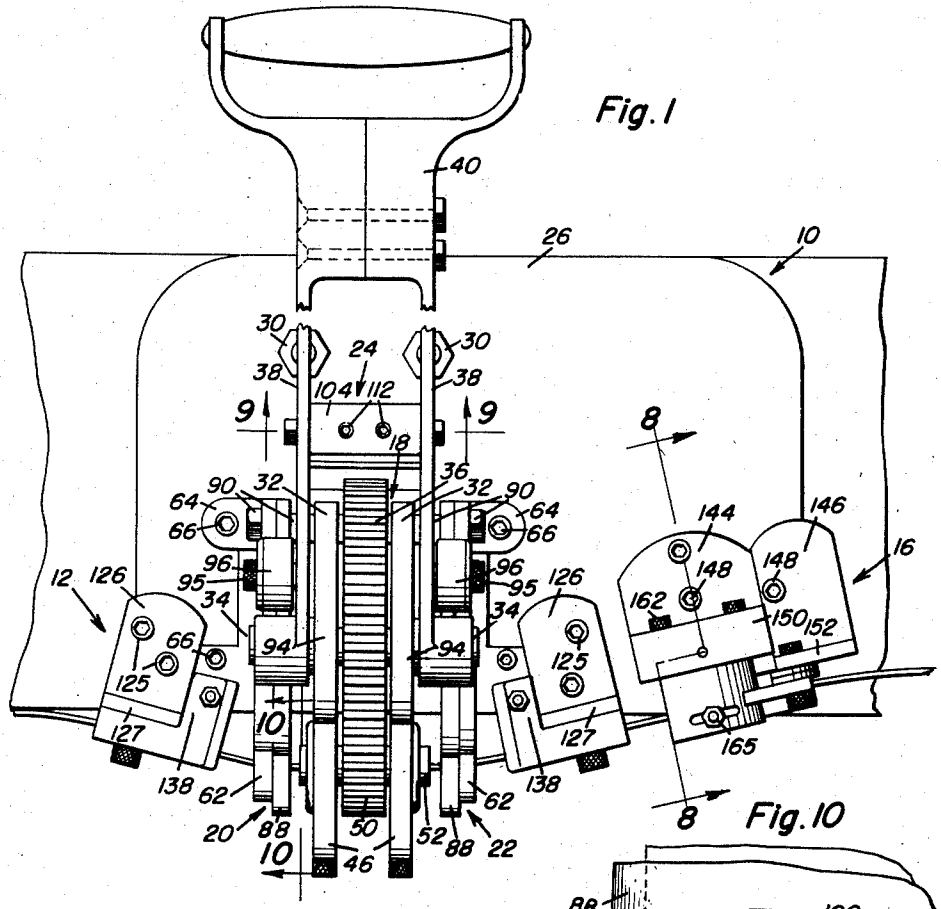


Fig. 10

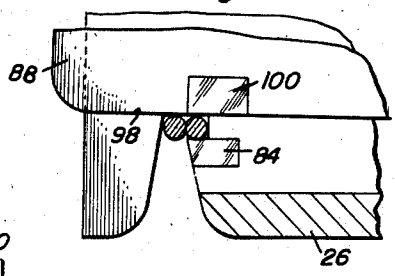


Fig. 5

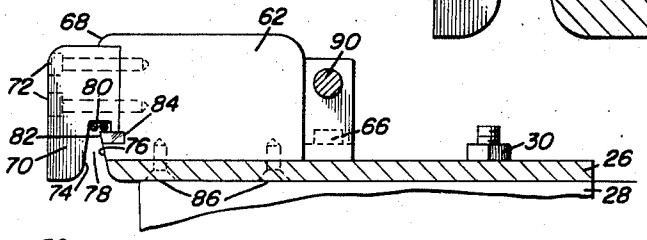
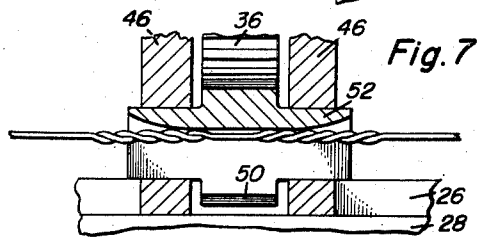


Fig. 7



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WIRE TYING MACHINE

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Fig. 2

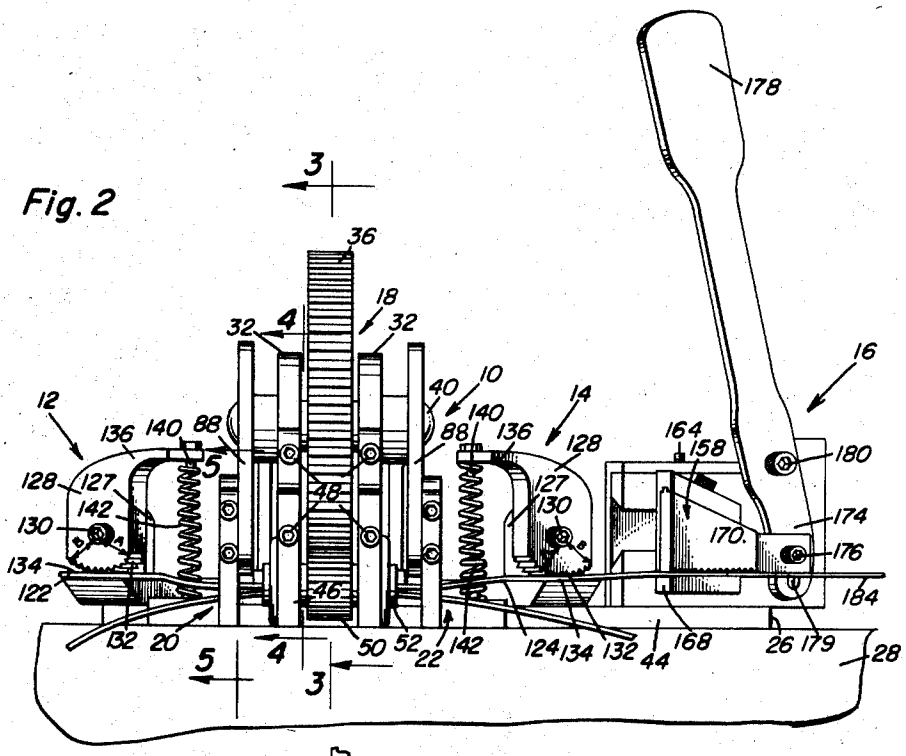


Fig. 8

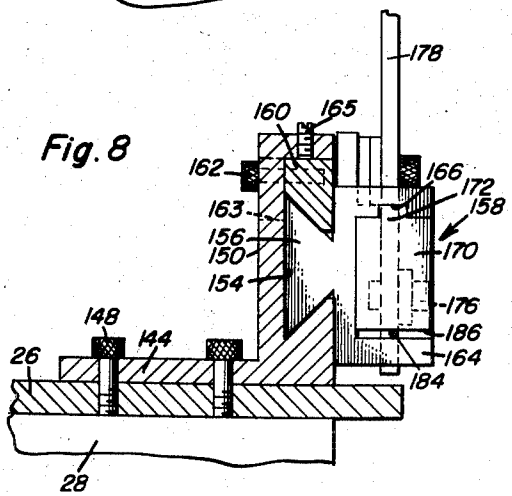
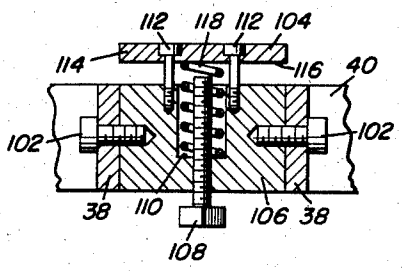


Fig. 9



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WIRE TYING MACHINE

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Fig. 3

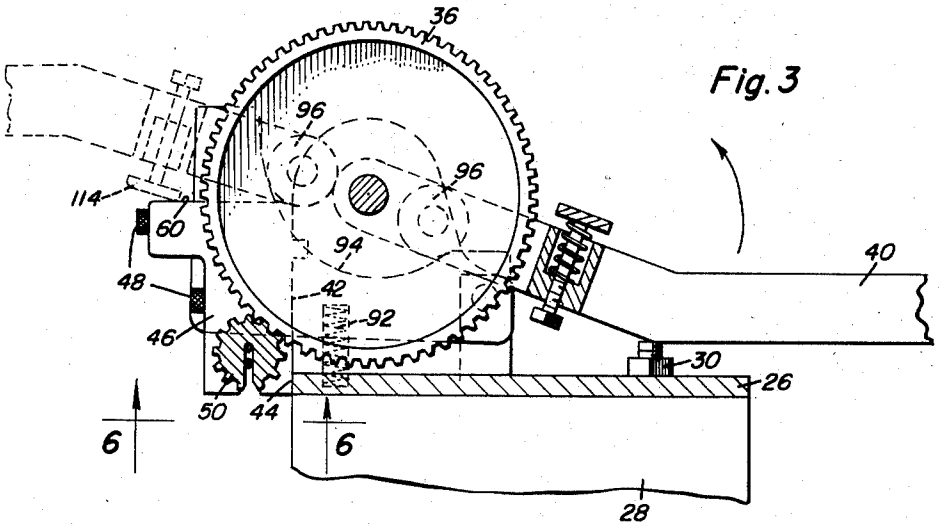


Fig. 4

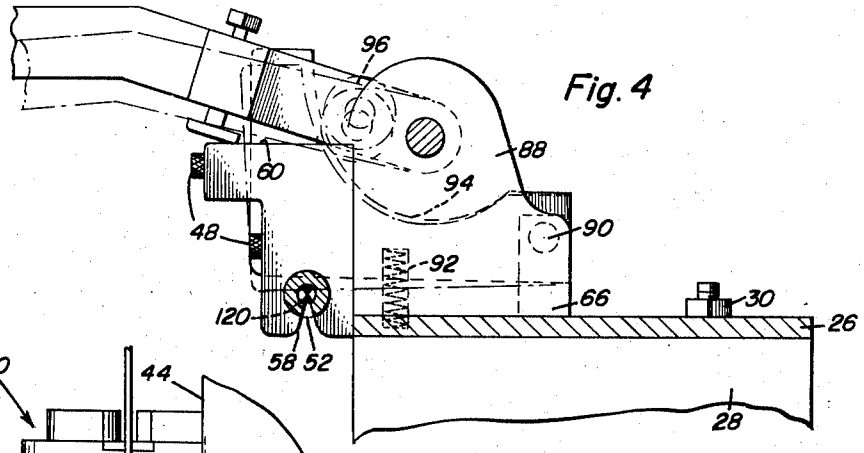
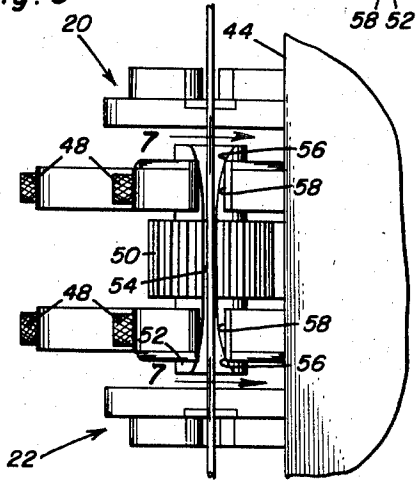


Fig. 6



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WIRE TYING MACHINE

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Application December 20, 1954, Serial No. 476,244

1 Claim. (Cl. 140—93.6)

This invention is related generally to wire tying machines in which a wire is looped about an object or group of objects and thereafter tensioned and twisted with the surplus ends of the wires being cut off retaining said object or objects together, and is more specifically directed to a semi-automatic wiring tying machine which is utilized as just mentioned. This novel machine being substantially portable and readily usable for tying various gauges of wire.

The principal objects of invention are to provide in a wire tying machine, an improved wire tensioning, twisting and cutting structure which is relatively simple to use, speedy in operation, economical in making a tie, i. e. wasting a minimum of wire, cutting the wire after tied in close proximity to the tie thus reducing the possibility of danger of cut hands to the operator of the device.

A further object of the invention is to provide in a wire tying machine giving rise to the objects mentioned above where a tying machine is semi-automatic.

And yet another object of invention is to provide in a wire tying machine giving rise to the objects mentioned above, including mutually cooperating wire holding, tensioning, twisting, cutting and aligning structure in which the wire holding and tensioning structure cooperates with the wire being tied substantially along a longitudinal axis of said wire, and in which the wire twisting, cutting and aligning structure is operated by a single manually actuated means.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, refernce being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a top plan view of the novel wire tying machine with the intermediate portion of the main operating handle being omitted;

Figure 2 is a front elevational view of the novel wire tying machine;

Figure 3 is a sectional view taken substantially on lines 3—3 of Figure 2, showing in phantom the position of the main operating handle after a wire tie has been made, but prior to the severing of the "selvage" end of the wire tie as well as the severing of the wire tie from the main wire supply source;

Figure 4 is a sectional view similar to that of Figure 3 taken substantially on the lines 4—4 of Figure 2, showing the main operating handle in the position shown in Figure 3 and showing in phantom the position of the main operating handle when the wire tie is being cut;

Figure 5 is a sectional view taken substantially on lines 5—5 of Figure 2, showing the cutter structure in a position just prior to cutting the "selvage" end of the wire tie;

Figure 6 is an enlarged view of a lower portion of the novel tying structure looking at the device in the direction indicated by line 6—6 of Figure 3;

Figure 7 is a sectional view taken substantially on line 7—7 of Figure 6 after the wire tie has been made and the severing of the wires from the tie and subsequent to the removal of the tie from the wire tying device;

Figure 8 is an enlarged sectional view taken on section line 8—8 of Figure 1, showing a portion of the novel wire tensioning structure;

Figure 9 is an enlarged sectional view taken substantially on line 9—9 of Figure 1, showing the stop structure associated with the main operating handle for providing the cutting and alignment of the wire tie structure; and

Figure 10 is a further enlarged sectional view taken substantially on line 10—10 of Figure 1 showing the position of the wire tie and the cooperating special cutting inserts.

The novel wire tying device is indicated at 10 and includes, indicated generally, left and right holding assemblies 12 and 14, respectively, as view from the front of the device as seen for example in Figure 2, a wire tensioning assembly 16, a wire twisting assembly 18, left and right wire cutting assemblies 20 and 22, respectively, as seen in Figure 2, and handle stop and wire twister assembly alignment structure 24 cooperating with the cutter assemblies. The wire tying machine is shown as being secured to a suitable support 28 by suitable fasteners 30, however, attention is brought to the fact that this wire tying machine is relatively small, approximately one foot in over-all length, and is thus readily portable as well as being adapted to being used without being secured to a support by merely resting the wire tying machine on the object upon which the wire tie is being placed.

Secured in parallel spaced relation to the base member 26 in any suitable manner is a pair of upwardly extending relatively parallel support plates 32, having suitably journalled for rotation therein a main drive gear support shaft 34 carrying fixedly secured thereon between the inner sides of said support plates a main drive gear 36. The main drive gear shaft projects from the outer sides of the support plates and have fixedly secured thereto the legs 38 of a bifurcated operating handle 40 the movement of which causing the rotation of the shaft 34 and the main drive gear secured thereon, in the direction indicated by the arrow in Figure 3.

Secured on the support plates 32 at the forward vertical edge 42 thereof are mutually parallel twister gear support members 46, secured thereon by suitable fasteners 48, such as Allen screws. A wire twister gear 50 is suitably secured to a wire twister gear shaft 52 which is rotatably supported between the support plates 46. As clearly seen, for example, in Figure 3, the wire twister gear is supported away from the forward edge 44 of the base support member 26 permitting the ready insertion and removal of the wire being tied. Although the gear 50 and its support shaft 52 might be separate, they are shown to be integral and cut from a single piece as seen, for example, in Figure 7. Extending through the gear 50 is a transverse slot 54 extending at both sides thereof into outwardly opening flared slots 56 contained in the shaft portion 52. As clearly seen in Figure 6 the lower portion of the support element 46 includes slots 58 therein which will be substantially parallel to the previously mentioned slots 54 and 56 of the twister gear, see Figure 6.

The upper portion of the support members 46 constitute abutment portion 60 which is in the pivotal path of a handle stop and wire twisting assembly alignment structure 24 for a purpose to be subsequently described.

Secured on each side of the support plates 32 are a pair of fixed cutter support plates 62 which include an angularly extending portion 64 secured to the base mem-

ber 26 by means of suitable fasteners 66. Secured to the forward edge 68 of the fixed cutter support plates, as seen in Figure 5, are fixed cutter plate elements 70 secured thereon by suitable fasteners 72. As can be clearly seen in Figure 5, the fixed cutter support plates 70 include a lower inwardly tapered portion 74 cooperating with similar portions 76 on the lower portion of the fixed cutter support plate 62 forming a downwardly opening flared wire receiving portion 78. This downwardly flared portion 78 includes at its top formed by members 62 and 70, a substantially square recess 80 having projecting therein a cutting portion 82 which includes therein a special cutting insert 84 upon which one of the wires of the wire tie will rest. Fixed cutter support plates 62 are also secured along their lower edge to the base member 26 by means of suitable fasteners 86.

Pivotally secured between the fixed cutter support plate 62 and the vertical support plates 32 are pivotal cutter members 88, which are pivotally mounted on the vertical support plates 32 by a supporting pin 90 journalled across the support members 32. Each of the pivotal cutter members are urged in a clockwise direction about the pivot pin 90 by a compression spring 92 see for example in Figures 3 and 4. The cutter plates include on an upper edge surface, a curved cam surface 94, the purpose of which is to be subsequently described. Carried on each of the legs 38 of the handle 40 by suitable shafts 95 journalled in the legs are cam rollers 96 which are operable to come in contact with the cam surface 94 as clearly seen in Figures 3 and 4 when the handle 40 is rotated in a counter-clockwise direction to impart twisting movement to the twisting gear 50. Contained on the lower edge 98 of the cutter member 88, as seen most clearly in Figure 10, are cutter insert portions 100 which cooperate with the similar inserts 84 on the fixed cutter support plates to provide a shear action therebetween as will be subsequently described. As seen in Figure 3, the handle 40 has been rotated and is shown in phantom for continued downward movement to cause downward pivotal movement of the pivotal cutter bar or shear arms, overcoming the pressure of spring 92 resulting in shear action between the elements 84 and 10, and the severing of a wire contained therebetween.

Suitably secured to the leg members 38 by fastener elements 102, for example, is a stop member 104 which is operable to contact the abutment portion 60 on support members 46 to provide alignment structure for the wire tie twisting assembly. As seen in Figure 9, the stop member 104 includes a substantially solid body portion 106 extending between the legs 38 having threadedly secured therein an adjustable screw 108 extending into a notched upper portion 110 of the body portion 106. Extending on either side of the notch portion 110 are a pair of threadingly secured guide elements 112 which extend through contact plate 114. Interposed between the notch portion 110 and the inner surface 116 of the contact plate 114 is a compression spring 118. When referring to Figure 3, it is noted that contact plate 114 has just come in contact with the abutment portion 60, and continued counter-clockwise movement of the handle 40 results in clockwise movement of the twisting gear 50 and its shaft portions 52 is that the open slots in the bottom of the just mentioned portion are partially closed as seen at 120 in Figure 4. When this has occurred the same downward movement causes the cam rollers 96 to be forced against the cam surface 94 and produce the necessary severing of both the "selvage" end 122 of the tie wire as well as that portion of the wire 124 which terminates at the other end of the wire tie. It should be noted that the guide elements 112 of the stop element are slidably received in the contact plate 114 and are suitably spaced to pass between the support members 46 when the spring 118 is compressed due to counter-clockwise movement of the handle 40 as previously mentioned.

Secured to the base member 26 by suitable fasteners 125 are the previously mentioned holder assembles 12 and 14, having the wire holding jaws thereof in a slight acute angular relationship to the fixed cutter support plate 62. As most clearly shown in Figure 2, the holding assemblies each include a base portion 126 which is secured to the base member 26 by the aforementioned securing means 125 having vertically extending therefrom vertical support plates or flanges 127 which pivotally carry thereon gripping jaws 128. The gripping jaws are pivotally mounted on the vertical support plates by suitable pivot pins 130. At the lower surface of the gripping jaws 128 is a serrated wire engaging surface 132 which is curved to provide an increasing radius of curvature from front to rear, i. e., the radius indicated at A of the gripping jaws 128 is less than that indicated at B so that the primary part of the gripping action of these jaws is done at the rear or adjacent the larger radius. Provided beneath the serrated portions of the gripping jaws 128 is a cooperating bevelled surface portion 134 which is an extension of the base support 124 of the holding assembly. The gripping jaws 128 include an integral pivot arm 136 to which is secured in any suitable manner a rearwardly directed arm-like element 138 which has a pin 140 extending therethrough around which is journalled a compression spring 142, the other end of said spring being in contact and suitably supported on the base support member 26. The spring 142 tends to urge the jaw 128 of the holding assembly 12 in a counter-clockwise direction, and the similar jaw 128 of the holding assembly 14 in a clockwise direction, for a purpose which will hereinafter become more apparent.

The structure heretofore described provides a substantially symmetrical wire tying machine with reference to the vertical axis of the main drive gear 36. As indicated in Figures 1 and 2, for example, wire tensioning structure 16 is provided adjacent the holding assembly 14, however, this tensioning structure could just as well be mounted to the left of holding assembly 12 instead of 14, the wire being threaded into the device in a reverse but similar procedure to that illustrated.

The wire tensioning structure includes a pair of angular bracket elements 144 and 146 secured to the base support member 26 by suitable fastening means 148 and including relatively parallel spaced vertical support flanges 150, 152, respectively. The vertical support flange 150 includes an outwardly facing dovetail slot 154 which reciprocably supports a similar dovetailed foot element 156 of the gripping jaw assembly 158 of the wire tightening structure. The gripping jaw assembly 158 includes the upper portion 160 of the vertical support 150 is secured thereto by suitable fastening elements 162 and may be made adjustable to compensate for wear therein by means of vertical slots 163, see Figure 8. A suitable locking screw 165 is provided at the upper edge of an inwardly turned flange 167 of support 150. The clamping assembly 158 includes a channel guide portion 164 which is integral with the dovetail foot 156 having a longitudinally extending slotted portion including at its upper edge a portion forming a keyway 166 and this transverse slotted portion extends the length of the member 164 and includes at the end 168 a substantially wider portion which tapers back toward the rear as seen in Figure 2. Reciprocably supported in the longitudinal slot is a reciprocable clamping head member 170 including on its upper edge a raised key 172 which cooperates with the keyway 166.

The rear portion of member 170 includes secured thereon a lower portion 174 by means of securing element 176 the wire tightening handle 178 including a lost motion slot 179 which is intermediately pivotally secured by element 180 to the vertical support flange 152 which is parallel as previously mentioned, to support vertical support 150.

The operation of this device is as follows:

The wire to be tied may either be or regular cut lengths if this is known or may be rolled off a coil of wire constituting a source of supply. Considering Figure 2, the wire indicated at **184** would extend toward the right to the source of supply and during a given wire tying operation the leading edge of the wire **122** would have been inserted through the wire tightening structure that is, i. e., between the lower portion of **164** and the lower portion of **170** which includes the serrated wire engaging teeth **186** extending on into the holding means **14**, through the longitudinal slots **54** and **56** of the twisting gear **59** down around the object to be tied back through the aforementioned transverse slots and out of the holding member **12** adjacent its holding surfaces. During this initial insertion of the wire into the wire tying machine, the wires will also have passed into the notch adjacent each of the fixed cutter plates **62**. In inserting the wire in the manner described above, the two wires passing through the cutitng structure and twisting structure are generally in vertical alignment, however, with the first counter-clockwise movement of the main drive gear the pair of wires which are engaged by the twisting gear are rotated in the position disclosed in Figures 5 and 10 where they are held in the notches **80** to be subsequently severed by the cutting structure.

The main drive gear **36** and the twisting gear **50** are so proportioned that the wire twisted thereby will include approximately four complete turns, this providing a very strong and substantial tie.

However, the aforementioned rotation of the main drive gear is not accomplished immediately. After the wire has been threaded into the device in the manner previously described, the leading end is positioned in the holding member **12** as close as possible thereto and any rightward pull on the wire **122** as observed in Figure 2 will, due to the increased gripping radius B, cause this wire to be securely held in position and longitudinal movement thereof will be prevented. The holding assembly **14** is held open manually so that the wire **84** may move toward the right due to the counter-clockwise rotation of handle **178** of the wire tightening structure after which the release of manual pressure on the holding assembly **14**, and since the wire **118** is under tension and tends to move toward the left, this movement being prevented by the increased gripping radius B which prevents leftward longitudinal movement of the wire therein. After sufficient tension has been placed on the wire to be tied, the previously mentioned rotation of the main drive gear **36** is completed causing approximately the twist disclosed in Figure 7 to occur. At this time, the structure has assumed the approximate position shown in Figure 3 and the two strands of wire forming the wire tie are in an approximate vertical position as shown in Figure 3. Continued counter-clockwise rotation of the handle **40** results in the position of the twisting gear shaft **52** and

shearing action between the cutter portions **84** and **100** of the fixed and pivotal cutter members. Release of pressure on handle **40** results in the twisting gear and wire-tie therein returning to the position shown in Figure 3 and ready removal of the device therefrom. In view of the close relationship of the cutter structure to the twisting structure, as well as the particular relationship of the holding structure and wire tightening structure it is possible to attain a wire tie with relatively little waste of wire as shown for example in Figure 7 which fully attains the objects of invention previously set forth.

From the foregoing, the construction and operation of the device will be readily understood and further explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art it is not desired to limit the invention to the exact construction shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claim.

What is claimed as new is as follows:

A wire tying machine including a base support member having a forward edge portion, a cooperating drive and twisting gear assembly which includes enmeshed drive and twisting gears rotatably carried by said base support member, drive and twisting gear assembly actuating means operatively associated with said drive gear and pivotally supported on said base member, said twisting gear having a portion providing a normally downwardly opening peripheral slot located beyond the forward edge of the base member for receiving the wire to be tied, a movable cutter pivotally supported on said support member, a spring reacting on said movable cutter and urging said cutter to the open position, a downwardly opening fixed cutter carried on said base support member adjacent to the path of travel of said movable cutter, said actuating means including a bifurcated handle having cam rollers thereon for actuating said movable cutter, resilient stop means extending between the bifurcated portions of said handle, abutment means carried on said base support member in the pivotal path of travel of said handle and engageable by said stop means during rotation of said handle forming a wire tie, said stop means being operative to urge said handle in the direction opposite to that for making a wire tie and positioning the transverse slot in said twister gear in the normal downwardly opening direction, and a wire tensioning device carried by said support member adjacent to said cutters to draw the wire tightly for both twisting and cutting.

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