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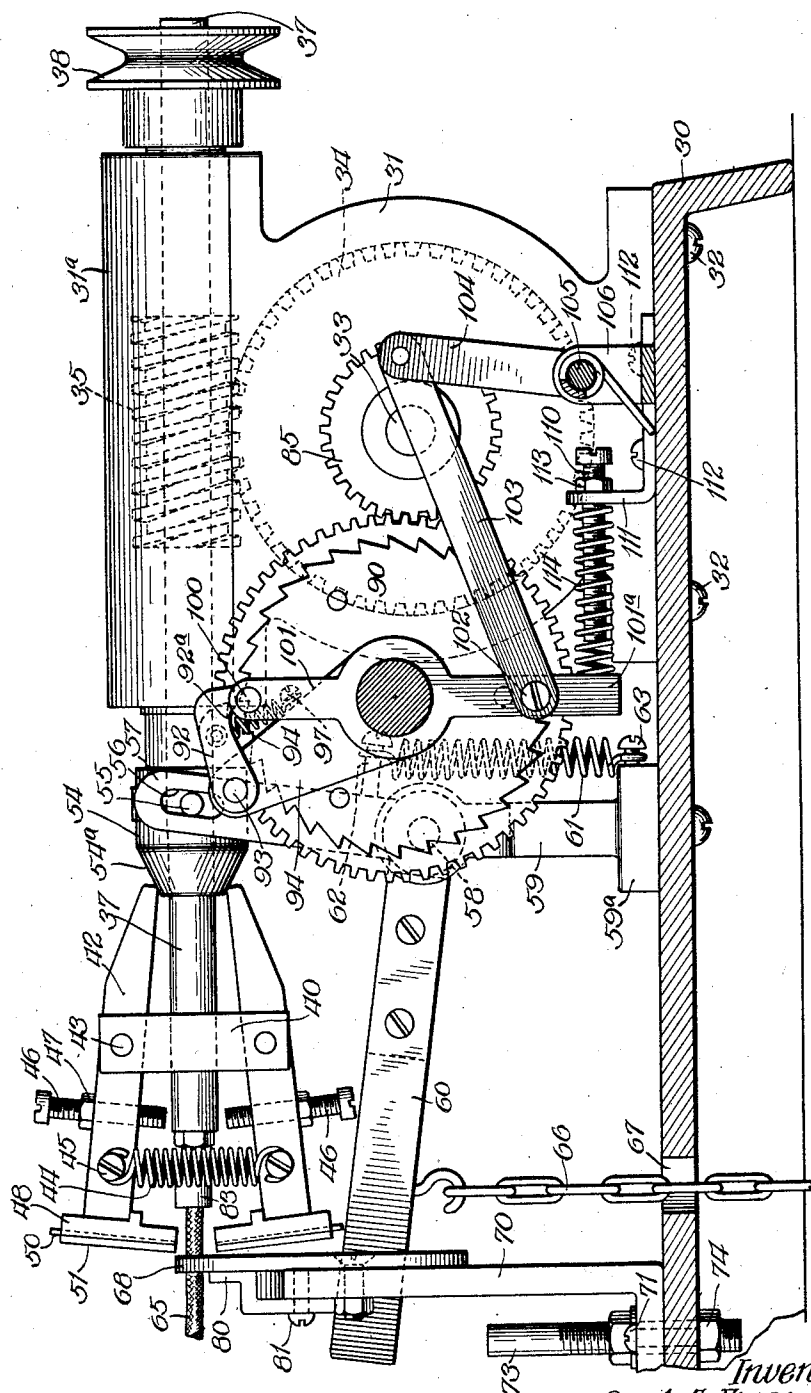
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C. E. ANDERSON ET AL

WIRE WINDING MACHINE

Filed August 27, 1920

11 Sheets-Sheet 2



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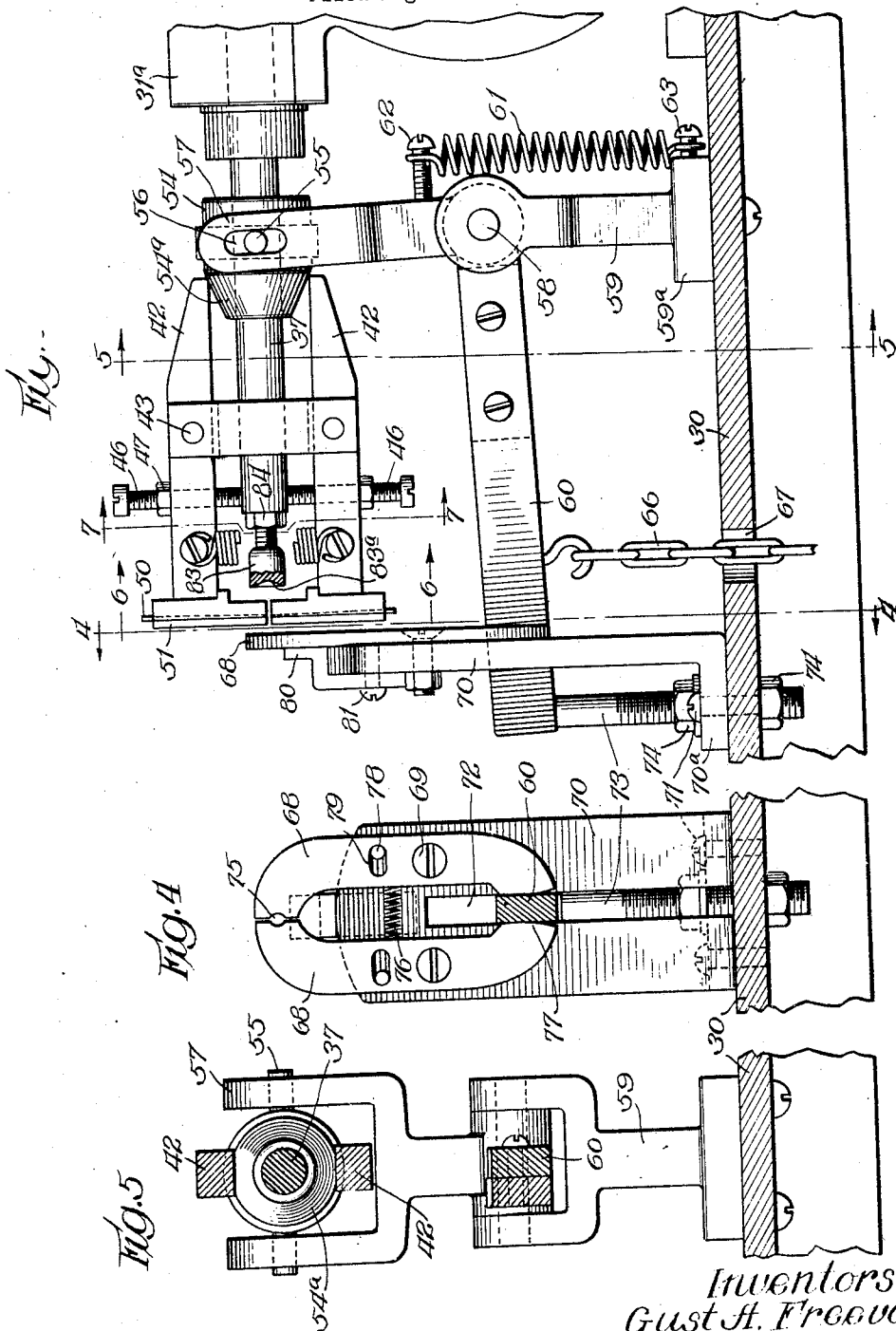
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11 Sheets-Sheet 3



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WIRE WINDING MACHINE

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11 Sheets-Sheet 4

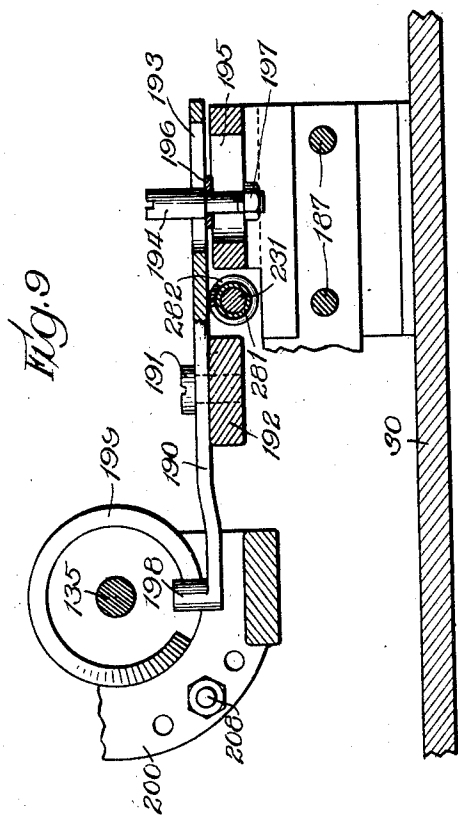
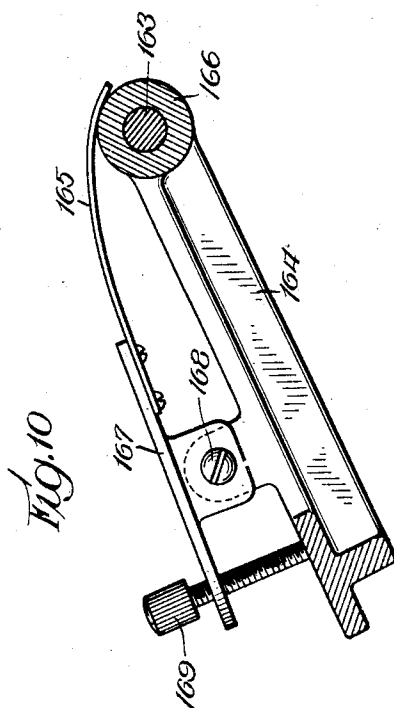


Fig. 7

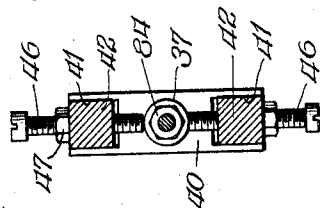


Fig. 6

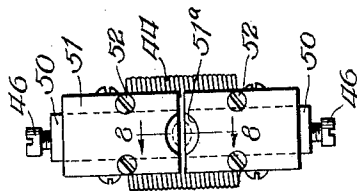
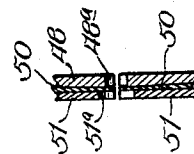


Fig. 8



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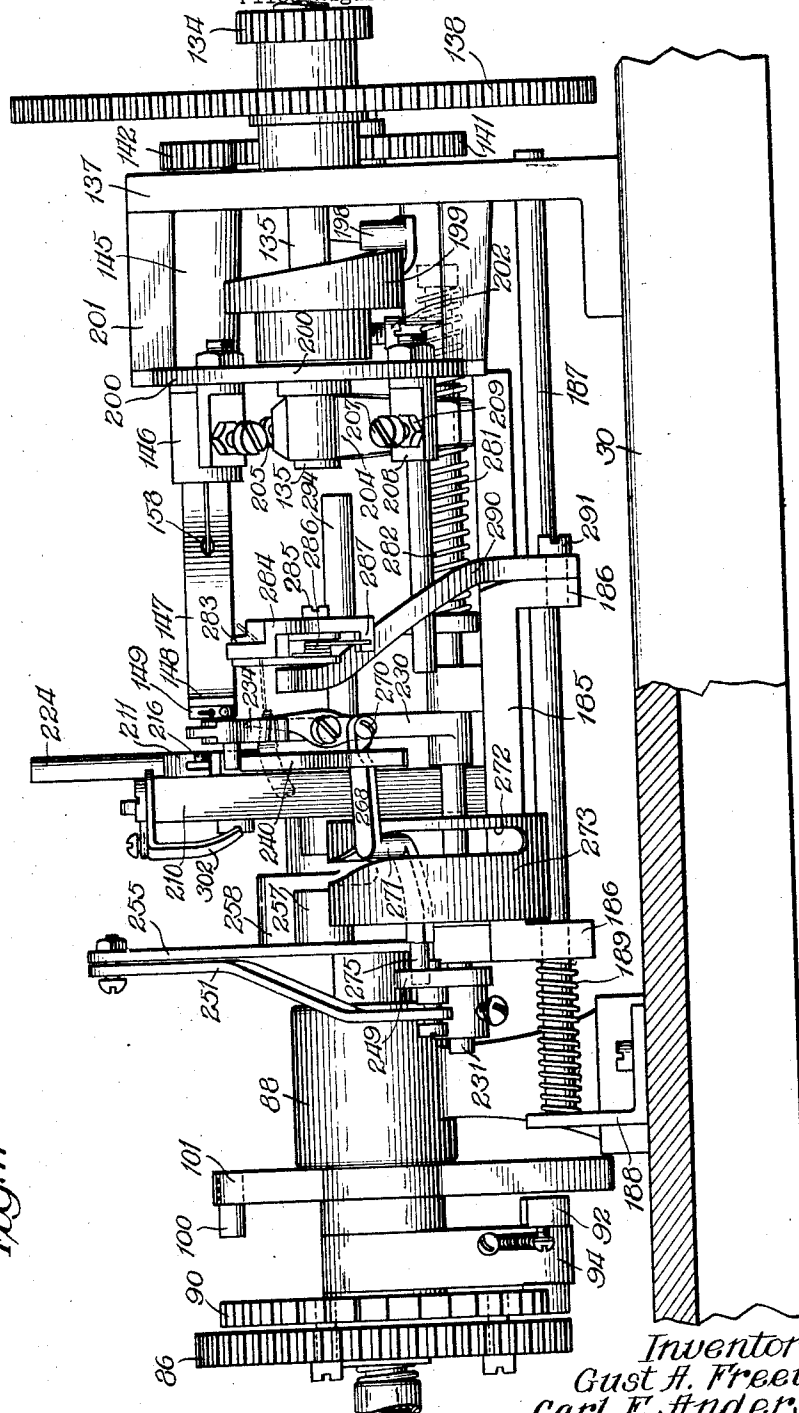
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Fig. 11



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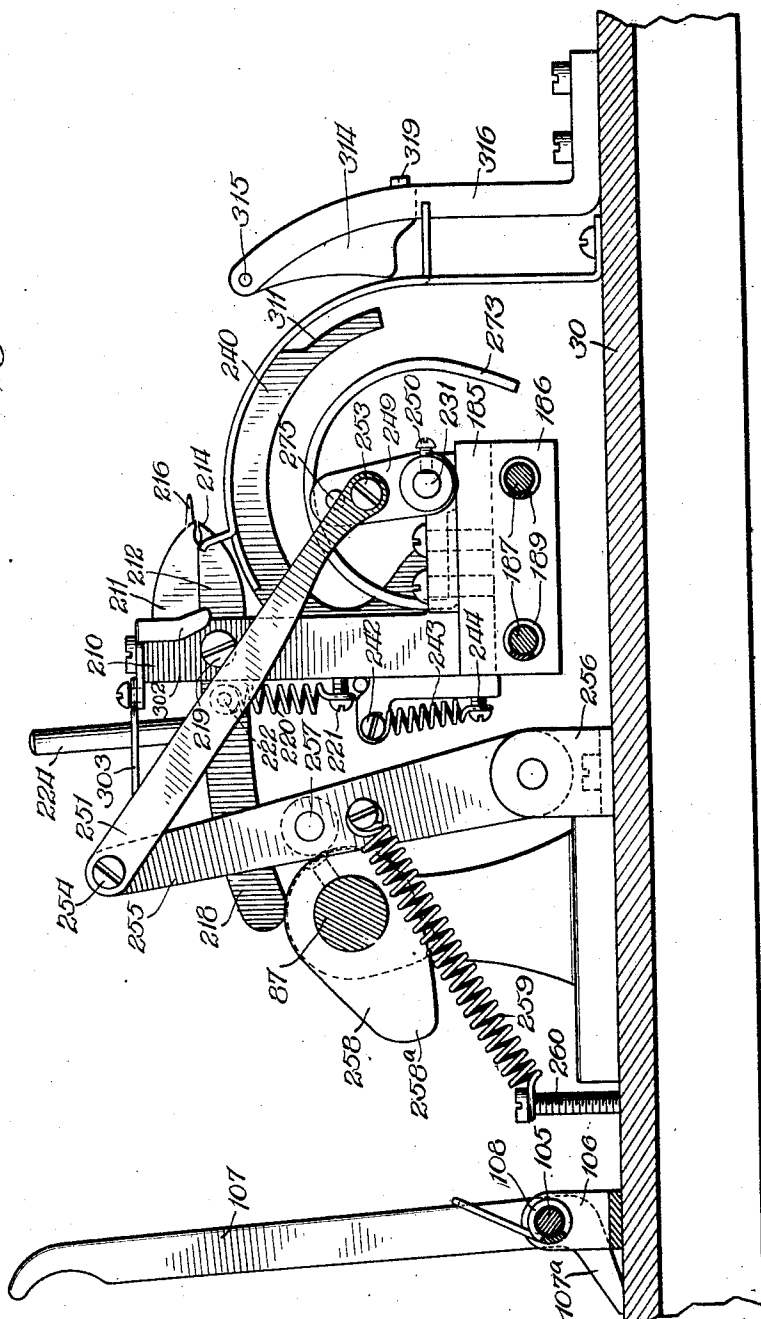
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FIG. 12



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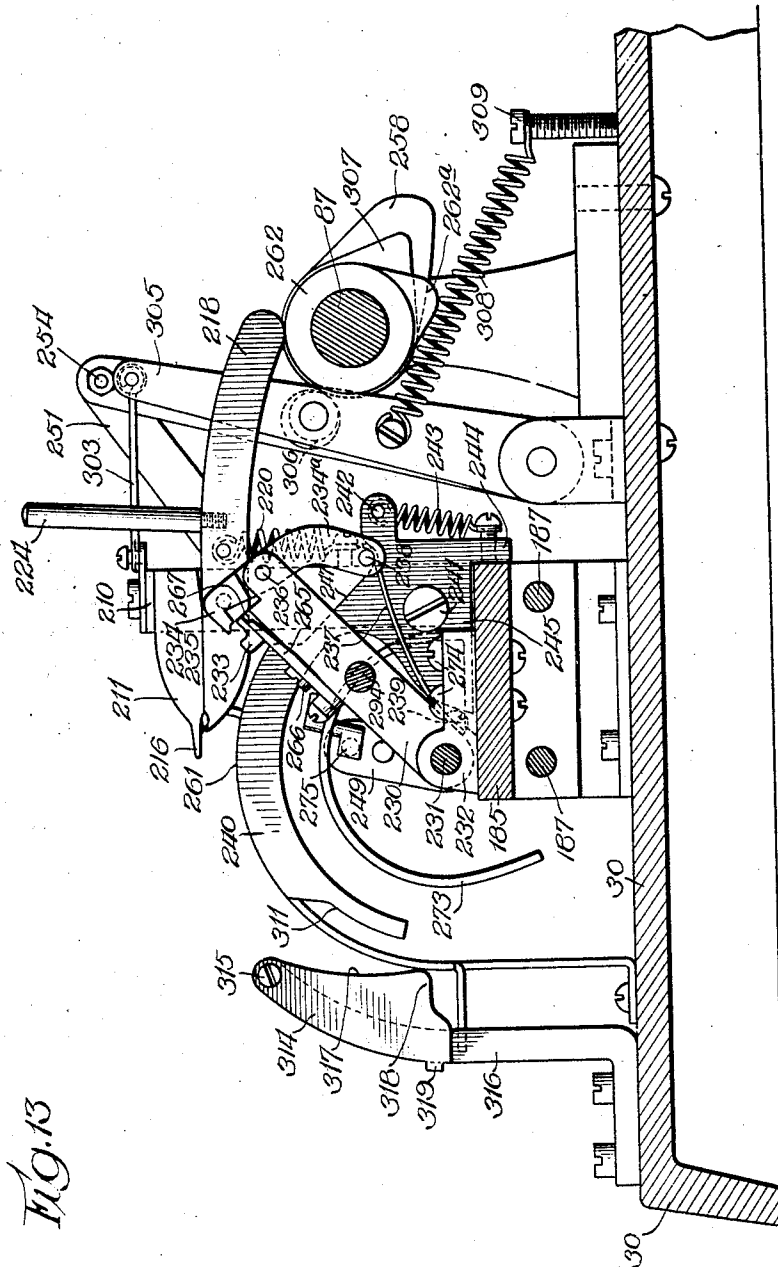


FIG. 13

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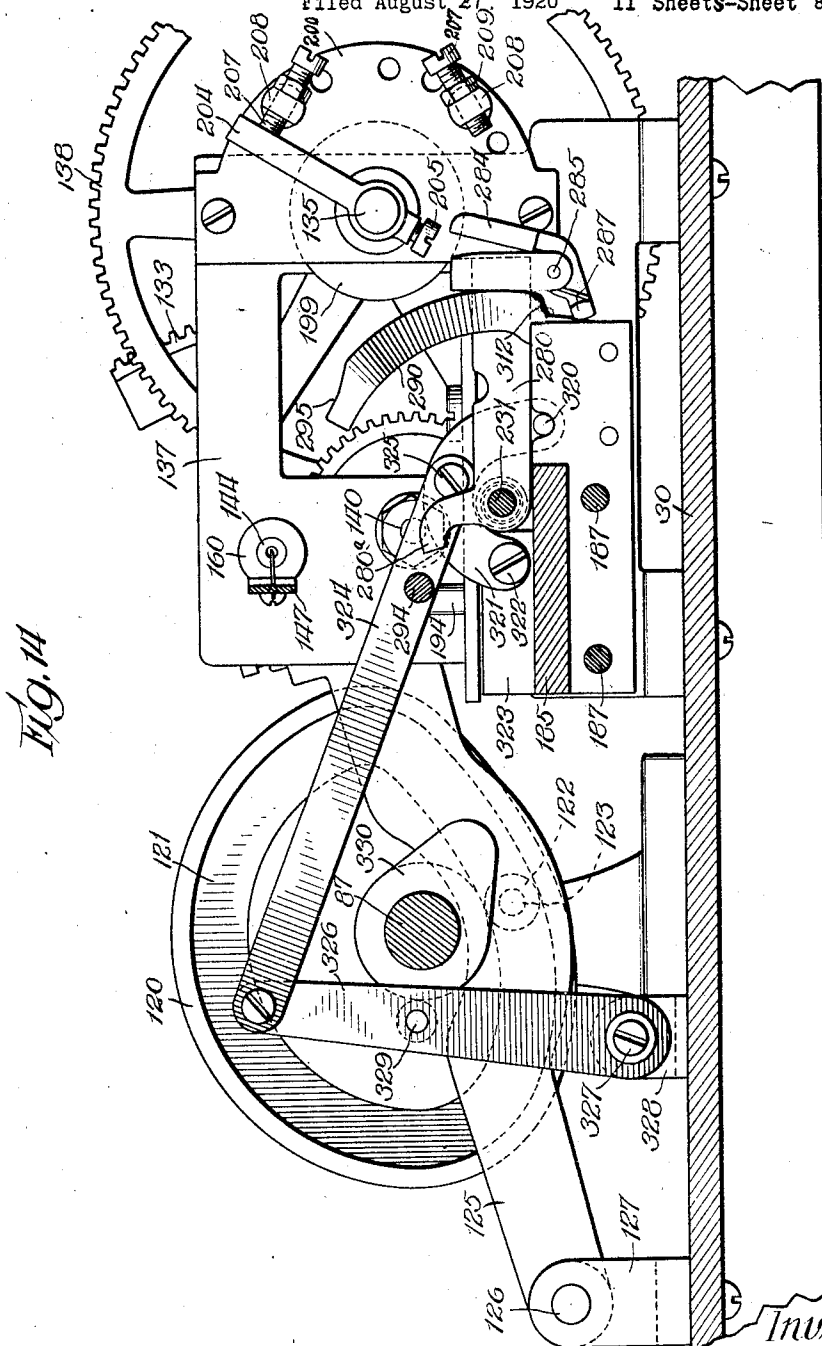
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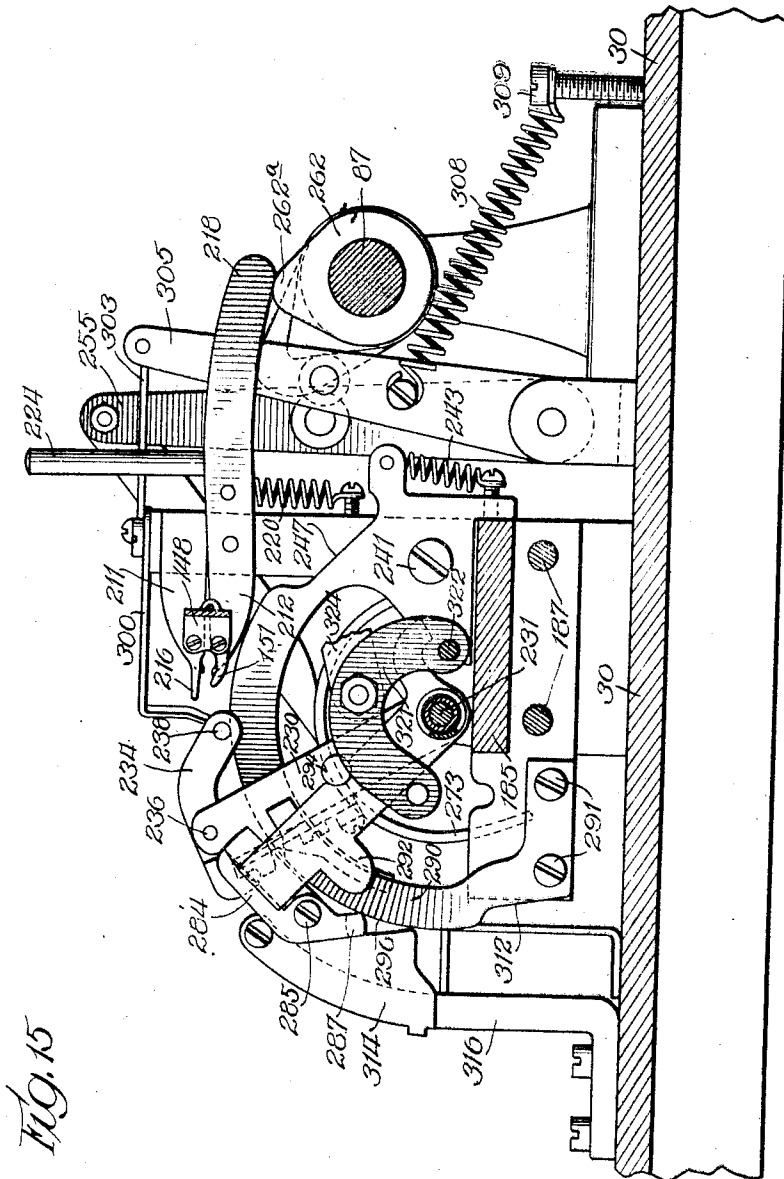


FIG. 15

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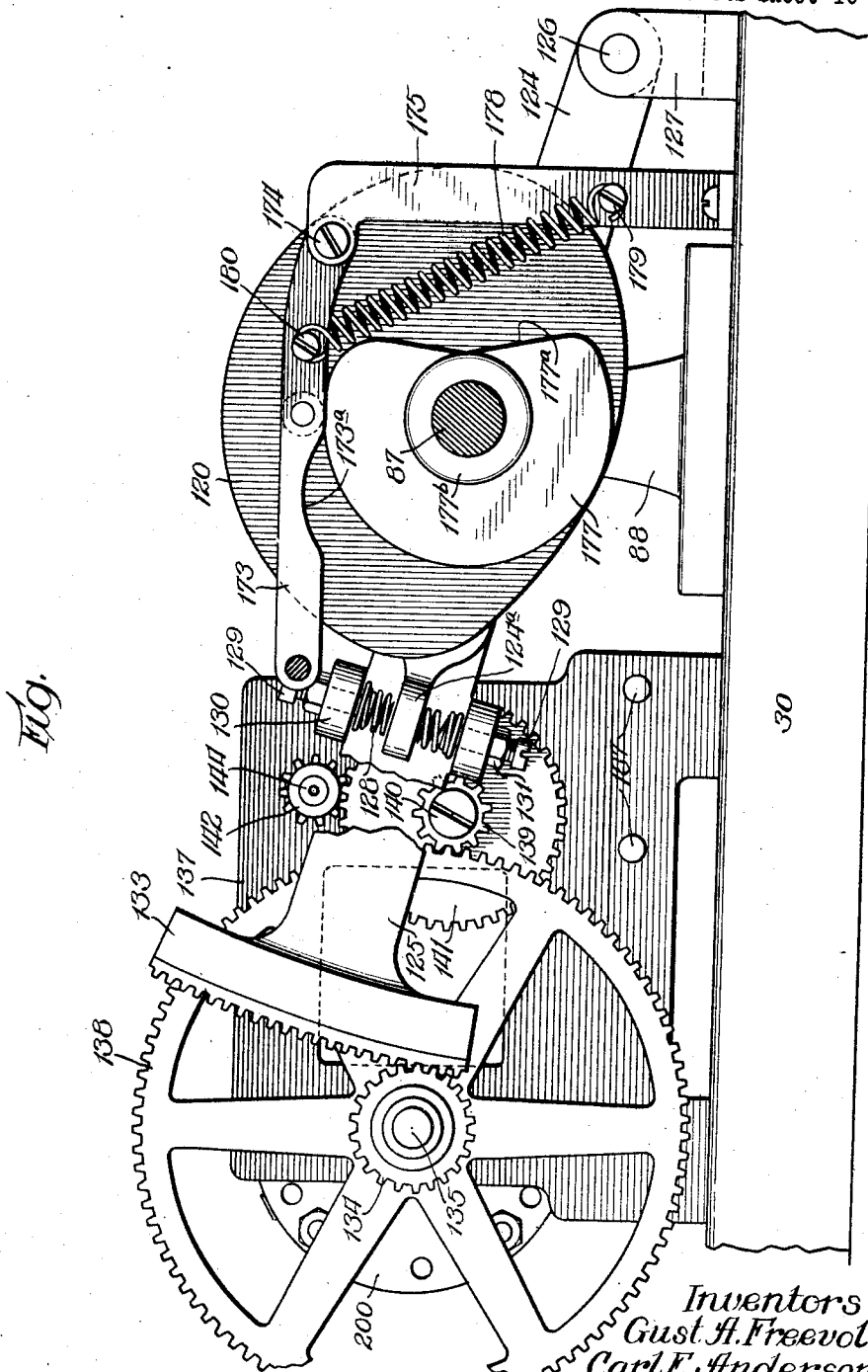
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WIRE WINDING MACHINE.

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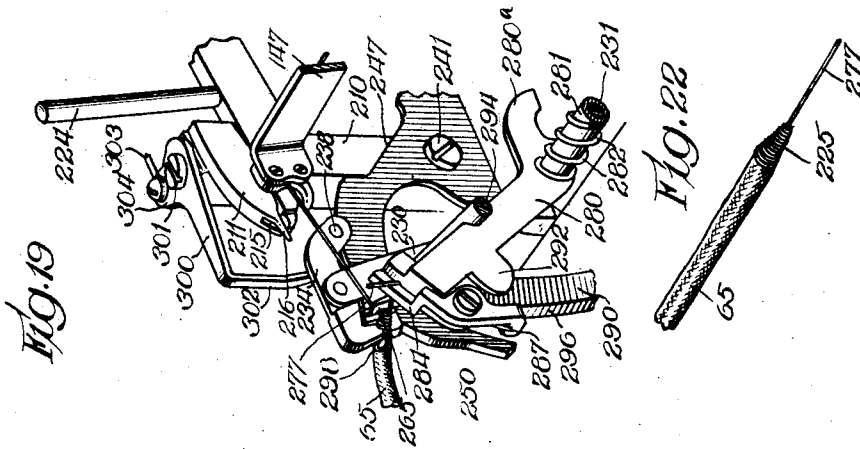
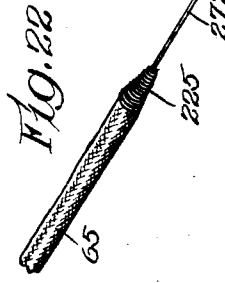
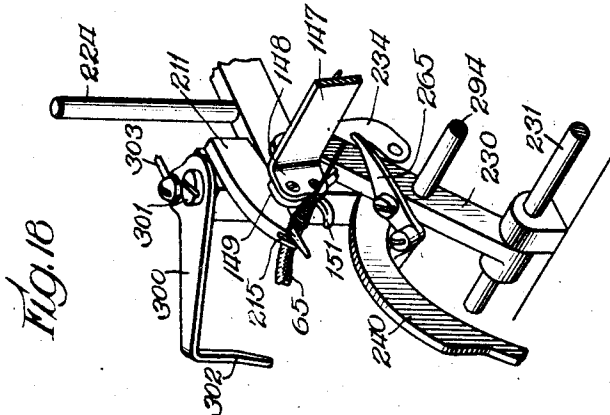
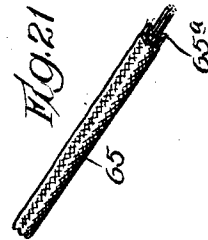
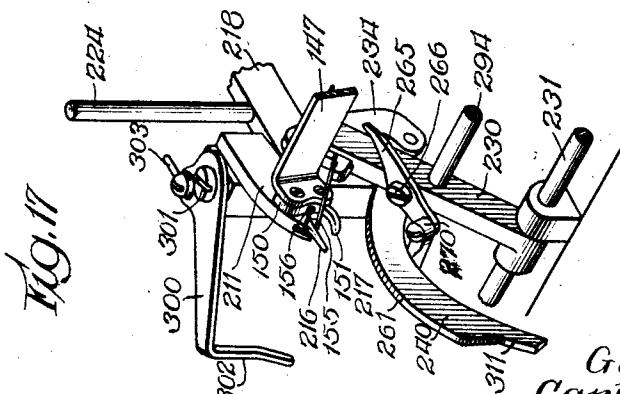
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WIRE WINDING MACHINE

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11 Sheets-Sheet 11



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UNITED STATES PATENT OFFICE.

CARL E. ANDERSON AND GUST A. FREEVOL, OF CHICAGO, ILLINOIS.

WIRE-WINDING MACHINE.

Application filed August 27, 1920. Serial No. 406,391.

This invention relates to improvements in machines for forming metallic tips on electric wires, and the like, and its purpose is to provide apparatus for automatically effecting the operations of stripping the ends of the wire of its insulation, and then effecting a spiral winding of wire thereon to form a metallic tip at the end of the insulation.

The principal object of the invention is to provide improved apparatus for effecting automatically and efficiently the operation of winding a metallic tip on an electric wire. A further object is to provide apparatus which is capable of operation at relatively great speed for effecting a continuous series of operations on electric wires, whereby the ends of the wires are provided with spirally wound metallic tips. A further object is to provide improved apparatus for stripping the end of the wire of its insulation. Still another feature is the provision of mechanism adapted to effect the operations of holding the insulated wire, winding a metallic tip of fine binding wire thereon, releasing the insulated wire from the holding means, cutting the fine binding wire after the winding operation has been completed, drawing out the free end of the binding wire in order to eliminate all slack in the part of the wire which has been wound, and returning all parts of the apparatus automatically to their initial positions for re-winding another insulated wire. Other objects relate to various features of construction and arrangement, which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification, taken in connection with the accompanying drawings, in which one embodiment is illustrated.

In the drawings—

Figure 1 shows a top plan view of the apparatus embodying the present invention;

Fig. 2 shows a transverse sectional view on the line 2—2 of Fig. 1, illustrating the stripping apparatus in elevation;

Fig. 3 shows an enlarged sectional view, similar to Fig. 2, illustrating the positions of the parts when they are in position to grip and strip an insulated wire;

Fig. 4 shows a vertical section on the line 4—4 of Fig. 3, looking in the direction of the arrows;

Fig. 5 shows a vertical section on the line 5—5 of Fig. 3, looking in the direction of the arrows;

Fig. 6 is a detail view, on the line 6—6 of Fig. 3, showing an end elevation of the holders for the stripping blades;

Fig. 7 shows a vertical section, taken on the line 7—7 of Fig. 3;

Fig. 8 is a detail vertical section on the line 8—8 of Fig. 6, showing the method of mounting the stripping blades in the holders;

Fig. 9 shows a detail sectional view on the line 9—9 of Fig. 1, looking in the direction of the arrows;

Fig. 10 shows a detail sectional view on the line 10—10 of Fig. 1, looking in the direction of the arrows;

Fig. 11 shows a longitudinal sectional view on the line 11—11 of Fig. 1, illustrating a side elevation of the major portion of the winding apparatus;

Fig. 12 shows a transverse sectional view on the line 12—12 of Fig. 1, looking in the direction of the arrows;

Fig. 13 shows a transverse sectional view on the line 13—13 of Fig. 1, looking in the direction of the arrows;

Fig. 14 shows a transverse sectional view on the line 14—14 of Fig. 1, looking in the direction of the arrows;

Fig. 15 shows a transverse sectional view on the line 15—15 of Fig. 1, looking in the direction of the arrows;

Fig. 16 shows a transverse sectional view on the line 16—16 of Fig. 1, looking in the direction of the arrows;

Fig. 17 shows a perspective view of the parts which enter directly into the holding and winding operations illustrating the position of the end of the fine wire in the apparatus and the relative positions of adjacent parts when they are in position to begin winding operations and just before the insulated wire is placed in position to be wound;

Fig. 18 shows a perspective view of the parts illustrated in Fig. 17 in the relative positions which they occupy in a succeeding stage of the operation immediately after the end of the insulated wire has been spirally wound by the fine wire;

Fig. 19 shows a perspective view, similar to those of Figs. 17 and 18, illustrating the

same parts and other associated parts of the mechanism in a succeeding stage of the operation, where the insulated wire has been released from the holding device and the free end of the fine wire which has been drawn out from the spool is about to be severed by the cutting blade;

Fig. 20 shows a perspective view of the end of an insulated wire before the stripping operation has been performed;

Fig. 21 shows a perspective view of the same insulated wire after the insulation has been stripped from the end thereof; and

Fig. 22 shows a similar perspective view of the end of the insulated wire after it has been spirally wound by the apparatus of this invention to form a metallic tip.

The apparatus, as illustrated in the drawings, is mounted upon a base plate 30, which may preferably be supported upon a table or the like, to permit the convenient operation of the mechanism. A casing 31 is secured to one end of the base plate by means of screws 32. This casing has a shaft 33 journaled therein and adapted to be driven by a worm gear 34 fixed thereon. This worm gear is driven by a worm 35, which is mounted in a cylindrical extension 31^a of the casing on a main driving shaft 37, journaled in bearings carried by the casing. A pulley 38 is fixed on the projecting end of the shaft 37, and this pulley is adapted to be driven by a belt connected to an electric motor or the like. All parts of the apparatus are driven from the shaft 37, either directly or through the worm 35 and worm wheel 34.

The stripping mechanism is actuated directly by the shaft 37, which projects from the casing 31^a at the end opposite the pulley 38. This part of the shaft has a transversely extending block 40 rigidly secured thereon, and this block is provided with notches 41 at its opposite ends adapted to receive the arms 42, which are pivoted thereon by means of pins 43. The longer ends of these arms which project away from the casing 31^a are normally forced together by means of a pair of coil springs 44, which are connected to the arms by means of screws 45. The closing movement of the arms 42 is limited by means of a pair of set screws 46, each of which engages one of the arms and is held in adjusted position by a lock nut 47. The inner extremities of these set screws are adapted to coact with the shaft 37, in order to limit the movement of the arms. The extremities of the arms 42, beyond the springs 44, are rigidly connected to transversely extending holding plates 48, which are provided with vertically extending recesses forming grooves adapted to receive the cutting or stripping blades 50. These blades are held in position on the holding plates 51, which are secured to the members 48, by means of screws 52. The meeting

ends of the holding plates and the clamping plates are provided with notches 48^a and 51^a, respectively, into which the cutting blades 50 project; and, when the insulated wire is inserted in position to register with these notches, the cutting blades are adapted to rotate with the shaft 37, and thus sever the insulation from the metallic wire. When the shaft is rotating, the centrifugal force created by its rotation operates normally to separate the holding members 48 against the tension of the springs 44, so that the arms 42 occupy the positions illustrated in Fig. 2, and when the operator desires to strip the end of the insulated wire, it is necessary to effect the closing of the blades by means of a sliding collar 54, having an inclined cam face 54^a formed on the end thereof to coact with the extremities of the arms opposite the cutting blades. The sliding collar is provided with transversely projecting pins 55, which are adapted to engage slots 56 formed in the U-shaped arms of a lever 57. This lever is pivoted at 58 on a supporting post 59 carried by the base plate 30, and it is actuated by a transversely extending lever arm 60, which may be secured thereto or formed integrally therewith. The double-armed lever 57 is normally held in the position illustrated in Fig. 2 by means of the coil spring 61, which is connected at its upper end to a screw 62 projecting from the lever 57 above its pivoted axis. At its lower end the coil spring is connected by a screw 63 to the base 59^a of the post 59.

When the operator desires to move the cutting blades into a position wherein they engage the insulated wire 65, as illustrated in Fig. 3, the lever arm 60 is moved downwardly by means of a chain 66, which extends through an aperture 67 in the base plate and is connected preferably to a pedal, which may be operated by the feet. This movement of the lever arm 60 moves the collar 54 outwardly on the shaft 37, and the inclined face 54^a of the collar serves to move the arms 42 about their pivots and thereby move the cutting blades together.

The electric wire 65 is held in position during the stripping operation by means of a pair of pivoted holding arms 68, of the form illustrated particularly in Fig. 4. These arms are pivotally mounted on screws 69, which are carried by an upwardly extending plate or frame member 70 secured to the base 30 by means of screws 71. This supporting plate is provided with a vertical slot 72, through which the lever arm 60 is adapted to project, and the downward movement of this lever arm is limited by means of a threaded stop member 73, which engages apertures in the base plate 30 and in the lower flange 70^a of the supporting plate, being held in adjusted position by means of lock nuts 74.

The upper ends of the arms 68 are curved inwardly toward each other and are provided with registering notches 75, which are adapted to engage the insulated wire 65 and hold it during the stripping operation. The upper ends of these arms are normally forced apart by means of a coil spring 76, which is mounted between them, but they are brought into position to engage the insulated wire by the action of the lever arm 60, which, when it moves downwardly, engages the cam faces 77 which are formed on the lower extremities of the holding arms. The inward movement of the upper ends of the holding arms, due to the downward movement of the lever 60, is limited by means of a pair of pins 78 which project outwardly from the plate 70 and engage slots 79 formed in the holding arm 68. The insulated wire is adapted to be supported in a position wherein it will be engaged by the notches 75 of the holding arms by means of a plate 80, which is secured to the supporting plate 70 by screws 81 and mounted in a position wherein its upper edge terminates slightly below the registering notches 75. The inward movement of the insulated wire 65 between the holding arms 68 is limited by means of a stop member 83, which threadedly engages the end of the shaft 37, as shown in Fig. 3. The stop member is held in adjusted position by means of a lock nut 84, and the end thereof is hollowed out, or recessed, as shown in 83^a, so that the end of the electric wire is automatically centered in line with the axis of the shaft 37. By adjusting the position of the stop member it is possible to regulate the length of insulation which is stripped from the wire by the action of the rotating blades 50.

The shaft 37 operates continuously during the operation of the apparatus, and the arms 42, which carry the stripping blades, normally occupy the position illustrated in Fig. 2. When the operator is about to strip the insulated wire of a portion of its insulation, the end of the wire is inserted between the holding blades 68 above the supporting plate 80 until the end of the wire engages the recess 83^a in the stop member 83. The operator then presses downwardly on the pedal and causes the lever arm 60 to be lowered. The lowering of this lever arm brings the holding arms 68 into engagement with the wire 65, and shortly thereafter the cutting blades 50 are brought into engagement with the insulation by the action of a collar 54, which slides longitudinally on the shaft 37. The inward movement of the cutting blades 50 is somewhat gradual, due to the gradual inclination of the inclined surface 54^a, so that the rotating blades 50 gradually sever the insulation from the wire and it is pulled off the wire when the operator holds the body portion

of the wire out between the holding arms 68. The cutting blades may be adjusted in any desired position between the plates 48 and 51, and the blades may further be adjusted to engage any size of wire or thickness of insulation by regulating the adjusting screws 46. After the end of the wire has been stripped of its insulation, it is ready to be wound with fine wire to form a metallic tip by means of the mechanism hereinafter described.

The shaft 33, which is journaled in bearings carried by the casing 31, has a pinion 35 secured to the projecting end thereof, and this pinion is adapted to drive a gear 86, rotatably mounted upon an intermediate shaft 87, which extends longitudinally of the apparatus and is journaled in bearings 88 carried by the base plate 30. A ratchet wheel 90 is secured to the gear 86 by means of screws 91, and a driving connection is adapted to be formed between the gear 86 and the shaft 87 through a pawl 92, which is pivoted at 93 on a driving arm 94 rigidly secured to the shaft 87. A coil spring 95 is connected to the pawl and the driving arm at the points 96 and 97, respectively, so that the pawl is normally forced into engagement with the teeth of the ratchet wheel, and when in this position the longitudinal shaft 87 is driven by the gear 86 and the driving pinion 85.

A collar 98 is secured to the end of the shaft 87, and a coil spring 99 is mounted between this collar and the face of the gear, in order to force the gear and its ratchet wheel toward the fixed driving arm 94. The cam 92 is provided on its under side with a curved notch or recess 92^a, which is adapted to be engaged by a pin 100 projecting from an arresting arm or lever 101. This lever is pivotally mounted on the shaft 87, between the arm 94 and the adjacent bearing 88, and it is provided with a lower depending arm 101^a, which is pivotally connected at 102 to a crank rod 103. This connecting rod is actuated by the crank arm 104, which is secured to a shaft 105 journaled in a bearing bracket 106, carried by the base plate 30. An upwardly extending hand lever 107 is secured to the end of the shaft 105 opposite the crank arm, and this hand lever has a downwardly extending projection 107^a, as illustrated in Fig. 12, which is adapted to engage the base 30 and limit the downward swinging of the lever under the influence of a coiled spring 108, which is mounted on the shaft 105, with its extremities engaging the base plate of lever 107, in the manner illustrated in Fig. 1. This spring tends to cause the lever to occupy the normal position illustrated in Fig. 12, and this corresponds to the position of the arresting lever 101, illustrated in Fig. 2. The position occupied by the arresting lever,

or the limit of movement thereof, is determined by an adjusting screw 110, which threadedly engages a bracket 111, secured to the base plate 30 by means of screws 112.

5 This adjusting screw is secured in position by a lock nut 113, and it has a coiled spring 114 mounted thereon, between the bracket 111 and the lower end of the lever 101.

After the driving arm 84 has completed
10 one revolution with the pawl 92 engaging the teeth of the ratchet wheel 90, the pawl automatically rides up over the pin 100 and remains stationary, supported by this pin, while the gear and ratchet wheel continue
15 to rotate. When the operator wishes to set the longitudinal shaft 87 in operation, the hand lever 107 is moved toward the right, as viewed in Fig. 12, thereby causing the pin 100 to ride out from beneath the tooth of
20 the pawl 92, which then moves into engagement with the teeth of the ratchet wheel under the influence of the spring 95. The operator then releases the hand lever, which returns to its normal position under the
25 influence of the spring 108.

The principal parts of the winding mechanism are actuated through a cam 120, which is fixed on the longitudinal shaft 87. This
30 cam is of the form illustrated particularly in Fig. 14, being provided on its lateral side with an annular groove 121, of irregular curvature, which is adapted to be engaged by a roller 122, mounted on a pin 123 carried by the intermediate lever 124. This intermediate lever is mounted adjacent an actuating lever 125, and both levers are pivoted, at 126, on a bracket 127 carried by the base plate 30. The intermediate lever terminates in a transverse flange 124^a, which is
40 adapted to be engaged on its opposite sides by springs 128 seated on the ends of adjusting screws 129. These adjusting screws engage the transverse ears or flanges 130 which are formed on the actuating lever 125, and
45 are held in adjusted position by means of lock nuts 131. The springs provide a resilient connection between the intermediate lever and the actuating lever, and the screws 129 serve as stops to limit the relative movement of the two levers. The actuating lever carries a rack bar 133 at its end, and this rack bar is adapted to drive a pinion 134, fixed on a countershaft 135. This countershaft is journaled in a bearing 136, formed
55 in a vertical frame 137, which is secured to the base 30. A relatively large gear 138 is secured to the countershaft adjacent the pinion 134, and this gear is adapted to drive a pinion 139, journaled on a stub shaft 140 carried by the frame 137. A gear 141 is mounted to rotate with the pinion 139, and this larger gear drives a small pinion 142, which is fixed on the winding spindle 144. This winding spindle is journaled in an
60 elongated bearing 145, which extends later-

ally from the frame 137, and the end thereof of opposite the pinion 142 carries the fixed hub 146 of the winding arm or finger 147, which extends longitudinally therefrom, terminating in a transversely bent portion 70 148.

A guiding member 149 is secured to the part 148, and both of these members are provided with alining curved notches 150, located in alinement with the axis of the 75 winding spindle and adapted to travel around the end of the insulated wire during the process of winding. The guiding member 149 has a curved hook 151 which extends outwardly from the lower part 80 thereof, as viewed in Figs. 17, 18, and 19. The fine binding wire 155, by which the metallic tip is formed on the insulated wire, is brought out through an aperture 156, which is formed in the guiding member 149 85 at the bottom of the recess 150. The wire 155 is led to the aperture 156 through the guiding member from the back of the winding finger 147, where it passes through a guide 157 carried by the winding arm. The 90 wire is led to the guide through an aperture 158 which is formed in the winding arm, as illustrated in Fig. 11, and the wire is led to the aperture 158 through an axial opening 95 160 which extends longitudinally through the winding spindle 144. From the outer end of the winding spindle the wire 155 extends longitudinally, and the supply thereof is wound on a spool 162, which is mounted on a shaft 163, carried by a bracket 164 100 secured to and extending longitudinally from the base plate 30. A detachable collar 164^a is secured to the end of the shaft 163, to permit the spool of wire to be replaced by a new supply. 105

The rotation of the spool 162 is controlled by a flat spring 165, which coacts with the drum 166 formed on the end of the spool. This spring is carried by an arm 167, which is pivoted at 168 on the bracket 164, as 110 shown at Fig. 10. An adjusting screw 169 threadedly engages the projecting end of the arm 167 and coacts with the bracket to permit regulation of the pressure of the spring on the drum of the spool. The wire 115 155 is supported between the spool 162 and the spindle 144 by a guide member 170, which is secured to the bracket 164.

During each winding operation of the spindle 144 and the winding arm 147, the 120 wire 155, in the region between the winding spindle and the guide 170, is pulled downwardly by means of an arm 171, which is provided with an aperture 172, through which the wire passes. This arm is carried 125 by a lever 173, which is pivoted at 174 on a bracket 175 secured to the base 30. A transverse pin 176 projects from the lever 173 and coacts with a cam 177, secured on the longitudinal shaft 87. This pin is main- 130

tained in contact with the cam by means of a coiled spring 173, which is connected to two screws 179 and 180 carried by the bracket 175 and the lever 173, respectively.

5 The cam 177 is of the form illustrated particularly in Fig. 16, being provided with a recess 177^a on one side thereof. When the recess reaches the proper position, it permits the lever arm 173 to move downwardly under the influence of the spring 173, thereby causing the arm 171 to press the wire 155 downwardly and draw a new supply of wire from the spool 162. The lever 173 is notched, as shown at 173^a, to permit it to clear the hub 177^b of the cam when the lever is in its lower position. After continued rotation of the cam, the lever is elevated to the position shown in Fig. 16, thereby creating a slack in the wire 155, which can be drawn up through the winding arm in the manner hereinafter described.

The insulated wire 65 is held and manipulated during the process of winding by means of mechanism mounted on a sliding plate or carrier 185. This carrier has depending ears or flanges 186, which are slidably mounted on a pair of guide rods 187. These guide rods are supported in horizontal positions at one end by the frame 137, and at the other end by a bracket 188 which extends upwardly from the base 30. Coil springs 189 are mounted between the bracket and the adjacent ears 186, and these springs tend normally to move the carrier 185 toward the right, as viewed in Figs. 10 and 11. The carrier is moved periodically toward the left and against the compression of the springs 189 by means of a lever arm 190, which is pivoted at 191 on a flange 192, carried by the frame 137. This lever arm is provided at one end with a longitudinal slot 193, which is engaged by a headless screw 194 secured to the carrier. This screw extends through a slot 195 in the carrier, and is engaged above and below the carrier by washers 196 and nuts 197, so that the guiding screw 194 can be adjusted transversely of the plate to regulate the travel of the carrier with a predetermined angular movement of the lever 190. The end of the lever opposite the slot 193 is provided with an upwardly projecting lug 198, adapted to coact with the curved end face of a cam 199 mounted on the shaft 135. This shaft, as previously described, is journaled in a bearing carried by the frame 137, and is also supported by a bearing formed in a vertical plate 200 secured to the ends of integral arms 201 which extend longitudinally from the frame 137.

The cam 199 is secured to the shaft between the frame 137 and the plate 200, and its angular position on the shaft may be regulated by a set screw 202. The end of the shaft 135, which projects beyond the plate

200, carries a radial stop arm 204, which is secured thereto by a set screw 205. This stop arm is adapted to coact in certain positions with the screws 207, which threadedly engage lugs 208 carried by the plate 200. These set screws form stop members which may be secured in adjusted positions by the lock nuts 209, and they serve to determine the limits of travel of the stop arm and the corresponding angular movement of the shaft 135.

The movable carrier 185, which is actuated in the manner heretofore described, supports a vertically extending fixed post 210, which has mounted thereon a fixed jaw 211 and a movable jaw 212, both of which extend transversely of the machine and are provided at their ends with alining notches or recesses 214, which are adapted to aline with the notches 150 in the end of the winding arm 147, and also with the axis of the winding spindle 144. The upper fixed jaw 211 is provided with a vertical slot 215 at the end thereof, and one wall of this slot terminates in a forwardly projecting tooth 216. The fine wire 155, by which the metallic tip is formed, is adapted to be looped around this tooth at the initial stage of the winding operation, as shown in Fig. 17, and at this stage of the operation the guiding member 149, carried at the end of the winding arm, is adapted to lie in close contact with the lateral sides of the jaws 211 and 212. The lower jaw 212 is provided with a rearwardly extending arm 218, and it is pivoted on the post 210 by means of a pin or screw 219. A coil spring 220 is attached to a screw 221, carried by the post 210, and the upper end of the spring is connected to the arm 218 at 222, so that the lower jaw 212 is normally held in closed position, as shown in Fig. 12.

A handle 224 extends upwardly from the arm 218, so that the jaws can be opened to permit the insertion of the insulated wire 65 between them in the manner illustrated in Fig. 18. It will be understood that the insulated wire 65, which initially has the appearance illustrated in Fig. 20, is first stripped at its end by the mechanism heretofore described, so that the end thereof then has the appearance illustrated at 65^a in Fig. 21. This projecting end 65^a, having the insulation stripped therefrom, is arranged to project beyond the jaws 211 and 212 into the notches 150 formed above the projection 151 at the end of the winding arm.

After the fine wire 155 has been looped around the tooth 216, as shown in Fig. 17, and the insulated wire has been placed between the jaws in the manner just described, the rotation of the winding arm 147 operates to form a spiral winding 225 on the end of the wire, as shown particularly in Figs. 18, 19, and 22, where the spiral winding is shown in the different stages of completion. Dur-

ing this winding operation the carrier is gradually moved toward the left, as viewed in Fig. 11, due to the operation of the cam 199 and the lever arm 190, thus advancing the insulated wire progressively as the fine wire is wound around it by the rotation of the winding arm 147.

After the fine binding wire 155 has been spirally wound around the insulated wire at the end of the part which has been stripped, it is automatically released from the jaws 211 and 212 by means of certain mechanism illustrated particularly in Figs. 13 and 15, where it is shown in the two different stages of its movement. This mechanism comprises a releasing arm 230, which is secured on a shaft 231 journaled in brackets 232 carried by the sliding carrier 185. This releasing arm is provided at its upper end with a forwardly projecting fixed jaw 233 and with a movable jaw 234 forming a wire-receiving recess 235, which is adapted to aline with the notches 214 in the jaws 211 and 212 when the releasing arm reaches the proper position in its travel. The movable jaw is pivoted on the upper end of the releasing arm at 236, and this jaw is normally held in its open position by means of a wire spring 237, which is keyed around a pin 238 projecting laterally from the extremity of the arm 234^a, and which is connected at its other end to the releasing arm 230 by means of a screw 239.

During the travel of the releasing arm 230 the movable jaw 234 is guided by a pivoted cam member 240, which is mounted to rock about a pivot 241 carried by the post 210. An arm 242 extends rearwardly from the cam, and is connected to the sliding plate or carrier 185 by a spring 243, which normally holds the cam member in the position illustrated in Fig. 13. A lug 244 extends downwardly from the cam member to engage the rear side of the carrier 185, and the forward tilting of the cam member in opposition to the spring 243 is limited by the engagement of the lower extremity 245 thereof with the upper surface of the carrier. The rear portion of the cam member 240, which curves upwardly and forwardly substantially concentric with the shaft 231, is provided along its upper edge with a notch 247, which is engaged by the pin 238 when the releasing arm is in its normal position, as illustrated in Fig. 13.

The releasing arm 230 is actuated to move toward the left, as viewed in Fig. 13, by means of a crank arm 249, secured on the shaft 231 by means of a set screw 250. A connecting rod 251 is pivotally connected to the crank arm at 253, and the other end of this connecting rod is pivotally attached, at 254, to an upwardly extending operating lever 255. This lever is pivoted on a bracket 256, carried by the base 30, and it carries a

pivoted roller 257 which is adapted to contact with a cam 258 secured on the longitudinal shaft 87. When the projecting part 258^a of this cam comes in contact with the roller 257, the crank arm 249 is moved toward the right, as viewed in Fig. 12, thereby rocking the releasing arm 230 to the left, as viewed in Fig. 13. The roller is maintained in contact with the cam 258 by means of a coil spring 259, which is connected to the lever 255 and to a screw 260 carried by the base plate.

As the releasing arm 230 reaches a position wherein the wire-receiving recess 235 registers with the wire-receiving notches in the jaws 211 and 212, the pin 238, carried by the jaw arm 234^a, rides up on the curved surface 261 of the cam 240, thereby closing the jaws 233 and 234 upon the insulated wire 65, which has just been spirally wound with the fine binding wire 155 at its end. At the same time the insulated wire is automatically released from the jaws 211 and 212 by means of a cam 262, secured on the shaft 87. The major portion of this cam is concentric with the shaft, so that during a large part of the cycle of movement of the apparatus the extremity of the arm 218 rides upon the circular portion of the cam and permits the jaw 212 to remain in its closed position under the influence of the spring 220. When the insulated wire is seized by the releasing jaws 233 and 234 the jaw arm 218 rides up on the projection 262^a of the cam, thus opening the movable jaw 212 and permitting the insulated wire 65 to be carried in a forward direction by the releasing jaw as the releasing arm continues its forward movement.

As the releasing arm moves in a forward direction from the holding jaws 211 and 212, the spirally wound tip 225, which is formed on the insulated wire, is still connected to the supply of fine wire 155, which is led thereto through the winding arm, and the forward movement of the insulated wire away from the winding arm serves to draw out from this arm a new supply of fine wire, thus taking up the slack which was created in the fine wire during the winding operation by the downward movement of the arm 171, controlled by the cam 177. When a suitable length of wire has been drawn out from the end of the winding arm, this wire is cut off by means of a knife 265, which is pivoted at 266 on the front face of the releasing arm 230. The upper end of this knife blade is adapted to enter and contact with a groove or recess 267 formed in the side face of the lower fixed releasing jaw 233. The wire which is drawn out from the end of the winding arm extends across this groove, and at a suitable point in the operation of the mechanism the knife 265 is moved inwardly across the groove, thereby

cutting the wire. This cutting movement of the knife is effected by means of an operating arm 268, which is pivotally connected to the lower end of the knife, as shown at 5 270. This arm is provided with an offset portion 271, adapted to travel in a cam slot 272, formed in the curved plate 273, which is secured to the carrier 185 by means of screws 274. The other end of the actuating arm 268 extends beneath the curved plate, and is provided with a cylindrical extremity 275, adapted to form a sliding engagement with the upper end of the crank arm 249. The actuating arm is thus moved by 10 the releasing arm 230 and the crank arm, and is guided by the cam slot 272. At a suitable point in its travel this cam slot guides the actuating rod toward the right, as viewed in Fig. 11, thereby causing the wire-cutting blade 265 to engage the notch 267 and sever the wire.

After the fine wire 155 has been severed from the supply wire which leads from the winding arm, and while the insulated wire 25 65 continues to be held by the releasing arm 230, there is brought into action a wire-pulling device, which is adapted to seize the free end 277 of the fine wire which has been wound around the end of the insulated wire. 30 This free end was initially looped around the tooth 216 of the holding jaw 211, as illustrated in Fig. 17, and, after the spiral winding 225 has been formed, this loop still remains around the tooth, as illustrated in Fig. 18. It is then necessary to seize the 35 free end of this wire, which lies within the spiral winding and parallel to the insulated wire, in order to remove the loop. This operation is effected by means of a wire-drawing arm 280, carried by a sleeve 281, which 40 is slidably and rotatably mounted upon the shaft 231. A coil spring 282 is mounted on the sleeve, between the arm 280 and one of the bearing brackets 232 in which the shaft is journaled, and serves normally to 45 force the sleeve and wire-pulling arm 280 toward the left, as viewed in Fig. 11.

The upper curved extremity of the wire-pulling arm is provided with a longitudinal notch or recess 283, which is adapted to be 50 engaged by a holding arm or jaw 284, pivoted at 285 on the side of the arm 280. The spring 286 is mounted on the pivot pin 285, and engages a transverse lug 287 on the projecting end of the holding arm 284, so that the upper jaw of this holding arm is normally held in its open position. The jaws 55 of the wire-pulling arm are controlled by a guiding cam 290, which is secured by a screw 291 to one of the depending flanges 186 of the carrier 185. This guiding cam is curved forwardly and downwardly, as shown in Fig. 14, and it is also curved longitudinally toward the right, as viewed in 60 Fig. 11.

The pulling arm 280 is provided with a projection 292, which is adapted to coact with the cam 290 and cause a movement of said arm longitudinally of the shaft 231, as the arm is moved in a forward direction. The 70 pulling arm is moved in a forward and downward direction by the shaft 231 by means of a rod 294, which projects laterally from the releasing arm 230. The lug 287, which is formed on the end of the pivoted jaw or 75 arm 284, is adapted to coact with the upper surface of the cam 290, and when this engagement first begins the projection 287 is adapted to ride in a depressed portion 295 of the cam. When the cutting blade 265 is 80 actuated by the rod 263 to sever the wire, as illustrated in Fig. 19, the projecting lug 287 of the jaw 284 rides up on the curved surface 296 of the cam 290, and causes the jaw to grip the wire against the walls of 85 the slot 283, which operation is illustrated particularly in Fig. 19. As the forward movement of the arm 280 is continued, the insulated wire 65 is still gripped firmly by the jaws 233 and 234 of the releasing arm, 90 since the projecting pin 238 of the jaw 234 continues to ride upon the upper curved surface 261 of the cam 240, but the arm 280 has a simultaneous longitudinal movement, due to the action of the cam 290, and thus 95 causes the loose end 277 of the fine wire, at 155, to be drawn longitudinally of the insulated wire, thereby eliminating or drawing out the small loop 298, which previously occupied a position around the tooth 216 during the process of winding. 100

During the movement of the arms 230 and 280, and after these arms have moved to a sufficient extent to effect the cutting of the wire and the provision of sufficient clearance 105 between the jaw 234 and the end of the winding arm, the free end of the wire 155, between the aperture 156 and the end of the winding arm and the point where the wire has been cut by the knife 265, is bent around 110 towards the right, as viewed in Fig. 11, until it occupies a position substantially parallel to the winding arm 147. This operation is effected by means of a bending arm 300, which is pivotally mounted at 301 upon the 115 upper end of the post 210. This arm carries a depending hook 302, which extends downwardly and is adapted to sweep around the ends of the jaws 211 and 212, and around the end of the projection 151 of the winding arm until the free end of the wire 155 occupies a position parallel to the arm 147. 120 The arm 300 then returns to the normal position illustrated in Fig. 17, and is actuated by a connecting rod 303, which is pivotally connected to a projection 304 thereon. This connecting rod 303 extends rearwardly, and is pivotally connected to the upper end of the operating lever 305. This lever is pivotally mounted on the bracket 256, by which 125 130

the lever 245 is supported, and it carries a transversely projecting roller 306, adapted to coact with a cam 307 mounted on the shaft 87. This cam normally causes the bending arm 300 to occupy its normal position. When the projection 307 engages the roller 306, the bending arm is moved around its pivot to engage the projecting end of the wire 155. The roller is maintained in contact with the cam 307 by means of a spring 308, which is connected to the lever and to a screw 309 projecting upwardly from the base.

While the bending arm is performing its function, the arms 230 and 280 continue their downward movement until the projecting pin 238, carried by the jaw 234, passes out of engagement with the curved surface 261 of the cam 240 and enters the depressed portion 311 of the cam. This movement of the pin permits the jaw 234 to open, due to the action of the spring 237, and at the same time the holding jaw 284 of the pulling arm is opened by the spring 286, due to the engagement of the lug 287 with the lower recessed portion 312 of the cam 290. The insulated wire 65, provided with its spirally-wound tip, and the projecting end of the wire which has been drawn out by the pulling arm are thus automatically released by the jaws which have been holding them, and they are free to drop therefrom. The removal of the wire 65 from the jaws is ensured by means of a toggle member 314, which is pivoted at 315 on an arm 316 extending upwardly from the base 30. This toggle member has a curved face 317, which normally occupies a position in the path of travel of the insulated wire 65, and as this wire is moved downwardly by the arm 230 the toggle member is pushed outwardly until the wire passes beneath the portion 318 thereof. The toggle member then returns by gravity to its normal position, with the hook member overlying the insulated wire, the inward movement of the toggle member being limited by a lug 319, which projects over the outer face of the arm 316. When the wire 65 has been released by the jaws 211 and 212 and the jaws 233 and 234, the arm 230 begins its return movement, and the wire 65 is then positively forced out of engagement with the jaws by the toggle 314, in case the wire has not already dropped by gravity.

As the arm 230 continues its return movement the cutting blade 265 is again opened by the engagement of the actuating rod 268 with the cam slot 272, so that the projecting end of the cutting blade is adapted to pass beyond the intumed end 148 of the winding arm 147 as the releasing arm 230 passes between the end of the winding arm and the holding jaws 211 and 212. During the time that the releasing arm is performing its forward and return movements, the winding arm 147 remains stationary, due to the fact that the roller 122 is then engaging a portion of the cam 120, which permits the lever 125 and the rack bar 133 to remain substantially stationary while the shaft 87 continues to rotate and actuate the holding, cutting and bending arms.

As soon as the releasing arm 230 has returned to a position rearwardly of the winding arm, the rack bar 133 begins its upper movement, thus causing the winding arm to continue its rotation and causing the shaft 135 to renew its actuation of the cam 199, thereby returning the carrier 185 to the right, as viewed in Fig. 11, due to the operation of the lever 190. The return motion of the carrier is continued by the cam until the wire-holding member 149, at the end of the winding arm, occupies a position substantially in contact with the side faces of the holding jaws 211 and 212. During this movement of the carrier 185 the arms 230 and 280 remain substantially stationary, except for their bodily movement with the carrier.

When the wire-holding member 149 has engaged the side faces of the holding jaws 211 and 212, it will be found that the stop arm 204 is engaging the upper stop screw 207, and that the rack bar 133 has reached the upper limit of its travel. The arm 97, which drives the shaft 87, through the engagement of the pawl 92 with the ratchet wheel 90, will also have completed one revolution, so that the recess 92^a in the pawl will again engage the pin 100 carried by the arm 101, thereby releasing the pawl from the ratchet wheel and arresting the operation of the mechanism, except for the continued operation of the stripping apparatus, which is operated directly by the shaft 37.

The parts are then in readiness for another operation of stripping and winding the end portion of the insulated wire. After the wire has been stripped in the manner described, it is placed between the holding jaws 211 and 212, and the operation, as previously described, continued until the winding operation is completed. At some point during the winding operation, and before the insulated wire has been carried in its forward movement by the arm 230, the pulling arm 280 is returned to its upper position by means of a rod 320 which extends longitudinally from a curved lever 321, pivoted at 322 on the upper projection 323 of the carrier 185. This lever is actuated by a connecting rod 324, which is pivotally connected to the central part thereof, as shown at 325, and attached at the other end to the upper end of the lever arm 326. This lever arm is pivoted at 327 on a bracket 328 carried by the base 30, and an intermediate

portion of the lever is provided with a roller 329 adapted to coact with a cam 330, fixed on the shaft 87. This lever 321 normally assumes, by gravity, the position illustrated in Fig. 14, but during the winding operation the projecting portion of the cam engages the roller 329 and causes the rod 320 to push the arm 280 upwardly and force the projecting lug 287 of the jaw 284 over the shoulder at the lower end of the curved portion of the cam 290. The return movement of the lever 280 is limited by the engagement of the projecting arm 280^a thereof with the upper surface of the carrier 185, and when this position is reached the lug will engage the depressed portion 295 of the cam 290, and thus allow the jaw 284 to assume an open position, in readiness to engage the free end 277 of the fine wire 155, when this end portion is carried in a forward direction by the jaws 233 and 234. The mechanism in the region of the cam slot 272 is protected by a guard plate 332 and a similar guard 333 is mounted over the stripping apparatus.

The operation of the apparatus, which is doubtless clear from the foregoing description, may be briefly summarized as follows: The shaft 27 rotates continuously and the spring blades carried by the arms 42 are held apart by the action of centrifugal force, the opening movement of the arms being limited by the springs 44 and by the engagement of the ends of the arms with the collar 54. The operator inserts the end of the insulated wire 65 between the holding arms 68 and above the supporting member 86, these arms being normally spread apart by the action of the spring 76. After the end of the wire has been brought into engagement with the recess 83^a of the stop member 83, the operator causes the chain 66 to be pulled downwardly, thereby lowering the lever 60, closing the holding arms 68, and causing the collar 54 to slide in a forward direction and close the stripping blades 50 upon the wire 65. The insulation is thus cut from the wire, and is removed therefrom when the wire is pulled out from between the jaws. When the operator releases the chain 66, the parts of the stripping apparatus are automatically returned to their normal positions, as illustrated in Fig. 2, by the action of the spring 61. The operator then separates the holding jaws 211 and 212, by pulling in a forward direction on the handle 224. The wire 65 is then passed into engagement with the notches 214 of these jaws, with the stripped end portion thereof projecting over the projecting part 151 of the wire-holding member 149 and in register with the notches 150 at the end of the winding arm 147. Before placing the insulated wire in this position, the fine wire 155 is looped around the tooth 216, as illus-

trated in Fig. 17. The parts are then in readiness for the winding operation, which is begun by manually manipulating the hand lever 107, in order to actuate the arm 101 and permit the pawl 92 to ride over the pin 100, so that it will be permitted to pass into engagement with the teeth of the ratchet wheel 90. The shaft 87 is then rotated by the ratchet wheel, and the levers 124 and 125 operate the rack bar 133 to effect the actuation of the winding spindle 144 through the train of connected gears. As the winding arm 147 is rotated the transverse end portion 148 thereof and the wire-holding member 149 are carried around the projecting end portion of the wire 65, and at the same time the carrier 185 is moved toward the left, as viewed in Fig. 11, due to the action of the cam 199, so that the fine wire 155 is caused to form a closely arranged helix on the end of the insulated wire.

During this operation the arm 175 is moved downwardly under the control of the cam 177, in order to provide slack in the wire 155, which may be drawn up in readiness for the next succeeding operation of winding. When the spiral winding of the end of the insulated wire has been completed, the rack bar 133 will have reached the lower limit of its travel, and it is then permitted to assume a substantially stationary position, due to the curvature of the slot 121 in the cam 120. The wire-holding member 149 is then separated from the holding jaws 211 and 212, and the cam 258 then operates the lever 255 to turn the crank arm 249 and carry the releasing arm 230 in a forward direction. As this arm passes between the wire-holding jaws, the insulated wire is released by the holding jaws and is gripped by the jaws 233 and 234. The insulated wire is then carried in a forward direction away from the winding arm 147, and this operation serves to pull out the slack which has previously been provided in the wire 155 by the action of the arm 171.

After this wire has been drawn out, it is severed by the action of the cutting blade 265, which is actuated by the rod 268, and at the same time the free end 277 of the wire, which has been wound around the insulated wire, is gripped by the movable jaw 284 at the upper end of the pulling arm 280. The releasing arm 230 and the pulling arm are then moved in a downward direction and simultaneously spread apart, so that the free end of the wire is pulled out to eliminate the loop which previously passed around the tooth 216. When the arms 230 and 280 reach the lower limits of their travel their jaws are separated by the action of the cams 240 and 290, respectively, and the insulated wire is then permitted to be withdrawn, either by gravity or by the action of the toggle 314. The arm 230 then

returns to its forward position, which movement is permitted by the spaced relation of the end of the winding arm with respect to the holding jaws 211 and 212. This movement of the arm 230 is not interfered with by the projecting end of the wire 155, due to the fact that this end portion of the wire has been bent around into a position parallel with the winding arm by the action of the bending arm 300. After the arm 230 has returned to its normal position, the rotation of the arm is continued, and the carrier 185 is moved to the right, as viewed in Fig. 11, until the parts assume the relative position shown in Fig. 17, ready for the winding operation.

It will be observed that various parts of the mechanism are capable of adjustment in order to permit the operation of the mechanism upon wires of different sizes, and also to permit the winding of metallic tips of various lengths. After the winding has been completed by this machine, a hollow tip is provided, as illustrated in Fig. 22, and it is then merely necessary to cut off the projecting end of the wire. If desired, a metal cap may be fitted over the wire helix and the whole tip may be dipped in solder, in order to provide a more rigid construction.

Although we have shown and described a certain embodiment of the invention for purposes of illustration, it will be understood that it may be constructed in various forms without departing from the scope of the invention as defined in the appended claims.

We claim:

1. In apparatus of the class described, means for holding an insulated wire, means for holding the end portion of a binding wire, means for supplying said binding wire, and means engaging said binding wire between the second named holding means and said supplying means for winding said binding wire about said insulated wire.

2. In apparatus of the class described, means for holding an insulated wire, means for supplying binding wire, means for winding said binding wire around said insulated wire, and means engaging said insulated wire for moving said insulating wire and thereby drawing out a new supply of binding wire after each winding operation in readiness for a succeeding operation.

3. In apparatus of the class described, means engaging a binding wire for spirally winding a metallic tip on an insulated wire, and means for inserting a pull on the end of said binding wire after said winding operation to tighten the wound wire.

4. In apparatus of the class described, means for holding an insulated wire, means for winding a metallic wire thereon, means for moving said holding means longitudinally of said insulated wire during the

winding operation, and means for releasing said insulated wire from said holding means after said winding operation.

5. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve around the end of said wire, means carried by said winding arm for supporting a metallic wire adapted to be wound on said insulated wire, means for securing the end of said fine wire in fixed position with relation to said insulated wire, and means for moving said holding means longitudinally of said insulated wire during the rotation of said winding arm.

6. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve around the end of said wire, means carried by said winding arm for supporting a metallic wire adapted to be wound on said insulated wire, means for securing the end of said fine wire in fixed position with relation to said insulated wire, means for moving said holding means longitudinally of said insulated wire during the rotation of said winding arm, and means movable between said winding arm and said holding means for removing said insulated wire from said holding means after said winding operation.

7. In apparatus of the class described, means for holding an insulated wire, a winding arm extending longitudinally from in proximity to the end of said insulated wire and having a part adapted to revolve about said wire, means carried by said winding arm for supporting a fine wire to be wound on said insulated wire, a projecting member movable with said holding means and adapted to have said fine wire looped about it, and means for moving said holding means away from said winding arm during the operation of winding.

8. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve about said insulated wire, means carried by said winding arm for supplying a fine metallic wire to be wound on said insulated wire, means for supplying said fine wire to said winding arm, means for providing slack in the supply of said fine wire during the winding operation, and means operated after the winding operation for removing said insulated wire from said holding means and drawing out said slack through said winding arm.

9. In apparatus of the class described, means for holding an insulated wire, means for winding a fine metallic wire around said insulated wire, a projecting tooth carried by said holding means, the free end of said fine wire being adapted to be looped about said tooth, means for moving said insulated wire out of engagement with said holding means

for disconnecting said loops of fine wire from said tooth after the winding operation, and means for engaging the free end of said fine wire and drawing out said loop.

10. In apparatus of the class described, means for holding an insulated wire, a winding arm, means carried by said winding arm for supporting a binding wire adapted to be wound on said insulated wire, means for connecting the free end of said binding wire in fixed position with respect to said insulated wire, means for cutting off said binding wire after the winding operation, and means for drawing out the binding wire through said winding arm in preparation for the succeeding operation in winding.

11. In apparatus of the class described, means for holding an insulated wire, a winding arm, means for supplying binding wire from said winding arm, means for rotating said winding arm and simultaneously advancing said holding means, means for moving said insulated wire from said holding means after the winding operation and thereby drawing out said binding wire through said winding arm, and means for cutting the drawn-out portion of said binding wire.

12. In apparatus of the class described, means for holding an insulated wire, a winding arm, means for supplying binding wire from said winding arm, means for rotating said winding arm and simultaneously advancing said holding means, means for moving said insulated wire from said holding means after the winding operation and thereby drawing out said binding wire through said winding arm, means for cutting the drawn-out portion of said binding wire, and means for drawing out the slack in the portion of said binding wire which has been wound on said insulated wire.

13. In apparatus of the class described, means for holding an insulated wire, a winding arm, means for supplying binding wire from said winding arm, means for rotating said winding arm and simultaneously advancing said holding means, means for moving said insulated wire from said holding means after the winding operation and thereby drawing out said binding wire through said winding arm, means for cutting the drawn-out portion of said binding wire, and means for bending the free end of said binding wire into a position alongside of said winding arm.

14. In apparatus of the class described, a pair of holding jaws, means for manually operating said holding jaws to permit the insertion of an insulated wire therein, a winding arm, means to revolve a part of said winding arm about said insulated wire, means to move said jaws away from said

winding arm during its rotation, means movable between said winding arm and said jaws for engaging said insulated wire and moving it transversely to said winding arm, and means for automatically opening said jaws to release said insulated wire.

15. In apparatus of the class described, a pair of holding jaws adapted to hold an insulated wire, a winding arm having a part adapted to revolve about said wire, means for supplying binding wire through said winding arm, means for operating said winding arm, means for moving said jaws away from said winding arm during its rotation, and releasing means adapted to engage said insulated wire to carry it away from said jaws and thereby draw out a new supply of said binding wire through said winding arm.

16. In apparatus of the class described, a pair of holding jaws adapted to hold an insulated wire, a winding arm having a part adapted to revolve about said wire, means for supplying binding wire through said winding arm, means for operating said winding arm, means for moving said jaws away from said winding arm during its rotation, releasing means adapted to engage said insulated wire to carry it away from said jaws and thereby draw out a new supply of said binding wire through said winding arm, and means for cutting the drawn-out portion of said binding wire.

17. In apparatus of the class described, means for holding an insulated wire, a winding arm having a part adapted to revolve about said wire, means for operating said winding arm, means for supplying binding wire from said winding arm, means for moving said holding means away from said winding arm during its rotation, a releasing arm adapted to move between said winding arm and said holding means, and jaws carried by said releasing arm to engage said insulated wire.

18. In apparatus of the class described, means for holding an insulated wire, a winding arm having a part adapted to revolve about said wire, means for operating said winding arm, means for supplying binding wire from said winding arm, means for moving said holding means away from said winding arm during its rotation, a releasing arm adapted to move between said winding arm and said holding means, jaws carried by said releasing arm to engage said insulated wire, and means for automatically operating said holding means to release said insulated wire.

19. In apparatus of the class described, means for holding an insulated wire, a rotatable winding arm, means for supplying binding wire from said winding arm, a releasing arm comprising means for engaging said insulated wire and removing it from

said holding means after the winding operation and thereby drawing out said binding wire from said winding arm, and means carried by said releasing arm for cutting said binding wire after it has been drawn out.

20. In apparatus of the class described, means for holding an insulated wire, a rotatable winding arm, means for supplying binding wire from said winding arm, a releasing arm comprising means for engaging said insulated wire and removing it from said holding means after the winding operation and thereby drawing out said binding wire from said winding arm, means carried by said releasing arm for cutting said binding wire after it has been drawn out, and a pulling arm comprising means adapted to grip the free end of the wire which has been wound on said insulated wire and move longitudinally therefrom to draw out the slack.

21. In apparatus of the class described, means for holding an insulated wire, means for winding a metallic binding wire thereon, means for engaging said insulated wire and removing it from said holding means after the winding operation, and means movable away from said last named means for gripping the free end of the wire which has been wound and drawing out the slack therein.

22. In apparatus of the class described, means for holding an insulated wire, means for winding a binding wire thereon, a tooth projecting from said holding means and adapted to have said binding wire looped about it, means for moving said binding wire out of engagement with said tooth and releasing said insulated wire from said holding means after said winding operation has been completed, and means movable away from said last named means for gripping the free end of the binding wire and drawing out the loop which has been formed by passing it around said tooth.

23. In apparatus of the class described, means for winding a binding wire on an insulated wire, means for holding said insulated wire after it has been wound, and means movable away from said holding means for drawing out the slack in the binding wire which has been wound.

24. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve about said insulated wire, means for supplying binding wire, a releasing arm movable transversely to said insulated wire, jaws carried by said releasing arm to engage said insulated wire and move it away from said holding means thereby drawing out said binding wire from said supply means, and means movable with and away from said releasing arm for gripping the end of said binding wire and drawing out slack in the portion which has been wound.

25. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve about said insulated wire, means for supplying binding wire, a releasing arm movable transversely to said insulated wire, jaws carried by said releasing arm to engage said insulated wire and move it away from said holding means thereby drawing out said binding wire from said supply means, a pulling arm movable with said releasing arm, and jaws carried by said pulling arm to engage the free end of said binding wire and pull out the slack in the portion which has been wound while said insulated wire is carried by said releasing arm.

26. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve about said insulated wire, means for supplying binding wire, a releasing arm movable transversely to said insulated wire, jaws carried by said releasing arm to engage said insulated wire and move it away from said holding means thereby drawing out said binding wire from said supply means, a pulling arm movable with said releasing arm, jaws carried by said pulling arm to engage the free end of said binding wire and pull out the slack in the portion which has been wound while said insulated wire is carried by said releasing arm, and means carried by said releasing arm for cutting the portion of binding wire which has been drawn out from said supply means.

27. In apparatus of the class described, means for holding an insulated wire, a winding arm adapted to revolve about said insulated wire, means for supplying binding wire, a releasing arm movable transversely to said insulated wire, jaws carried by said releasing arm to engage said insulated wire and move it away from said holding means thereby drawing out said binding wire from said supply means, a pulling arm movable with said releasing arm, jaws carried by said pulling arm to engage the free end of said binding wire and pull out the slack in the portion which has been wound while said insulated wire is carried by said releasing arm, means carried by said releasing arm for cutting the portion of binding wire which has been drawn out from said supply means, means for returning said releasing arm to its normal position, and means for returning said pulling arm to its normal position.

28. In apparatus of the class described, a driving shaft, means actuated by said driving shaft for stripping the insulation from the end of an insulated wire, a ratchet wheel driven by said driving shaft, an intermediate shaft, a driving arm mounted on said intermediate shaft, a pawl carried by said driving arm and adapted to engage said

ratchet wheel, and means for automatically disengaging said pawl after one rotation of said driving arm.

29. In apparatus of the class described, 5
a driving shaft, means actuated by said driving shaft for stripping the insulation from the end of an insulated wire, a ratchet wheel driven by said driving shaft, an intermediate shaft, a driving arm mounted on said intermediate shaft, a pawl carried by said driving arm and adapted to engage said ratchet wheel, means for automatically disengaging said pawl after one rotation of said driving arm, and means for manually operating said disengaging means to permit the continued actuation of said driving arm by said ratchet wheel. 15

30. In apparatus of the class described, a driving shaft, means actuated by said driving shaft for stripping the insulation from the end of an insulated wire, a ratchet wheel driven by said driving shaft, an intermediate shaft, a driving arm mounted on said intermediate shaft, a pawl carried by said driving arm and adapted to engage said ratchet wheel, means for automatically disengaging said pawl after one rotation of said driving arm, means for manually operating said disengaging means to permit the continued actuation of said driving arm by said ratchet wheel, and means actuated by said intermediate shaft for winding a metallic tip on the end of said insulated wire. 20

31. In apparatus of the class described, a driving shaft, a ratchet wheel actuated by said driving shaft, an intermediate shaft, a driving arm connected to said intermediate shaft, a pawl mounted on said driving arm and adapted to engage said ratchet wheel, means for automatically disconnecting said pawl and said ratchet wheel after a predetermined rotation of said intermediate shaft, means for holding an insulated wire, means for winding a binding wire thereon, and means operated by said intermediate shaft for actuating said holding means and said winding means. 25

32. In apparatus of the class described, a driving shaft, a ratchet wheel actuated by said driving shaft, an intermediate shaft, a driving arm connected to said intermediate shaft, a pawl mounted on said driving arm and adapted to engage said ratchet wheel, means for automatically disconnecting said pawl and said ratchet wheel after a predetermined rotation of said intermediate shaft, means for holding an insulated wire, means for winding a binding wire thereon, means for moving said holding means away from said winding means, and means actuated by said intermediate shaft for operating said moving means and said winding means. 30

33. In apparatus of the class described, a driving shaft, an intermediate shaft, means 35

for connecting said shafts, means for breaking said connection after a predetermined rotation of said intermediate shaft, a sliding carrier, means actuated by said intermediate shaft for moving said carrier, holding means supported by said carrier for holding an insulated wire, and rotatable winding means mounted independently of said carrier and operated by said intermediate shaft for winding a binding wire on said insulated wire during the movement of said carrier. 70

34. In apparatus of the class described, a driving shaft, an intermediate shaft, means for connecting said shafts, means for breaking said connection after a predetermined rotation of said intermediate shaft, a sliding carrier, means actuated by said intermediate shaft for moving said carrier, holding means supported by said carrier for holding an insulated wire, rotatable winding means mounted independently of said carrier and operated by said intermediate shaft for winding a binding wire on said insulated wire during the movement of said carrier, and means mounted on said carrier and movable across the axis of rotation of said winding means for engaging said insulated wire and moving it away from said holding means. 80

35. In apparatus of the class described, a driving shaft, an intermediate shaft, means for connecting said shafts, means for breaking said connection after a predetermined rotation of said intermediate shaft, a sliding carrier, means actuated by said intermediate shaft for moving said carrier, holding means supported by said carrier for holding an insulated wire, rotatable winding means mounted independently of said carrier and operated by said intermediate shaft for winding a binding wire on said insulated wire during the movement of said carrier, means mounted on said carrier and movable across the axis of rotation of said winding means for engaging said insulated wire and moving it away from said holding means, and means mounted on said carrier and movable simultaneously with said last named means for engaging the free end of the binding wire and drawing out the slack in the portion which has been wound. 85

36. In apparatus of the class described, a driving shaft, an intermediate shaft, means for connecting said shafts, means for breaking said connection after a predetermined rotation of said intermediate shaft, a sliding carrier, means actuated by said intermediate shaft for moving said carrier, holding means supported by said carrier for holding an insulated wire, rotatable winding means mounted independently of said carrier and operated by said intermediate shaft for winding a binding wire on 120

said insulated wire during the movement of said carrier, means mounted on said carrier and movable across the axis of rotation of said winding means for engaging said insulated wire and moving it away from said holding means, and means actuated by said intermediate shaft for operating said last named means. 20

37. In apparatus of the class described, a driving shaft, an intermediate shaft, means for connecting said shafts, means for breaking said connection after a predetermined rotation of said intermediate shaft, a sliding carrier, means actuated by said intermediate shaft for moving said carrier. holding means supported by said carrier for holding an insulated wire, rotatable winding means mounted independently of said carrier and operated by said intermediate shaft for winding a binding wire on said insulated wire during the movement of said carrier, means mounted on said carrier and movable across the axis of rotation of said winding means for engaging said insulated wire and moving it away from said holding means, cutting means movable with said last named means, and a cam mounted on said carrier for controlling the operation of said cutting means. 25

In testimony whereof, we have subscribed our names. 30

CARL E. ANDERSON.
GUST A. FREEVOL.