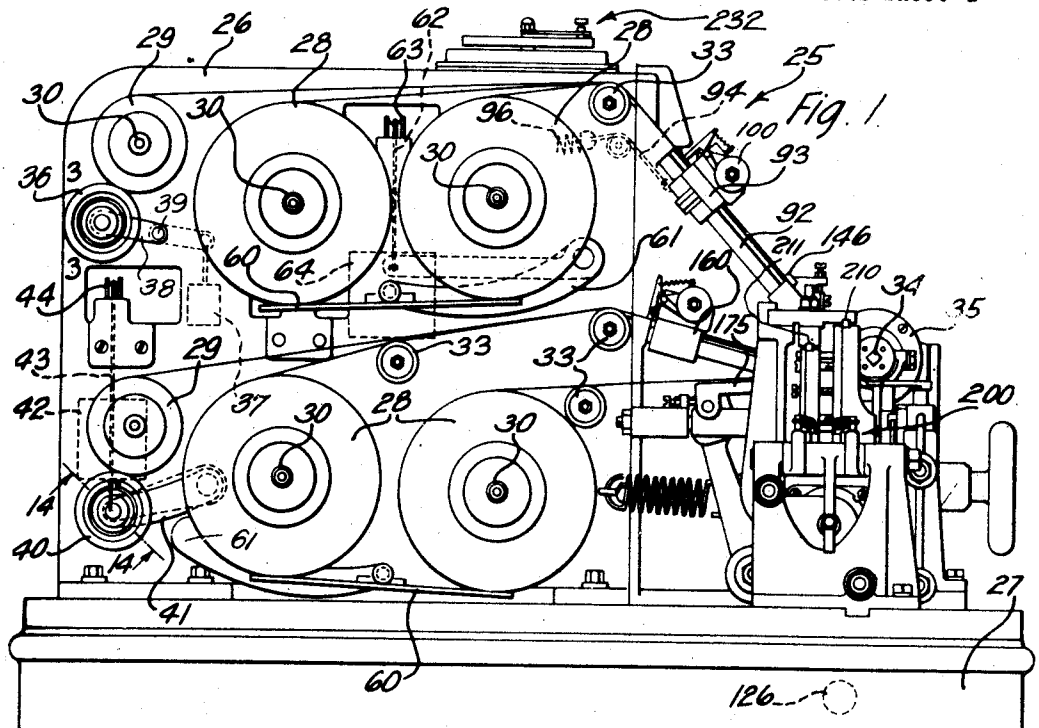
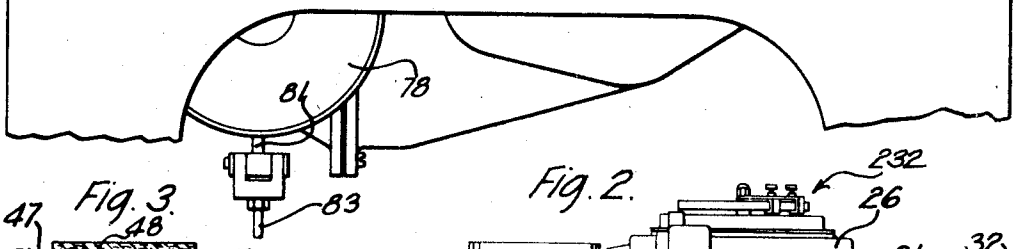
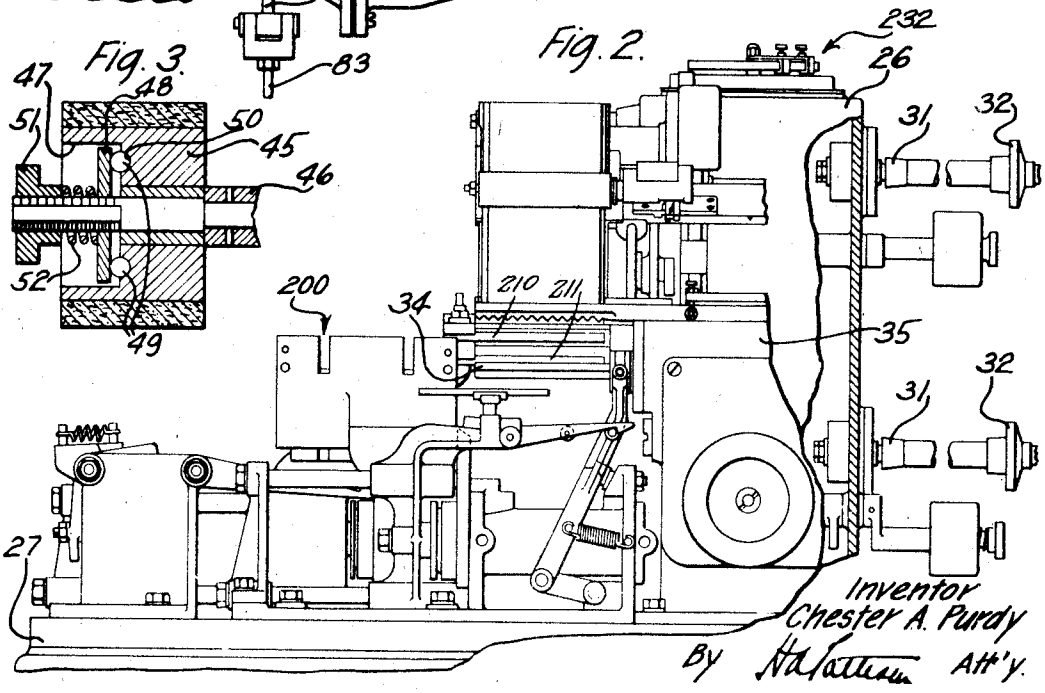
June 19, 1934. C. A. PURDY 1,963,381

CONDENSER WINDING MACHINE

Filed June 22, 1929 6 Sheets-Sheet 1







Inventor
Chester A. Purdy
By H. A. Patterson Att'y.

June 19, 1934. C. A. PURDY 1,963,381

CONDENSER WINDING MACHINE

Filed June 22, 1929 6 Sheets-Sheet 2

Fig. 9.

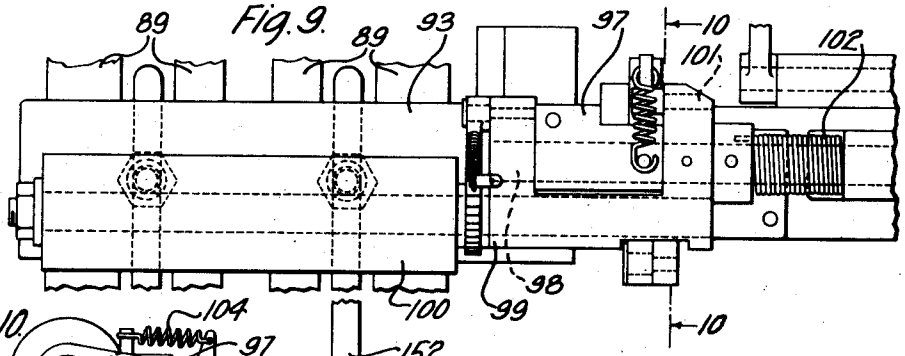


Fig. 10.

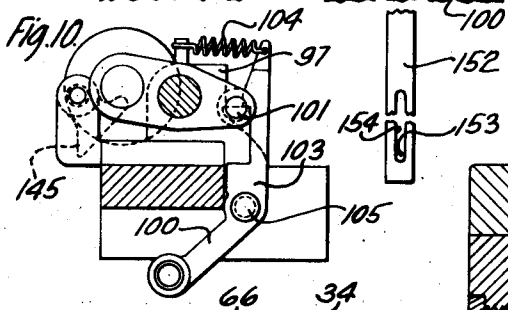


Fig. 5.

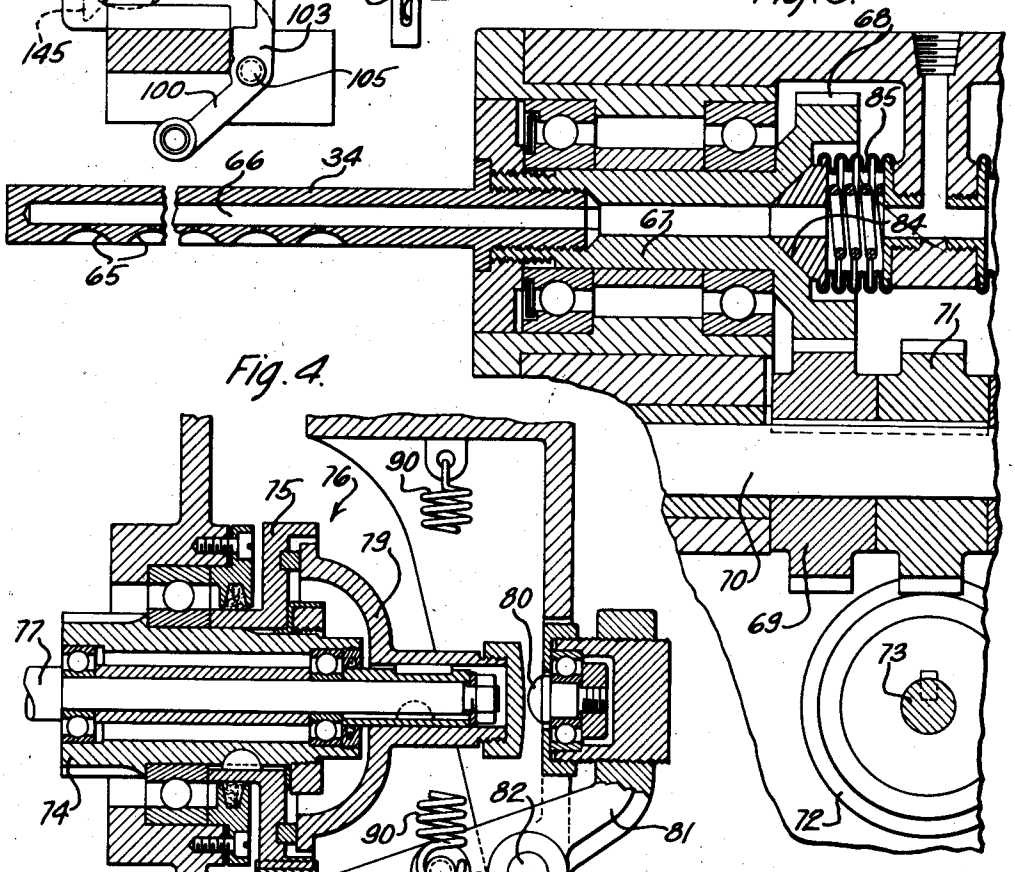
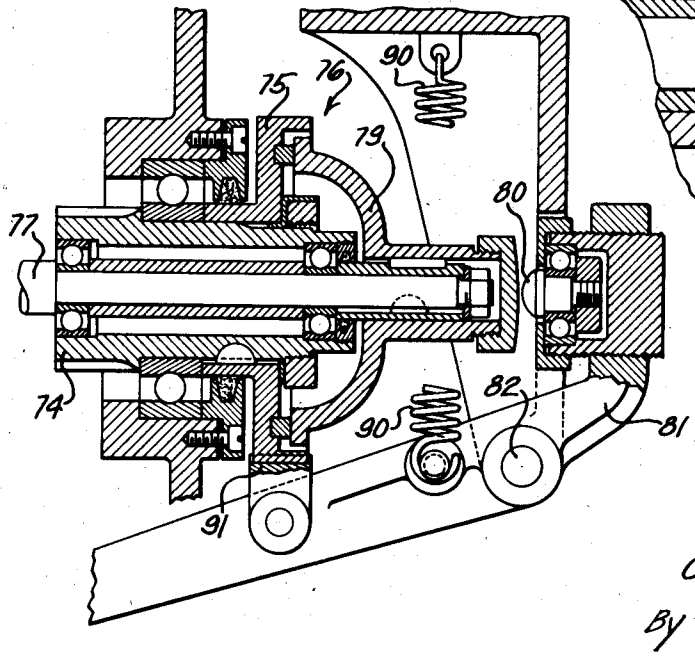


Fig. 4.

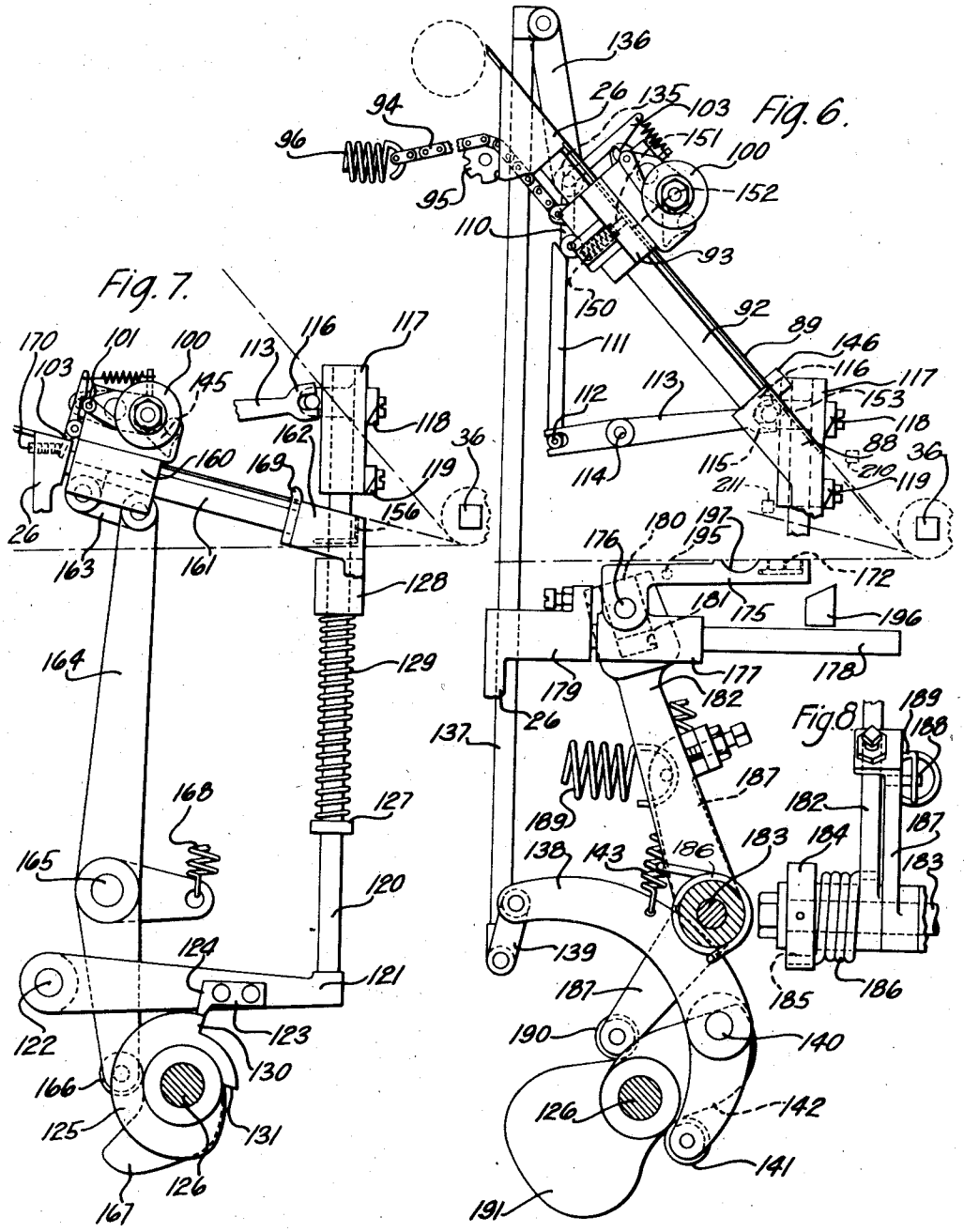


Inventor
Chester A. Purdy
By M. Patterson Atty.

June 19, 1934. C. A. PURDY 1,963,381

CONDENSER WINDING MACHINE

Filed June 22, 1929 6 Sheets-Sheet 3



Inventor
Chester A. Purdy
By H. A. Patterson Atty.

June 19, 1934. C. A. PURDY 1,963,381

CONDENSER WINDING MACHINE

Filed June 22, 1929 6 Sheets-Sheet 4

Fig. 11.

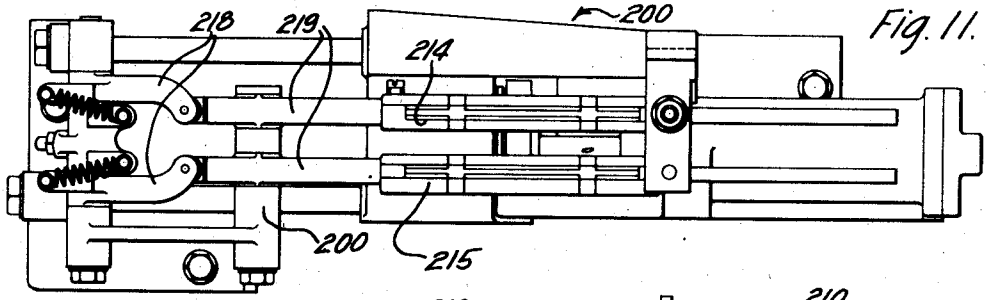


Fig. 12.

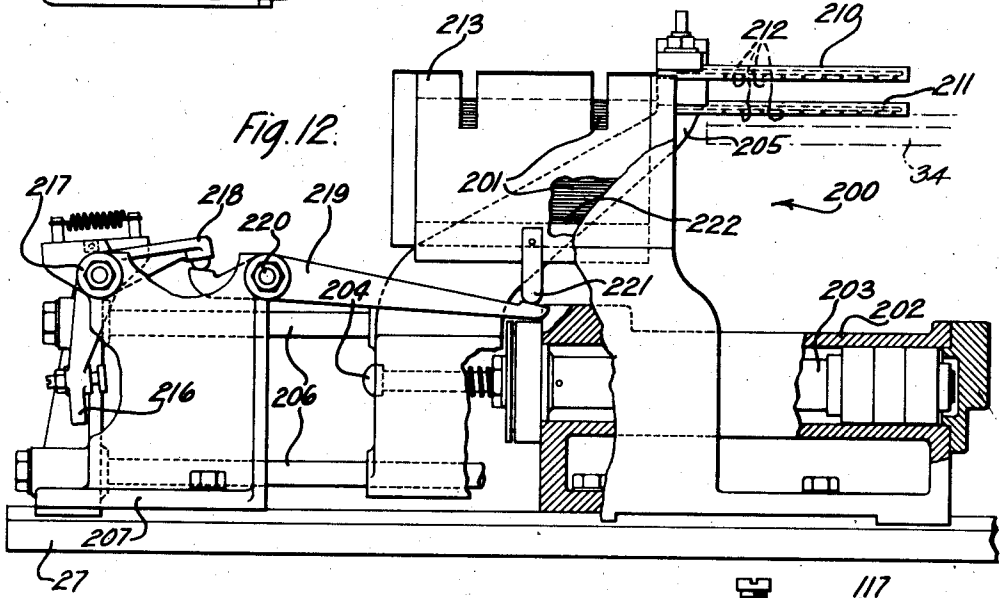


Fig. 13.

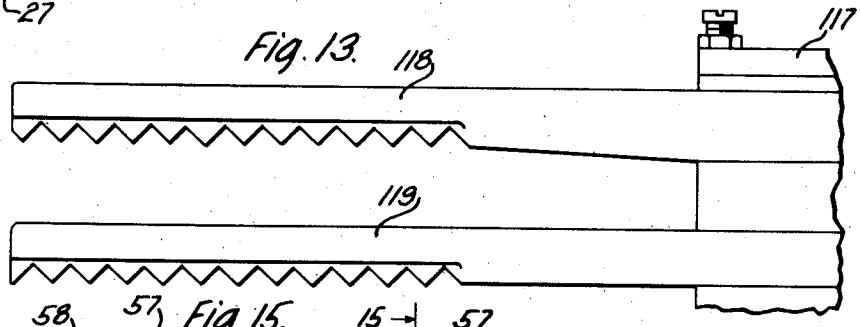


Fig. 15.

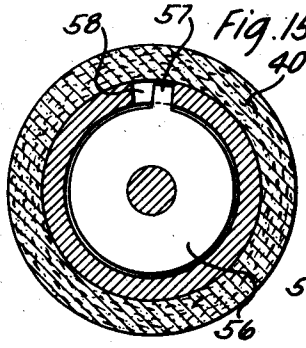
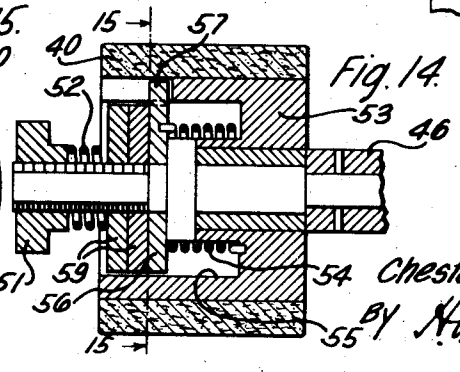


Fig. 14.

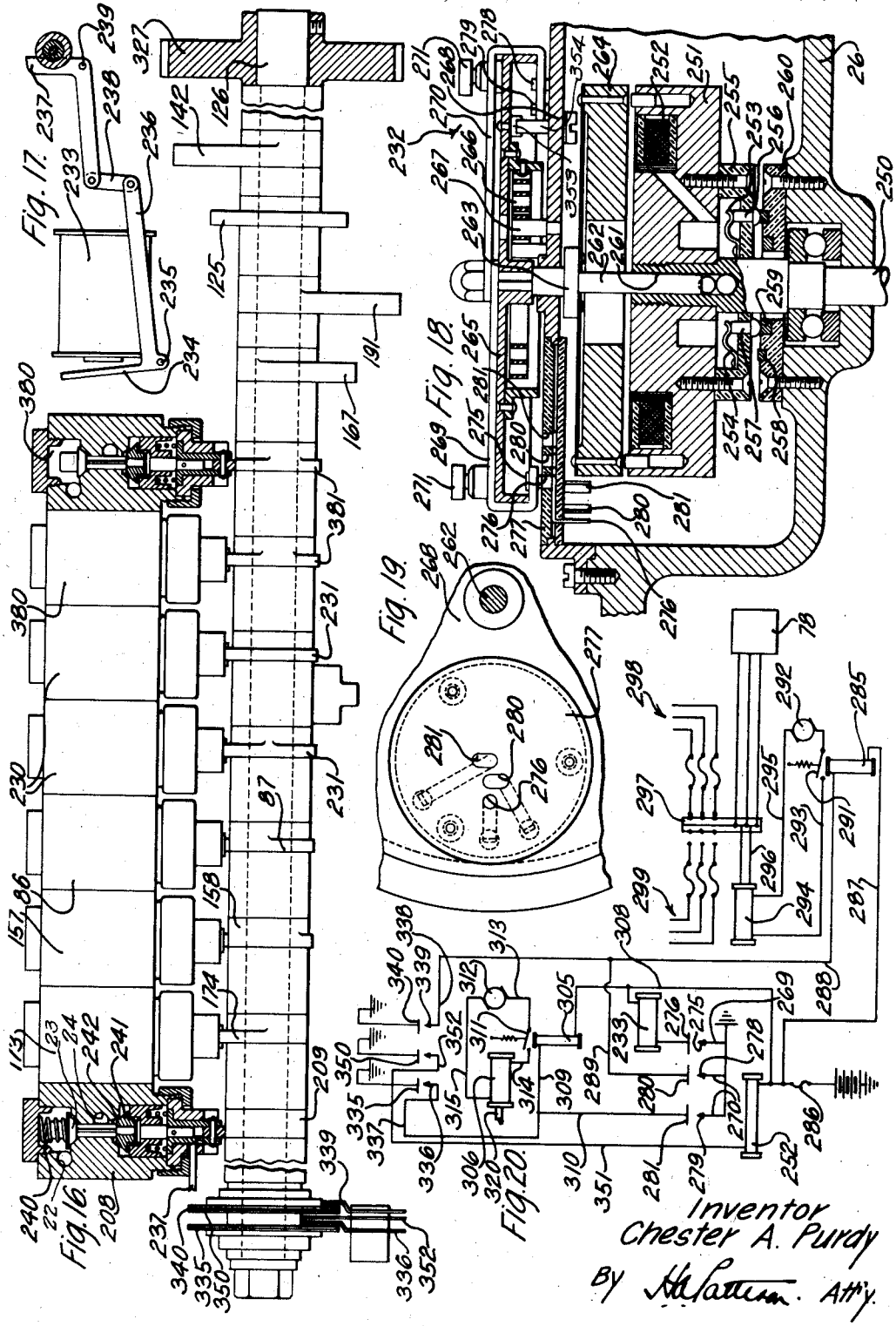


Inventor
Chester A. Purdy
By N. Watters Att'y.

June 19, 1934. C. A. PURDY 1,963,381

CONDENSER WINDING MACHINE

Filed June 22, 1929 6 Sheets-Sheet 5



June 19, 1934. C. A. PURDY 1,963,381

CONDENSER WINDING MACHINE

Filed June 22, 1929 6 Sheets-Sheet 6

Fig. 23.

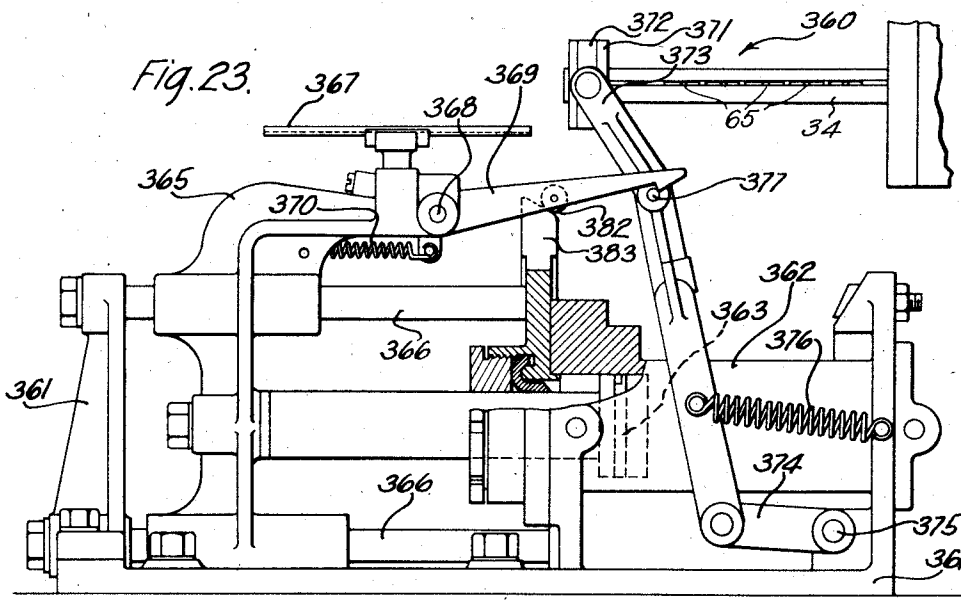


Fig. 22.

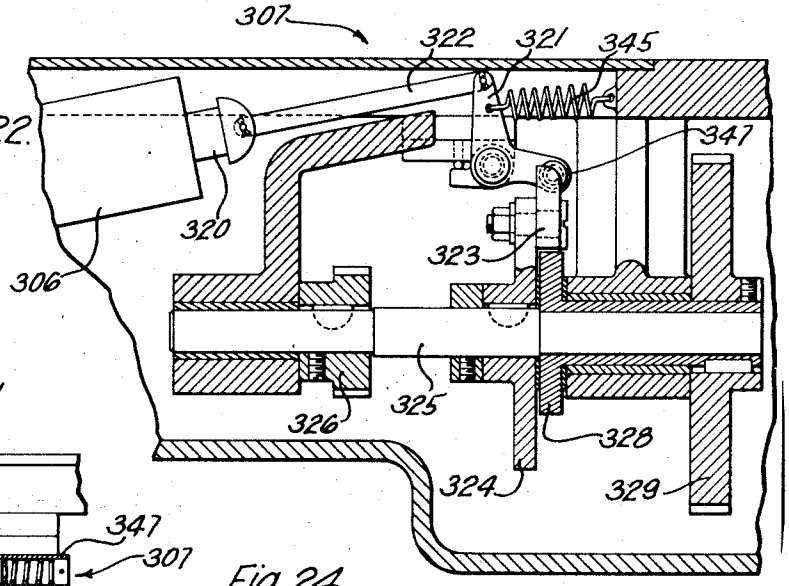


Fig. 21.

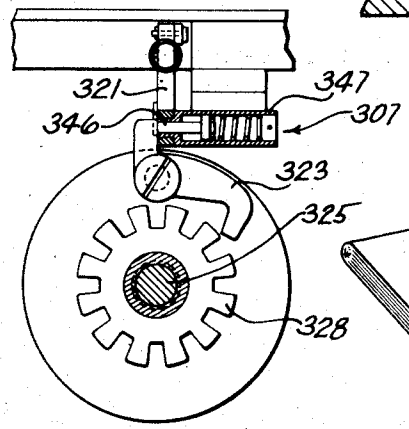
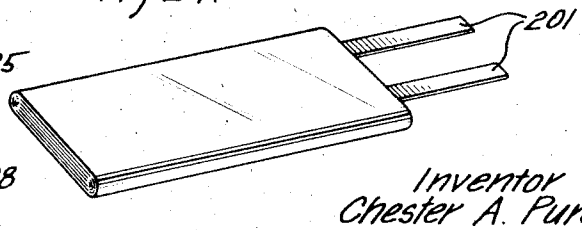


Fig. 24.



Inventor
Chester A. Purdy
By N. A. Patterson Atty.

Patented June 19, 1934 1,963,381

UNITED STATES PATENT OFFICE

1,963,381

CONDENSER WINDING MACHINE

Chester A. Purdy, Oak Park, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application June 22, 1929, Serial No. 372,818

22 Claims. (Cl. 242—56)

This invention relates to material winding machines, and more particularly to a machine for automatically forming electrostatic condensers.

The promary object of this invention is to provide a compact and efficient winding machine for automatically and rapidly forming material into coils or rolls.

In accordance with this object one embodiment of the invention contemplates the provision of an automatic condenser winding machine comprising a vertically disposed central supporting framework having mounted on opposite sides thereof a plurality of spindles for carrying spools of web material such as paper and metal foil. Reciprocable upper, middle and lower feed tables or pads also mounted on each side of the framework are provided for automatically advancing the paper and foil to a position adjacent a pair of rotatable arbors to which the paper and foil on each side of the central framework are drawn and held due to the connection of the arbors with a vacuum system. A counting mechanism operatively associated with the arbors automatically increases the speed thereof and controls a terminal feed mechanism for inserting the terminals of the condenser after approximately half of the number of layers or turns of paper and foil have been wound on each of the arbors. After the terminals have been inserted and an additional number of turns of paper and foil have been wound on each of the arbors, the counting mechanism effects a reduction in speed of the arbors and operates a clutch to rotate a cam shaft through one complete revolution, whereby a plurality of knives automatically sever the paper and foil in a predetermined sequence on each side of the winding machine and ejectors remove a finished condenser from each of the arbors. The feed tables or pads again advance the paper and foil to the arbors and the operations are automatically and continuously repeated.

Other features and advantages of the invention will be apparent from the following description when taken in conjunction with the accompanying drawings, in which

Fig. 1 is a fragmentary side elevational view of an automatic winding machine embodying features of the invention and particularly designed for the forming of electrostatic condensers;

Fig. 2 is a fragmentary front elevational view thereof with certain portions of the duplicate apparatus on the right hand side broken away to more clearly show the spindles and tension devices;

Fig. 3 is an enlarged detailed sectional view of a tension device taken on line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary sectional view showing a manually operated clutch for connecting the winding machine to the driving means;

Fig. 5 is an enlarged fragmentary longitudinal sectional view of a winding arbor;

Fig. 6 is an enlarged fragmentary schematic side view, partially in section, showing the upper and lower feed tables or pads for advancing the paper and foil;

Fig. 7 is an enlarged fragmentary schematic side view, partially in section showing the middle feed table or pad and the arrangement for operating the knives to sever the paper and foil;

Fig. 8 is an enlarged fragmentary front elevational view of a safety feature for preventing injury to the lower feed table or pad shown in Fig. 6;

Fig. 9 is an enlarged fragmentary plan view of the upper feed pad;

Fig. 10 is a transverse sectional view of a structure for latching and resetting the clamping rollers on the upper feed pads, taken on line 10—10 of Fig. 9;

Fig. 11 is an enlarged plan view of the left hand terminal feed mechanism which is a duplicate of the terminal feed mechanism on the right hand side;

Fig. 12 is a side elevational view, partly broken away and shown in section, of the left hand terminal feed mechanism;

Fig. 13 is an enlarged fragmentary front view of the knives used to sever the paper and foil;

Fig. 14 is an enlarged longitudinal sectional view of a torsional recoil device taken on line 14—14 of Fig. 1, for pulling back the lower metal foil from the edge of the paper when they are severed to assure proper insulation between it and the upper foil;

Fig. 15 is a transverse sectional view thereof taken on line 15—15 of Fig. 14;

Fig. 16 is an enlarged fragmentary elevational view partly in section of a cam shaft and associated vacuum and air pressure valves for controlling the operation of the various mechanisms;

Fig. 17 is a side view of an electromagnetic locking device for the valve shown on the extreme left hand side of Fig. 16;

Fig. 18 is an enlarged fragmentary transverse sectional view of an adjustable electromagnetic counter for controlling the number of turns of paper and foil to be wound into a condenser, the time of placing the terminals in the condenser,

the speed of operation of the winding machine and the operation of the cam shaft;

Fig. 19 is an enlarged fragmentary plan view of a portion of the counter showing the position of the various electrical contacts for controlling the sequence of operation;

Fig. 20 diagrammatically discloses the electrical controlling circuits for the winding machine;

Fig. 21 is an enlarged fragmentary end view partly in section of a clutch for effecting the rotation of the cam shaft through one revolution;

Fig. 22 is an enlarged longitudinal sectional view of an electromagnetic mechanism for controlling the operation of the clutch for rotating the cam shaft through one revolution;

Fig. 23 is an enlarged fragmentary front elevational view partly in section of the left hand ejector mechanism, and

Fig. 24 is a perspective view of a finished condenser unit produced by the winding machine.

Referring now to the drawings wherein like reference numerals designate similar parts throughout the various views, the numeral 25 designates a winding mechanism, including a central, vertical frame 26 secured to a bed plate 27 supporting on both sides thereof a plurality of supply rolls of condenser paper and tin foil 28 and 29, respectively, rotatably mounted on spindles 30—30 journaled in the sides of the frame 26. Each of the spindles is provided with a frusto-conical portion 31 (Fig. 2) for engaging the inner end of the supply roll of paper or foil and a collar 32 having a similarly tapered portion is adapted to be moved inwardly on the spindle to clamp, center, and rigidly hold the roll thereon. A plurality of anti-friction idler rollers 33—33 journaled in the frame 26 are provided at points for supporting and guiding the paper and foil to winding arbors 34—34 which are rotatably mounted in a housing 35 secured to the bed plate 27 at the front of the machine.

In order to maintain the proper tension on the tin foil as it is wound on each of the arbors 34, upper and lower cork friction rollers 36 and 40 are provided (Fig. 1). The lower roller 40 is rotatably mounted on a bell crank lever 41 attached to the frame 26 and is maintained in yielding contact with the lower roll of tin foil 29 by a weight 42 suspended from a cable 43 passing over a pulley 44 and having its other end secured to an arm of the bell crank lever 41. The upper friction roller 36 is held in yielding contact with the upper roll of tin foil 29 by any suitable means, which may be similar to the arrangement just described in connection with the lower friction roller, or may consist in a lever 38 pivoted at 39, having the upper roller 36 mounted at its outer end, and having a weight 37 suspended from its inner end.

The upper friction roller 36 (Fig. 3) comprises an annular member 45 rotatably mounted on a stud 46 secured to the lever 38 and having a bore 47 in which is mounted a friction plate 48 adapted to resiliently engage roller bearings 49 positioned in a race 50 of the member 45. Interposed between the outer face of the plate 48 and the inner face of the nut 51 threaded on the outer end of the stud 46 is a coil spring 52, whereby upon the manual rotation of the nut 51 the compressing force of the spring 52 can be varied to control accurately the tension of the upper roll of tin foil 29.

The lower friction roller 40 (Figs. 14 and 15) is provided with a torsional recoil device for pulling back the lower foil from the edge of the paper after they are severed to assure proper insulation between it and the upper foil. In order to provide this recoil feature an annular member 53, also mounted on a stud 46 secured to the bell crank lever 41, is equipped with a torsion spring 54 positioned within a bore 55 and having one end secured to the member 53 and its other end fastened to a disk 56. The disk 56 has a radial projection 57 adapted to move within a recess 58 (Fig. 15) in the annular member 53. Upon counter-clockwise rotation of the lower roller 40 due to its frictional engagement with the lower roll of tin foil 29, the wall of the member 53 at the recess 58 engages the projection 57 and rotates the disk 56 to store energy in the torsion spring 54 whereby when the foil is severed the spring forces the disk 56 and the lower roller 40 in a clockwise direction to pull the tin foil back a short distance such as about one-quarter of an inch from the edge of the paper. The lower roller like the upper one is provided with the coil spring 52 interposed between friction plates 59 and the face of the nut 51 so that the compressing force of the spring 52 can be varied to control accurately the tension of the lower roll of tin foil 29.

To properly tension the insulating paper 28, the upper and lower pairs of paper rolls on each side of the central frame 26 are engaged on their lower peripheries by a strip 60 (Fig. 1) pivoted to one arm of a bell crank lever 61 rotatably mounted in the frame 26. The other arm of the bell crank lever has fastened to it a cable 62 which passes over a pulley 63 and has its other end secured to a weight 64 so that the bell crank lever is urged upwardly to bring the strip 34 in engagement with the rolls of paper 28.

Each of the winding arbors 34—34 is provided with concave vacuum ports 65 (Fig. 5) in its periphery connecting with a bore 66 therein, and each of the arbors is threaded into a spindle 67 having a gear portion 68 which meshes with a gear 69 secured to a shaft 70. A central, conical shaped opening 84 connecting with the bore 66 is adapted to make a resilient, air tight connection with a corrugated, spring pressed member 85 connected to a source of vacuum through a valve 86 controlled by a cam 87 which is fastened to a cam shaft 126 (Fig. 16). The shaft 70 in turn is driven by a gear 71 secured thereto meshing with the worm wheel 72 keyed to a driven shaft 73. The driven shaft 73 is connected through suitable gearing (not shown) to a gear 74 secured to a driven friction disk 75 of a clutch 76. As shown in Fig. 4, the gear 74 having the driven friction disk 75 secured thereto is rotatably mounted on an extended driving shaft 77 of a motor 78 (Fig. 1). Slidably keyed to the outer extremity of the motor shaft 77 is a cup-shaped friction disk 79 which is adapted to be engaged by a button 80 rotatably mounted in a ball bearing journal carried by a lever 81 pivoted at 82 to the underside of the bed plate 27, whereby upon the depression of a foot pedal (not shown) a rod 83 (Fig. 1) connected to the lever 81 is moved downwardly to effect counter-clockwise rotation thereof and thus bring the button 80 into contact with the cup-shaped friction disk 79 to force it into engagement with the driving friction disk 75 and thus cause rotation of the gear 74 to effect the actuation of the winding machine. When pressure is removed from the foot pedal, the energy stored in a tension spring 90 causes clockwise rotation of the lever 81 to thus release the friction disk 79 and bring a brake 91 into contact with the periphery of the driven friction disk 75 to stop quickly rotation of the winding machine.

Slidably mounted on a pair of inclined guide

rods 92—92 (Figs. 1 and 6) positioned on each side of the central frame 26 and having their ends secured to the frame 26 and upper platen 88 is an upper pad or table 93 for feeding the upper layers of tin foil and paper to the winding arbors 34—34. Positioned directly above and interposed between the guide rods are a plurality of stationary strips 89—89 for supporting the paper and tin foil. The upper table 93 is normally maintained at the upper ends of the guide rods by a sprocket chain 94 passing over an idler sprocket wheel 95 and connected to a coil spring 96, as shown in Fig. 6. A projecting portion 97 (Fig. 9) of the table 93 carries a rod 98 serving as a pivot for a rocker arm 99 which carries at one end a cork compression roller 100 and at its other end a catch pin 101. The compression roller is urged into contact with the upper surface of the feed table 93 by a torsion spring 102 having its ends secured to the rocker arm 99 and the table 93, respectively. However, the roller 100 is normally maintained out of contact with the table by a latch 103 actuated by a spring 104 and pivoted at 105 to the table. The latch has a depending arm 110 adapted to be engaged by a vertically slidable lever 111 (Fig. 6) having secured at its lower end a stud 112 positioned within a slot in the outer ends of a lever 113 pivoted at 114. The other end of the lever 113 has a fork 115 engaging a pin 116 secured to a bracket 117 carrying knives 118—118 and 119—119 for severing the tin foil and paper. The knives have a serrated cutting edge (Fig. 13) for expediting the severing of the paper and foil while in motion. As shown in Fig. 7, the bracket 117 is fastened to the upper end of a vertical rod 120, the lower end of which is engaged by the outer extremity of a lever 121 pivoted at 122 to the frame 26. Secured to the lever 121 is a plate 123 having a depending projection 124 engaging a cam 125 secured to and carried by the cam shaft 126 (Fig. 16). Interposed between a collar 127 and portion 128 of the frame 26 is a compression spring 129 whereby the bracket 117 and knives 118—119 are normally urged downwardly by the spring 129 along with the rod 120 to force the plate 123 of the lever 121 into contact at all times with the cam 125. The cam 125 has a portion 130 for permitting the knives to descend sufficiently to cut the upper and middle sheets of paper and foil, and also another portion 131 for subsequently allowing the knives to descend further to cut the lower sheet of paper after a sufficient number of turns of paper have been wound around the condenser to provide a protective covering therefor.

From the foregoing it will be readily understood that as the cam 125 rotates and permits the energy stored in the spring 129 to force the knives 118—119 downwardly, the downward movement thereof will cause a clockwise rotation of the lever 113 to move the lever 111 upwardly into engagement with the depending arm 110 and thus move the latch 103 out of engagement with the catch 101, whereby the energy of the torsion spring forces the compression roller 100 into engagement with the upper surface of the table 93. The upper end of the table 93 carries a lug 135 pivotally connected to a lever 136 which has its upper end pivoted to an end of a vertically reciprocable arm 137. The lower end of the arm 137 is pivotally connected to the long arm of a bell crank 138 through a link 139. The bell crank 138 is pivoted at 140 to the frame 26 and carries on the extremity of the short arm a roller 141 which is forced into engagement with a cam 142 of the cam shaft 126 by a spring 143. Upon rotation of the cam shaft 126, the cam 142 forces the bell crank 138 in a counter-clockwise direction to effect an actuation of the arm 137 and lever 136 whereby the table 93 is moved downwardly along the guide rods 92—92 until a resetting trigger 145 (Fig. 10) is forced into engagement with a stop 146 (Fig. 6) secured to the frame 26, whereby the trigger 145 is rotated in a counter-clockwise direction to force the compression roller 100 upwardly against the torsion of the spring 96. When the compression roller reaches its uppermost position, the tension of the spring 104 pulls the latch 103 into engagement with the catch pin 101 to lock the compression roller in its raised position.

Seated within the lower portion of the table 93 are coil springs 150 adapted to move pins 151 upwardly to clamp guide strips 152 against the table 93 so that upon its inclined downward movement, the guide strips will be carried by the table to thus support and guide the ends of the foil and paper into engagement with the winding arbors 34 during the feeding operation. The downward movement of these guide strips is limited by stop pins 153 (Figs. 6 and 9) engaging the upper ends of slots 154 in the guide strips.

Positioned directly beneath the upper feed table 93 is a middle feed table 160 (Figs. 1 and 7) also slidably mounted on a pair of guide rods 161—161 having their ends secured in the frame 26 and a middle platen 162. The middle platen 162 is provided with a plurality of vacuum ports 156—156 connected to a vacuum system through a valve 157 (Fig. 16) which is operated by a cam 158 secured to the cam shaft 126, so timed that upon the severing of the foil and paper the latter will be held in place by the vacuum ports while the recoil device of the lower friction roller 40 pulls the foil back from the edge of the paper to assure proper insulation. The middle feed table is similar in construction to the upper feed table 93 and hence will not be described in detail. Pivoted to the underside of the middle feed table is a link 163 connected to a bell crank lever 164 pivoted at 165 to the frame 26. The short arm of the bell crank lever 164 carries at its outer extremity a roller 166 maintained in engagement with a cam 167 of the cam shaft 126 by means of a coil spring 168 secured to a portion of the bell crank lever 164 adjacent its pivot point. When the cam shaft 126 and the cam 167 secured thereto is rotated, the bell crank lever is rocked clockwise to move the middle feed table 160 downward along the pair of inclined guide rods 161—161 until the resetting trigger 145 thereof engages a stop 169 secured to the middle platen 162, whereby the trigger 145 forces the compression roller 100 upwardly so that the latch 103 engages catch pin 101 to lock the compression roller in its raised position in the same manner as previously described for the upper feed table 93. As the cam 167 continues its rotation, the energy stored in the coil spring 168 returns the feed table 160 to the upper ends of the guide rods 161—161, whereupon the lower extremity of the latch 103 abuts an adjustable stop screw 170 to move the latch out of engagement with the catch pin and thus permit the compression roller to move downwardly into engagement with the top surface of the middle feed table 160.

A lower feed table 175 (Fig. 6) positioned directly under the middle feed table is pivotally mounted at 176 on a sleeve 177 reciprocally supported on a pair of guide rods 178—178 secured

to a projecting portion 179 of the frame 26. The feed table 175 has vacuum ports 172 for holding the lower sheet of paper to the table, which ports are connected to a vacuum system upon operation of a valve 173 (Fig. 16) by a cam 174 carried by the cam shaft 126. On the inner end of the pivot pin 176 is secured a guide 180 slidably engaging guideway 181 of a lever 182 rotatably mounted on a rod 183 suitably journaled in the frame 26. Keyed to the outer end of the rod 183 is a collar 184, (Fig. 8) in an aperture 185 of which is positioned the end of a torsion spring 186, the other end of the torsion spring being fastened to the lever 182. An end of one arm of a bell crank lever 187 secured to the rod 183 is normally maintained in contact with the lever 182 due to the energy stored in the torsion spring 186, and this arm also carries a pin 188 to which is fastened an end of a tension spring 189 for returning the lower feed table 175 to its retracted position. A roller 190 secured to the extremity of the lower arm of the bell crank lever 187 engages the camming edge of a cam 191 secured to the cam shaft 126, whereby upon rotation of the cam shaft the bell crank lever 187 and lever 182 are rotated clockwise through the interconnection of the torsion spring 186 to move the lower feed table forwardly toward the winding arbor. As the lower feed table approaches the winding arbor, a pin 195 (Fig. 6) protruding from the inner side of the table engages an inclined surface of a stationary cam 196 to rock the table 175 counter-clockwise to bring a concave portion 197 of the table in close proximity to the winding arbor to permit the vacuum which is now transferred from the lower feed table to the vacuum ports 65 of the arbor to draw the sheet of condenser paper carried thereby into engagement with the arbor. The torsion spring serving as an interconnection between the levers 187 and 182 constitutes a safety device to prevent injury to the lower feed table in case it meets an obstruction, since the movement of the bell crank lever 187 is then taken up by the torsion spring 186, thus permitting the lower feed table to remain stationary.

Automatic terminal feed mechanisms designated generally by the numeral 200 (Figs. 2, 11 and 12) secured to the bed plate 27 adjacent each of the winding arbors are provided for advancing and placing a pair of conducting terminals, preferably of tinned copper, 201 (Fig. 24) into the condenser at substantially the middle point in the winding of the condenser. Inasmuch as the terminal feed mechanism on the right hand side of the central frame 26 is a duplicate of that on the left hand side, only the latter is shown and will be described in detail. Mounted beneath and to the rear of the winding arbor is an air cylinder 202 housing a piston 203 which carries at its outer end a spring pressed plunger 204 and an arm 205 slidably mounted on a pair of guide rods 206—206 having their ends fastened to a bracket 207 and to the cylinder 202, respectively. When air under pressure is admitted to the cylinder, the piston 203 (Fig. 12) is moved to the left whereby the arm 205 having a pair of rectangular hollow feed fingers 210—211 positioned at different levels and provided with ports 212 connected to a suitable vacuum system (not shown) through a valve 208 (Fig. 16) operatively associated with a cam 209 carried by the cam shaft 126, is moved to the left directly over a magazine 213 having separate compartments 214—215 in which are stacked the terminals 201. At this point the spring pressed plunger 204 engages a depending arm 216 of a double bell crank lever 217 to rock it clockwise and move its other arms 218—218 (Figs. 11 and 12) to actuate levers 219—219 pivoted at 220 to the bracket 207 whence the other ends of the levers 219—219 move depending lugs 221—221 secured to vertically reciprocable bottoms 222. The bottoms are thus moved upwardly to bring the terminals 201 into resilient engagement with the underside of the rectangular feed fingers 210—211. The vacuum thereon attracts and holds the terminals on the underside of the feed fingers, whereupon a valve 230 (Fig. 16) operatively associated with a cam 231 of the cam shaft 126 is operated to discontinue the air pressure on the right hand side of the piston 203 and connect it to atmosphere whereby the air pressure which is always on the left hand side of the piston moves it and the terminal feed fingers to the right above the left hand winding arbor, into the position shown in Figs. 11 and 12.

At a predetermined time a counting mechanism 232 to be hereinafter described establishes an energizing circuit for an electromagnet 233 (Fig. 17) to attract its armature 234 pivoted at 235 so that an arm 236 thereof connected to a latch 237 through a link 238 actuates the latch counter-clockwise about its pivot 239. This movement of the latch removes it from a slot in the stem of the valve 208 (Fig. 16) thereby releasing the valve stem to permit the energy stored in the spring 240 of the valve to move the valve downwardly so that the conical portion 241 of the stem is moved out of engagement with the valve seat 242 to connect the port 24, which leads to the feed fingers, to atmosphere. The downward movement of the valve also brings the upper conical portion 23 into engagement with its seat, thereby breaking the connection between port 24 and a port 22, which leads to the source of vacuum. The result of the valve action just described is to discontinue the vacuum on the terminal feed fingers. Discontinuance of the vacuum causes the pair of terminals 201 to be dropped into the condenser at about the middle point of the winding, each of the terminals contacting with different sheets of tin foil.

As shown in Fig. 16, the cam shaft 126 has secured thereto a series of cams for actuating the upper, middle and lower feed tables herein before described, a plurality of vacuum valves for connecting the vacuum to the feed tables, terminal feed fingers and arbors, and a plurality of air pressure valves for operating the terminal feed mechanisms and ejector mechanisms located on the left and right hand side of the frame 26, respectively.

The counting mechanism 232 comprises a shaft 250 journaled in the top of the frame 26 and connected through suitable gearing (not shown) with the winding arbors 34—34. The shaft 250 has secured at its upper end a rotatable electromagnet 251 carrying an energizing coil 252 the terminals of which are connected to leaf spring contacts 253—254 secured to an insulator 255 fastened to the under side of the electromagnet. The leaf spring contacts 253—254 in turn resiliently engage contactors 256—257 which slidably contact with rings 258—259 mounted in a stationary insulator 260 and connected at predetermined intervals to a battery as disclosed in Fig. 20 and to be hereinafter described. Journaled within a vertical bore 261 of the shaft 250 is a smaller shaft 262, to a shoulder 263 of which is secured an iron disk 264 adapted to be attracted and rotated by the electromagnet

251 when it is energized. The shaft 262 terminates at its upper end in a square shank carrying a circular member 265 graduated in revolutions of the winding arbors and on the under-side of which is secured one end of a torsion spring 266 having its other end secured to a stationary pin 267 projecting from a cover plate 268 fastened to the top of the frame 26. Also carried by the shaft 262 is a pair of grounded contacting arms 269—270 frictionally rotatable about the circular member 265 and having clamping nuts 271 for securing the arms to the circular member 265 in predetermined positions according to the number of turns of foil and paper to comprise the particular type of condenser being manufactured. The arms 269—270 are bent in under the circular member 265 where the arm 269 carries a contact 275 adapted to engage with contact 276 mounted in an insulator 277 of the cover plate 268, and arm 270 carries contacts 278—279 adapted to engage contacts 280—281, respectively, mounted in the insulator 277. Upon energization of the electromagnet 251 the circular member 265 and contacting arms 269—270 are rotated by the shaft 250 whereby as contact 278 of the arm 270 engages the contact 280, an energizing circuit for relay 285 (Fig. 20) is established from grounded battery through fuse 286, conductor 287, the winding of the relay 285, conductor 288, conductor 289, contact 280, contact 278 to ground. The energization of the relay 285 operates its armature 291 to complete a circuit from a source of electrical power 292 through armature 291, conductor 293, the winding of a solenoid 294, conductor 295 to the power source 292, whereby the core 296 of the solenoid 294 actuates a switch 297 to disconnect the winding machine motor 78 from a 440 volt, 60 cycle power line 298 and connect it to a 110 volt, 15 cycle power line 299 to thus decrease the speed of the motor 78 and of the winding machine.

Subsequent to the reduction in speed, contact 279 of the contacting arm 270 engages contact 281 to complete an energizing circuit for a relay 305 to effect the actuation of a solenoid 306 to operate a clutch 307, hereinafter called the one revolution clutch, (Figs. 21 and 22) to thereby accomplish the driving of the cam shaft 126 through one complete revolution. The energizing circuit for the relay 305 is traced from grounded battery through conductor 308, the winding of the relay 305, conductors 309—310, contacts 281 and 279 to ground. The energized relay 305 attracts its armature 311 to establish a circuit from a source of power 312 through conductor 313, relay armature 311, conductor 314, the winding of the solenoid 306, conductor 315 to the power source 312. Energization of the solenoid 306 attracts its core 320 to rock counterclockwise a latch 321 (Figs. 21 and 22) connected therewith through a rod 322, to release a catch 323 pivoted to a circular disk 324. This disk is keyed to a shaft 325 suitably journaled in the under side of the bed plate 27 and having secured thereto a gear 326 connected through suitable gearing (not shown) with a gear 327 secured to the cam shaft 126 (Fig. 16). Upon the release of the catch 323, it rotates clockwise into engagement with a sprocket wheel 328 secured to a gear 329 which is driven through suitable gearing (not shown) from the gear 74 of the clutch 76 connected with the winding machine motor 78 whereby the cam shaft is actuated.

Rotation of the cam shaft 126 brings a cam contact 335 carried thereby into engagement with a terminal 336 to establish a locking circuit for the relay 305 to maintain the one revolution clutch 307 operated to thus assure rotation of the cam shaft for one complete revolution. This locking circuit is traced from grounded battery through fuse 286, conductor 308, the winding of the relay 305, conductor 309, conductor 337, terminal 336, cam contact 335, to ground. At the same time a locking circuit is completed for the relay 285 to keep the winding machine motor 78 operating at low speed during the rotation of the cam shaft which effects the various feeding operations of the paper and foil to the winding arbors. The locking circuit for the relay 285 is traced from grounded battery through fuse 286, conductor 287, the winding of relay 285, conductor 288, conductor 338, terminal 339, a cam contact 340 to ground.

When the cam shaft has completed one revolution, the terminal 336 engages an insulated portion of the cam contact 335 to discontinue the locking circuit for relay 305, whereby a spring 345 (Fig. 22) having one of its ends secured to the latch 321 and the other fastened to the bed plate 27, pulls the latch 321 clockwise into the path of rotation of the catch 323. A spring pressed plunger 346 mounted in a housing 347 carried by the latch 321 abuts catch 323 and thus forces it out of engagement with the sprocket wheel 328 to disconnect the one revolution clutch and stop rotation of the cam shaft.

Just before the cam shaft has completed its revolution, the terminal 339 engages an insulated portion of the cam contact 340 whereby the locking circuit for the relay 285 is opened to cause the release of the solenoid 294 and the switching of the motor over to the 440 volt power line 298 to cause an increased speed of the arbors 34—34 during the winding period.

Also just before the cam shaft 126 has completed its revolution, the cam 167 actuates lever 164 and causes the middle table 160 to feed the lower sheet of foil to the winding arbor 34. It is at this point that the counter must begin to function, since each revolution of the arbor 34 after the lower sheet of foil has begun to wind increases the electrostatic capacity of the material on the arbor. Accordingly, a cam contact 350 (Figs. 16 and 20) also carried by the cam shaft is so designed as to complete a circuit from grounded battery through fuse 286, the winding 252 of the electromagnet 251, conductor 351, terminal 352, and cam contact 350 to ground to thus energize the coil 252 to start the counting mechanism 232. This circuit is continued during the idle period of the cam shaft and is disconnected when rotation of the cam shaft is again started. The de-energization of the electromagnet 251 permits the energy stored in the torsion spring 266 (Fig. 18) to return the member 265 and arms 269—270 to the zero position where a stop 353 secured to the under side of the member 265 engages a stop pin 354 projecting from the upper side of the cover plate 268. This construction for returning the counting mechanism to the zero or starting point, when the particular type of condenser being wound comprises a smaller number of turns of paper and foil than the counting mechanism indicates in one revolution of its contacting arms 269—270, saves the time that would otherwise be required to operate idly the machine until the counting mechanism registers zero.

At substantially the half way point in the num-

ber of turns of foil being wound on the arbors to form condensers, the contact 275 of the adjusted arm 269 of the counting mechanism engages the contact 276 to establish a circuit to energize the electromagnet 233 (Fig. 17) to release the valve 208. The release of this valve discontinues the vacuum to the terminal feed fingers 210—211 whereby the pair of condenser terminals 200—201 are dropped into contact with separate sheets of the tin foil being wound on each of the arbors to form a condenser. This energizing circuit for the electromagnet 233 is traced from grounded battery through fuse 286, conductor 308, the winding of the electromagnet 233, contact 276, contact 275 to ground.

Upon completion of the winding of a pair of condensers, ejector mechanisms 360 (Fig. 23) are actuated to remove the condensers from the arbors 34—34. Each of the ejector mechanisms positioned on the left and right hand sides of the frame 26 includes a bracket 361 on which is mounted a cylinder 362 having a piston 363 which carries a reciprocable holder 365 slidably mounted on guide rods 366—366 secured to and positioned between the bracket and the head of the cylinder. Positioned on the top of the holder 365 is an arcuate shaped tray 367 for receiving a condenser when it is ejected. Pivoted at 368 on the holder is a bell crank latch 369 the short arm of which is connected to the end of a spring 370 having the other end fastened to the holder so that the latch portion is urged downwardly into a horizontal position. Slidably mounted on and rotatable with each of the arbors is an ejector collar 371 carrying a freely rotatable sleeve 372 which is mounted on a bifurcated lever 373 connected to a link 374 pivoted at 375 to the bracket 361. A spring 376 normally retains the collar 371 at the inner end of the winding armor. Compressed air is admitted continuously to the cylinder 362 on the outer side of the piston head to retain it in toward the frame 26 so that the latch 369 is caught on a pin 377 secured to the bifurcated lever 373 but when air at the same pressure is admitted by a valve 380 which is operated by a cam 381 on the cam shaft 126, (Fig. 16), to the inner side of the piston head, due to the larger effective area thereof, the piston is forced outwardly. The outward movement of the piston carries the latch and the collar 371 connected through the latch pin 377 to thereby eject the condenser from the arbor onto the arcuate plate 367 carried by the holder 365. When nearing the limit of the outward movement of the ejector collar, a roller 382 mounted on the side of the latch 369 engages a stationary cam 383 secured to the cylinder head whereby the latch is forced upwardly to release the bifurcated lever and the spring 376 returns the ejector collar and lever to their retracted positions. When the cam 381 closes the valve 380 the air pressure on the outer side of the piston head forces the piston 363 in toward the frame 26 to its inoperative position. It is to be noted that a similar valve 384 and associated cam 385 are provided on the cam shaft for controlling the operation of the ejector mechanism on the right hand side of the central frame 26.

In operating the winding machine to form electrical condensers the upper sheet of tin foil 29 and the two upper sheets of paper 28—28 on the left hand side of the frame 26 are brought out over the upper idler roller 33, over and under the upper feed table 93 and compression roller 100, respecttively, and thence under and past the upper knife 118. The lower tin foil sheet and the sheet of paper adjacent thereto are brought out over the two middle idler rollers 33—33, over and under middle feed table 160 and its associated compressor roller 100, respectively, and from there under lower knife 119. Then the last sheet of paper is brought out over lower idler roller 33, over lower feed table 175 and under the lower knife 119.

When the paper and foil have been brought out over the right hand side of the frame in a manner similar to that described for the left hand side, the operator presses a foot pedal (not shown) whereby the rod 83 connected to the lever 81 is moved downwardly to effect counter-clockwise rotation thereof and thus bring the button 80 of the clutch 76 into contact with the cup shaped friction disk 79 to force it into engagement with the driving friction disk 75 and thus cause rotation of the gear 74 to effect high speed actuation of the winding arbors 34—34 through suitable gearing.

The counting mechanism 232 having been previously adjusted for controlling the winding of a particular type of condenser having a predetermined number of turns is actuated through suitable gearing from the winding arbors 34—34 to rotate the arms 269—270 from the shaft 250 whereby a contact 278 of the arm 270 engages the contact 280 to establish an energizing circuit for relay 285. This circuit is traced from grounded battery through fuse 286, conductor 287, the winding of the relay 285, conductor 288, conductor 289, contact 280, contact 278 to ground. The energization of the relay 285 operates its armature 291 to complete a circuit from the source of electrical power 292 through armature 291, conductor 293, the winding of the solenoid 294, conductor 295 to the power source 292, whereby the core 296 of the solenoid 294 actuates the frequency changer switch 297 to disconnect the winding machine motor 78 from a 440 volt, 60 cycle power line 298 and connect it to a 110 volt, 15 cycle power line 299 to thus decrease the speed of the motor 78 and of the winding machine. Thereafter, contact 279 of the contacting arm 270 engages contact 281 to complete an energizing circuit for the relay 305 to effect the actuation of the solenoid 306 to operate the one revolution clutch 307 to accomplish the driving of the cam shaft 126 as hereinbefore described. The rotation of the cam shaft 126 brings a camming contact 335 secured thereto into engagement with a terminal 336 to establish a locking circuit for the relay 305 to maintain the one revolution clutch 307 operative during one complete revolution of the cam shaft. Simultaneously therewith, a locking circuit is also completed for the relay 285 to maintain the winding machine motor 78 operating at low speed during the rotation of the cam shaft during the various feeding operations of the paper and foil to the winding arbors.

Upon rotation of the cam shaft 126 the brush terminal 352 meets an opening in the cam contact 350 whereby the energizing circuit for the coil 252 is discontinued to stop the actuation of the counting mechanism 232. The de-energization of the coil 252 permits the energy stored in the torsion spring 266 to automatically return the counting mechanism 232 to a zero indication.

At this point in the operation, the cams 381—381 of the cam shaft 126 permit the valves 380—380 to close and discontinue the compressed air to the inner side of the piston heads 363 of the ejecting mechanisms 360 positioned on the

left and right hand sides of the winding machine, whereby the pistons and the associated ejector collars 371, due to the compressed air admitted continuously to the outer sides of the piston heads, are forced in toward the frame 26 to move the trays 367 in under the winding arbors and bring the latches 269 into engagement with the latch pins 377 of the levers 373. As the cam shaft rotates further the cams 231—231 permit the valves 230—230 to connect air pressure to the outer side of the head of the pistons 203 of the left and right hand terminal feed mechanisms 200—200 to move the terminal feed fingers 210—210 and 211—211 over their respective magazines 213—213 and bring the terminals 201 into resilient engagement with the under side of the feed fingers as previously described. Upon rotation of the cam shaft through several more degrees, cam 158 operates the valve 157 to connect the vacuum ports 156 of the middle platen 162 to a vacuum system to thus attract and hold the paper while the recoil device of the lower tension roller 40 pulls the foil back from the edge of the paper to provide proper insulation. A short period of time thereafter the portion 130 of the cam 125 (Fig. 7) rotates into vertical alignment with the projecting portion 124 of the plate 123 whereby the rod 120 carrying the knives 118—118 and 119—119 are forced downwardly by compression spring 129 a distance sufficient to sever the paper and foil passing over the upper and middle feed tables 93 and 160, respectively.

Cam 167 then rotates into release position to permit the energy stored in the spring 168 to rock the bell crank lever 164 to return the middle feed table 160 to its uppermost position whereupon the latch 103 strikes the stop screw 170 to force the latch out of engagement with the catch pin 101. The torsion spring 102 (Fig. 9) then forces the roller downward to compress the paper and foil between the middle feed table 160 and the roller. Thereafter cam 174 operates valve 173 to connect the vacuum ports 172 of the lower feed table 175 to a vacuum system to hold the paper when the knives subsequently descend to sever it. This severing operation is accomplished by the cam 125 rotating the portion 131 into alignment with the plate 124 whence the spring 129 forces the knives still lower to sever the last or lowermost sheet of paper. This movement of the knives and the bracket 117 actuates the levers 113 and 111, whereby the latter lever trips the latch 103 to release the roller 100 to compress the paper and foil upon the upper feed table 93.

Upon return of the knives to their inoperative position through the action of the cam 125, cams 381—381 open the valves 380—380 to admit air under pressure to the inner side of the piston heads 363 of the left and right hand ejecting mechanisms 360 to operate the ejector collars 371—371 on the winding arbors 34—34.

The aforementioned operations are part of the complete cycle necessary to go through to arrive at the actual winding point in the forming of the condensers after placing rolls of paper and foil on the machine and preparing it for operation. The actual starting point in the forming of the condensers occurs after operation of the ejecting mechanisms in the cycle, when cam 191 of the cam shaft 126 rocks the bell crank lever 187 clockwise to move the lower feed tables 175 and the paper held thereon by the vacuum connected to the ports 172 therein toward the winding arbors 34—34. As the tables approach the winding arbors, the pins 195 secured thereto engage the inclined surface of the stationary cams 196 (Fig. 6) to rock the tables 175 counter-clockwise to bring the concave portions 197 thereof into close proximity with the winding arbors. At this point in the cycle of operations, cam 87 opens the valve to connect the ports 65 in the winding arbors to a vacuum system and cam 174 permits the valve 173 to close to disconnect the vacuum system from the lower feed table whereby the paper is attracted to and started around the arbors. Thereupon cam 209 operates the valve 208 to connect the terminal feed fingers to a source of vacuum and the latch 237 (Figs. 16 and 17) enters a slot in the stem of the valve 208 to hold it open. The vacuum through the ports 212—212 in the terminal feed fingers attract one terminal to each of the fingers. At the same time cam 142 actuates the arm 137 and lever 136 to move the upper feed table and the two sheets of paper and one sheet of foil clamped thereon by the compression roller 100 toward the winding arbors where the paper and foil are inserted between the first paper and the arbor. Also, cam 167 rocks the bell crank lever 164 clockwise to move the middle feed table 160 with one sheet of paper and foil held thereon by its associated compression roller 100 to insert the paper and foil between the first paper and the papers and foil started on the winding arbors by the upper feed tables.

The energizing circuit for the coil 252 of the counting mechanism is then established from grounded battery through fuse 286, the winding 252 of the electromagnet 251, conductor 351, terminal 352, cam contact 350 to ground to thus start operation of the counting mechanism as previously described. Simultaneously therewith the cam shaft 126, completes one revolution and the terminal 336 engages an insulated portion of the cam contact 335 to discontinue the locking circuit for the relay 305 whereby the spring 345 (Fig. 22) pulls the latch 321 into the path of rotation of the catch 323 to force it out of engagement with the sprocket wheel 328 to disconnect the one revolution clutch 307 and stop rotation of the cam shaft. Prior to the stopping of the cam shaft the cam 142 has rotated into a position to permit the spring 96 to return the upper feed table 93 to its uppermost position, the cam 167 with spring 168 has moved the middle feed table half way back to its normal position, and cam 191 with the assistance of spring 189 has returned the lower feed table 175 to its normal position. The vacuum connection to the arbors has also been broken by cam 87 permitting the valve 86 to close. Valves 230—230 associated with cams 231—231 have been operated to discontinue the compressed air on the inner side of the heads of the pistons 203 and to connect them to atmosphere whereby the air pressure, which is always on the outer side of the heads, moves the piston and the terminal feed fingers with the terminals 201 held thereto by vacuum into a position above the winding arbors.

Upon the stopping of the cam shaft 126, terminal 339 contacts with an insulated portion of the cam contact 340 to open the locking circuit for the relay 285 whence the solenoid 294 is de-energized and the switch 297 connects the motor 78 to the 440 volt, 60 cycle power line 298 to increase the speed of the winding arbors.

The paper and foil are now being wound on the winding arbors at high speed and at about the middle point in the number of turns comprising the particular type of condenser being wound

the contact 275 of the adjusted arm 269 of the counting mechanism 232 engages the contact 276 to complete an energizing circuit for the electromagnet 233 traced from grounded battery through fuse 286, conductor 308, the winding of the electro magnet 233, contacts 276 and 275 to ground. Energization of the electromagnet 233 attracts its armature 234 (Fig. 17) to actuate the latch 237 counter-clockwise to remove it from a slot in the stem of the valve 208 thereby releasing the valve stem to the energy of the spring 240 to close the valve and discontinue the vacuum on the terminal feed fingers. Discontinuance of the vacuum causes two terminals 201 to be dropped into each of the condensers being wound so that each separate sheet of foil contacts with an individual terminal 201.

When the required number of turns of paper and foil have been wound to form the two condensers as determined by the adjusted position of the arm 270 of the counting mechanism, the contact 278 thereof engages the contact 280 to establish an energizing circuit for the relay 285 to effect the movement of the freqquency changer switch 297 from the 440 volt, 60 cycle power line 298 to connect the motor 78 to the 110 volt, 15 cycle power line 299 to thus reduce the speed of the winding machine as has been previously described in detail.

Immediately thereafter contact 279 of the arm 270 of the counting mechanism engages contact 281 to establish an energizing circuit for the re.ay 305 which effects the operation of the solenoid 306 to thus operate the one revolution clutch 307 to drive the cam shaft 126. Upon rotation of the cam shaft, contact 335 carried thereby engages the terminal 336 to establish a locking circuit for the relay 305 to maintain the one revolution clutch 307 operated to thus rotate the cam shaft through one complete revolution. Also terminal 352 engages an opening in the cam contact 350 to discontinue the energizing circuit for the electromagnet 251 and thus render the counting mechanism 232 inoperative during the rotation of the cam shaft.

Cams 381—381 of the cam shaft then permit valves 380—380 to close to effect the movement of the latches 269 in toward the frame 26 to engage them with the latch pins 377 of the levers 373. As the cam shaft rotates further, cams 231—231 operate valves 230—230 to move the terminal feed fingers 210—210 and 211—211 back to their inoperative position, and cam 158 actuates the valve 157 to connect the vacuum ports 156 of the middle platen 162 to a vacuum system to hold the paper adjacent thereto, while the recoil device on the lower tension roller 40 pulls the foil back about one quarter of an inch from the edge of the paper to provide proper insulation between the edges of the two sheets of tin foil when the three upper sheets of paper and the foil are severed. This severing operation occurs immediately thereafter due to the cam 125 permitting the compression spring 129 to actuate the knives 118—118 and 119—119 a predetermined distance as controlled by portion 130 of the cam 125. Cam 167 then rotates into the position where the energy stored in the spring 168 becomes effective to return the middle feed tab'e to its uppermost position.

Subsequently cam 174 actuates valve 173 to connect the vacuum ports 172 of the lower feed table 175 to a vacuum system to hold the lowermost sheet of paper on each side of the frame 26 when the knives 119—119 descend to sever it. The lowermost sheet of paper is severed last to permit several protective turns of paper to be applied around each condenser. After portion 131 of the cam 125 allows the lower knives 119—119 to sever the last sheets of paper and the knives have been returned to their raised position, cams 381—381 open the valves 380—380 to operate the ejecting mechanisms 360—360 to remove the condensers from the arbors 34—34 and deposit them upon the trays 367—367. The cycle of operations is then continuously and automatically repeated until the desired number of the particular type of condensers are formed.

Although the invention herein described and illustrated is particularly well adapted for winding condensers, it will be understood that the invention is capable of many other modifications and adaptations and is to be limited only by the scope of the appended claims.

What is claimed is:

1. In a material winding machine, winding means for receiving web material, means for inserting a rigid article between the windings of the material, means for severing the material, and means operable in timed relation to the operation of the severing means for removing the wound material from the winding means.

2. In a material winding machine, means for winding materials, means for feeding the materials to the winding means, means for severing the materials, means for retracting one of the materials a predetermined distance upon the severance of the materials, means for ejecting the wound materials from the winding means, means for controlling the operation of winding, feeding, severing, and ejecting means in a predetermined sequence, and an electromagnetic counting mechanism for operating said controlling means.

3. In a material winding machine, means for winding material, means for feeding the material to the winding means, means for inserting an article between the layers of the wound material during the winding thereof, means for severing the material, means for ejecting the wound material from the winding means, means for controlling the operation of winding, feeding, severing, and ejecting means, and an electrically operated counting mechanism for operating said controlling means.

4. In a material winding machine, means for simultaneously winding a plurality of webs in superposed relation, means for severing the webs upon the winding of a predetermined number of turns, and means for retracting an edge of one of the webs a predetermined distance from an edge of the other webs.

5. In a condenser winding machine, a rotary member for receiving wound materials to form a condenser, reciprocable means for advancing a material to the rotary member, means for actuating the reciprocating means, and a resilient connection between the actuating means and the reciprocating means for preventing injury to the latter.

6. In a condenser winding machine, means for winding materials to form a condenser, means for automatically inserting a rigid terminal member into the condenser during the forming thereof, and an adjustable mechanism for controlling the time of inserting the terminal into the condenser.

7. A winding machine, comprising a rotary member designed to simultaneously receive two webs in superposed relation, means for advancing the forward end of one of the webs to the rotary

member to be wound thereon while the other web remains stationary, means for subsequently advancing the forward end of the other web into a position to be engaged between successive convolutions of the first mentioned web, a counting mechanism for indicating the number of turns of the webs wound upon the rotary member, and means for starting the operation of the counting mechanism upon the other web being so engaged.

8. A winding machine, comprising a rotary member having suction ports therein to retain a web in engagement therewith and designed to receive two webs in superposed relation, means for advancing the forward end of one of the webs to the rotary member in a position to be seized by said suction ports to be wound thereon while the other web remains stationary, and means for subsequently advancing the forward end of the other web into a position to be engaged between successive convolutions of the first mentioned web.

9. In a condenser winding machine, means for winding a plurality of webs of material to form a condenser, a reciprocable member for advancing one of the webs to the winding means, a second reciprocable member for advancing another of the webs to the winding means, and means for operating the several reciprocating members in predetermined sequence.

10. In a condenser winding machine, a rotatable winding arbor having vacuum ports, a stationary element for rotatably supporting the arbor and having a vacuum passageway, a spring pressed bearing engaging said arbor and having a port communicating with a port in said arbor, and an expansible tube affording communication from said passageway to said bearing.

11. In a material winding machine, means for winding material, means for severing the material, and a counting mechanism for controlling the operation of the severing means, said counting mechanism comprising an electromagnetic clutch, and means for returning the counting mechanism to a predetermined indication when said clutch is de-energized.

12. In a material winding machine, means for winding material, means for severing the material, means for varying the speed of said winding means, a counting mechanism for controlling said speed varying means and for controlling the operation of the severing means in predetermined time relationship, and means for returning the counting mechanism to a zero indication, said means rendered effective automatically upon the winding of a predetermined number of turns of material.

13. In a material winding machine, means for winding material, means for severing the material, means for varying the speed of said winding means, means for inserting terminals between predetermined convolutions of the material, and a counting mechanism for controlling the operation of said terminal inserting means, of said speed varying means and of said severing means.

14. In a condenser winding machine, means for winding material to form a condenser, a reciprocating member arranged to hold terminal members, and means for actuating said reciprocating member at a predetermined time during the winding of the condenser for automatically inserting the terminal members into the condenser during the forming thereof.

15. In a material winding machine, means for winding material to form a condenser, a reciprocating member arranged to hold a terminal member, a magazine for holding the terminal members in stacked formation, and means for actuating said reciprocating member for causing it to transfer a terminal member from said magazine to a position between the materials of the condenser.

16. In a material winding machine, means for winding a plurality of webs in superposed relation, means controlled by the amount of material which has been wound by said winding means for severing the webs, means for moving one of the webs in a direction opposite its normal direction of travel for a predetermined distance, and means for simultaneously advancing another of the webs through a predetermined distance relative to the first mentioned web.

17. In a material winding machine, a rotatable arbor, a feed pad, means for moving said feed pad in one direction to move a web of material toward said arbor, means for moving said feed pad in another direction to move the web of material into engagement with said arbor, and means for starting the winding of said web on said arbor.

18. In a condenser winding machine, means for winding materials to form a condenser, means operating in timed relation with said winding means for inserting a metallic terminal member into the condenser while the winding means is operating.

19. In a material winding machine, means for winding materials, means for severing the materials, means for feeding the severed materials to the winding means, and means for retarding one of the materials so that they may be fed to the winding means one in advance of the other.

20. In a condenser winding machine, means for winding materials to form a condenser, means for inserting a metallic member into the condenser, and means rendered effective automatically in timed relation with said winding means for actuating said terminal inserting means.

21. In a material winding machine, means for winding materials, means for severing the materials, means for feeding the severed materials to the winding means, and means for retracting one of the materials so that said materials may be fed to the winding means one in advance of the other.

22. In a material winding machine, a rotatable winding arbor, means for guiding material to said arbor, means for advancing an end of said material to said arbor, means for applying suction at the surface of said arbor for grasping the end of the material while the arbor is rotating, and means operated in timed relation to said advancing means for controling said suction applying means.

CHESTER A. PURDY.