Sept. 18, 1945. F. WEISS 2,384,983

CONDENSER WINDING MACHINE

Filed Sept. 12, 1944 11 Sheets-Sheet 1

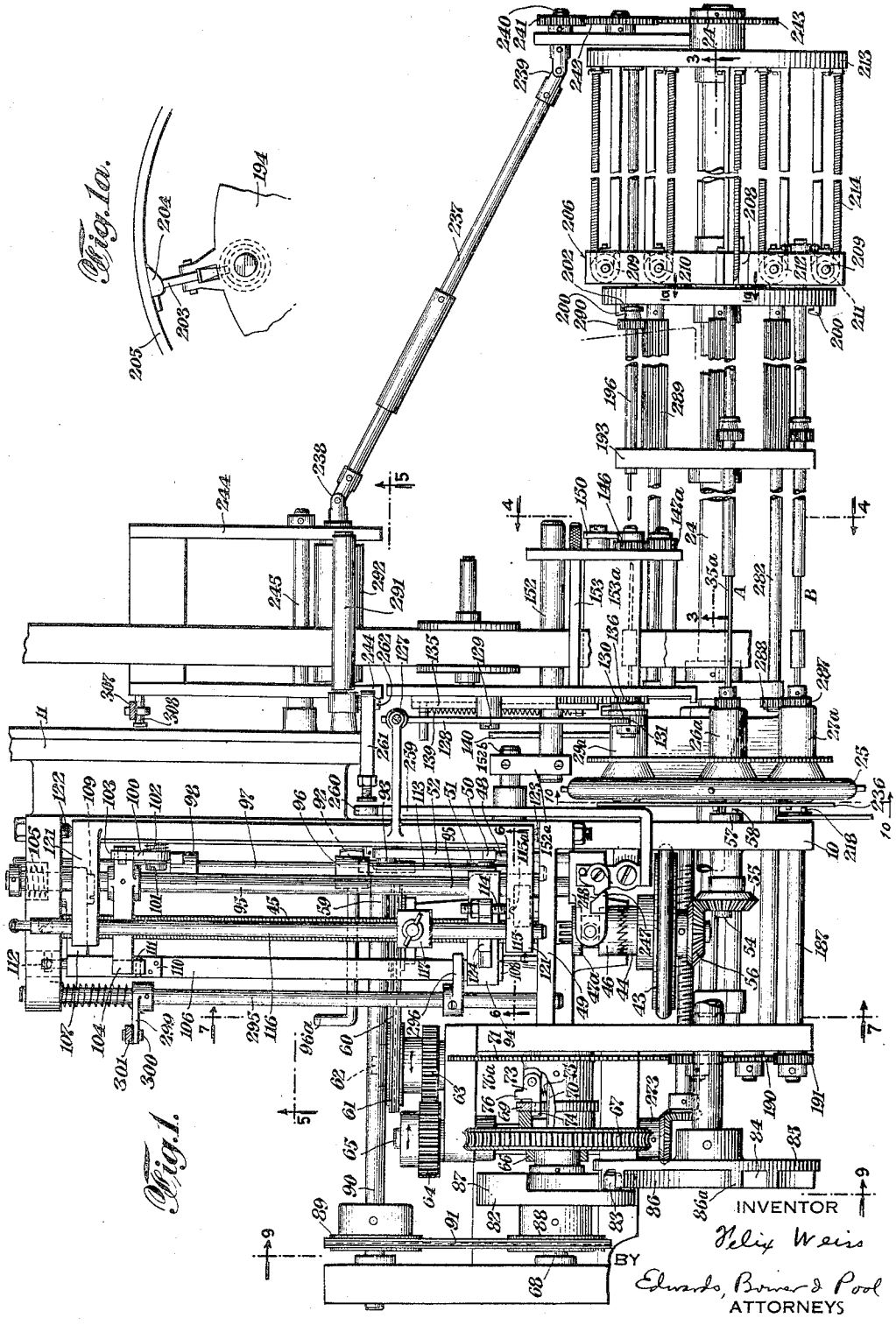


Fig. 1.

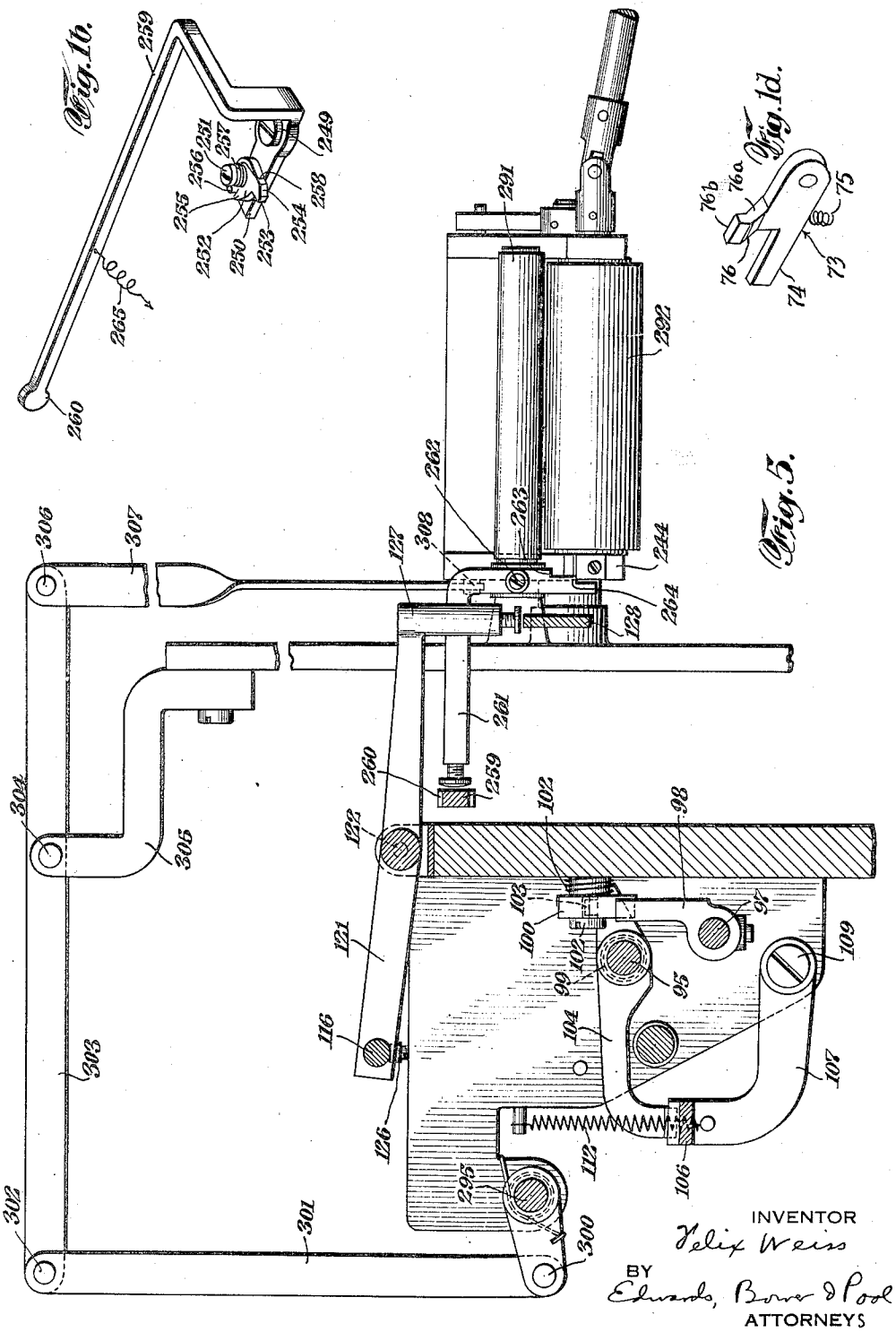
Fig. 1a.

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Fig. 9.

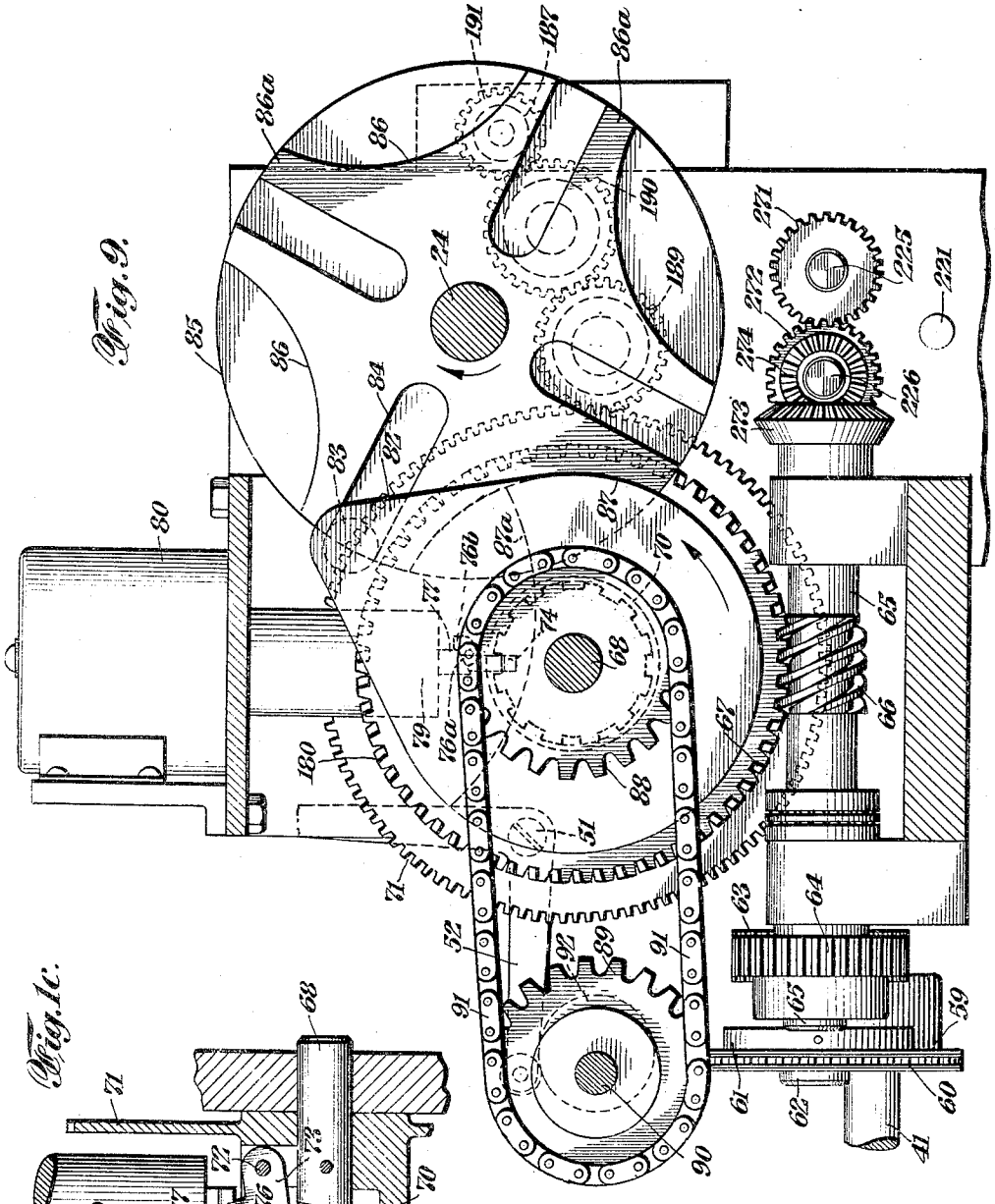


Fig. 1c.

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CONDENSER WINDING MACHINE

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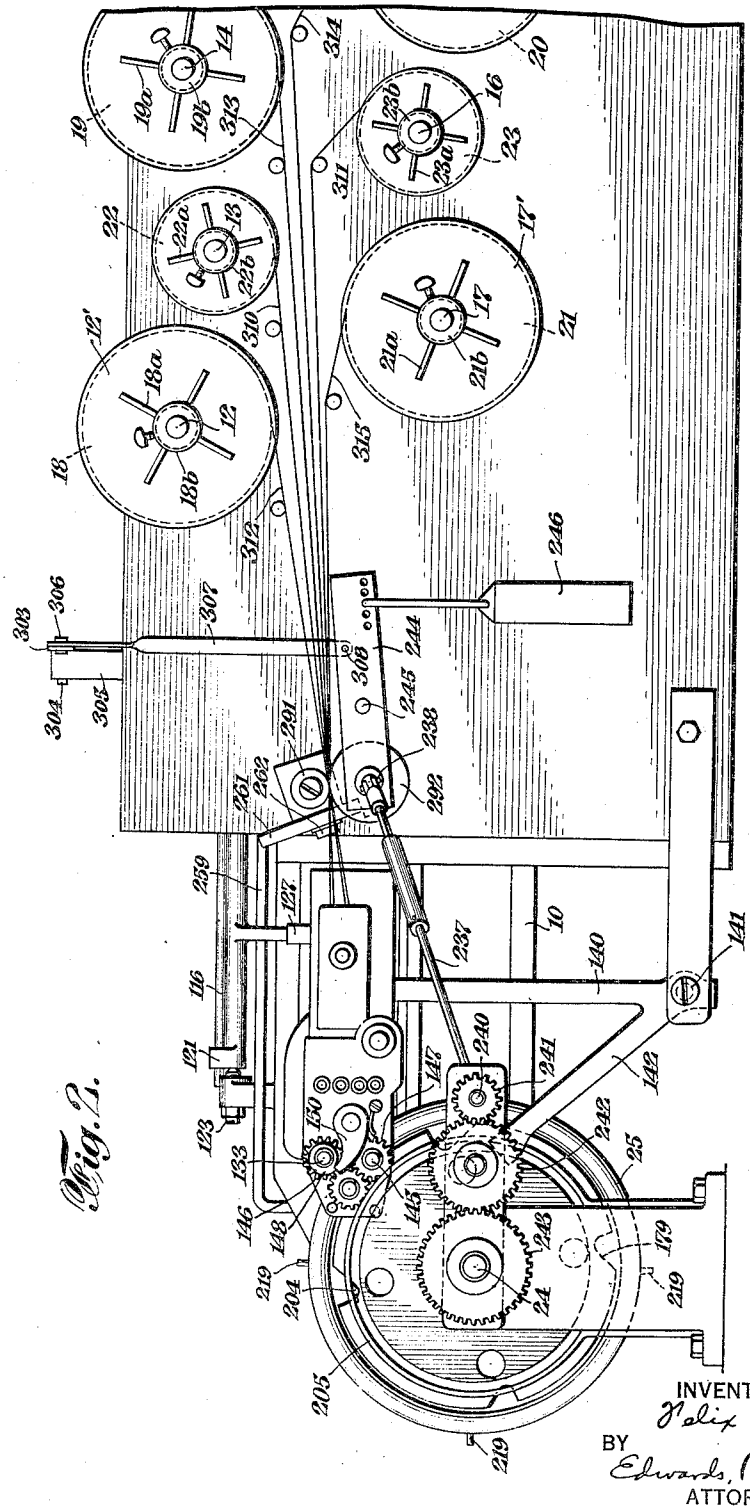


Fig. 2.

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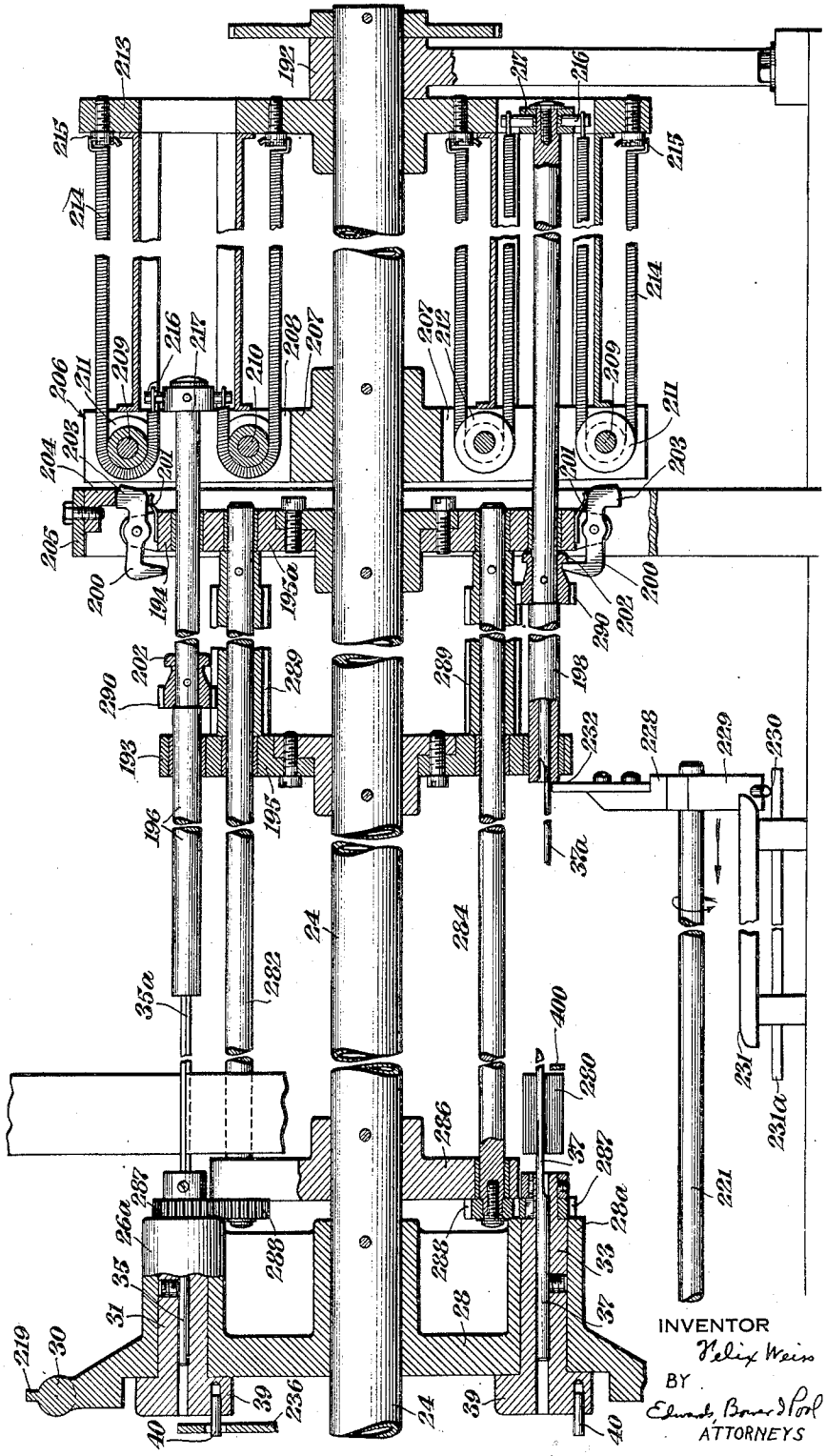


Fig. 3.

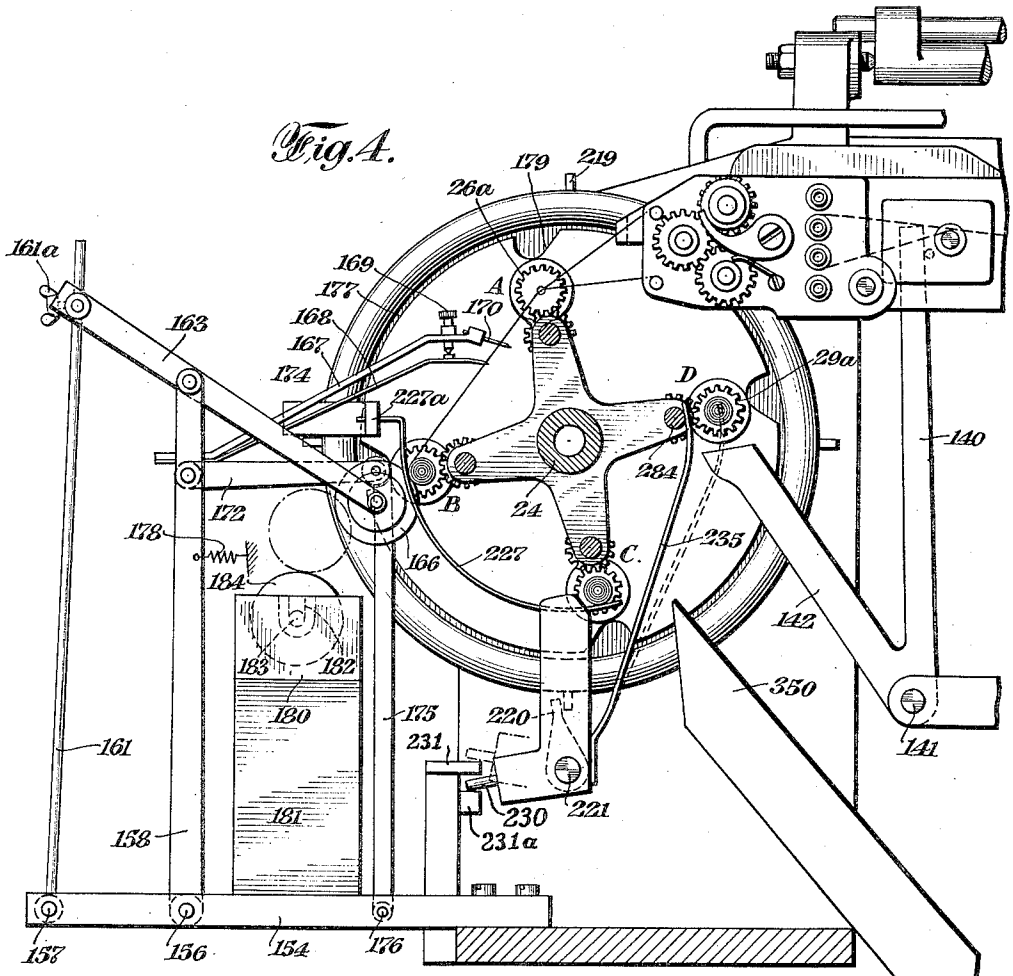
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Fig. 4.



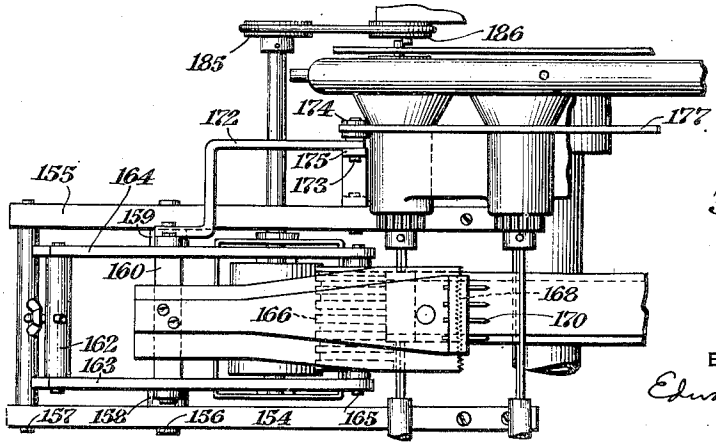


Fig. 4a.

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Fig. 11.

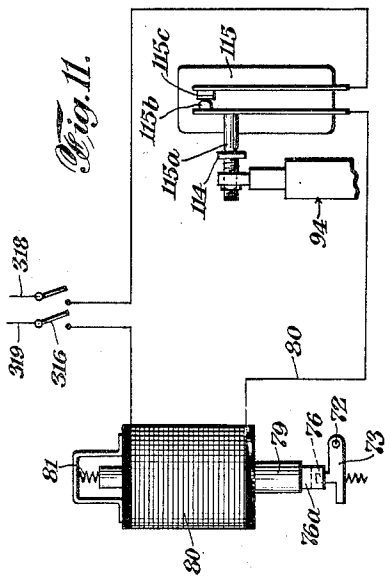


Fig. 7a.

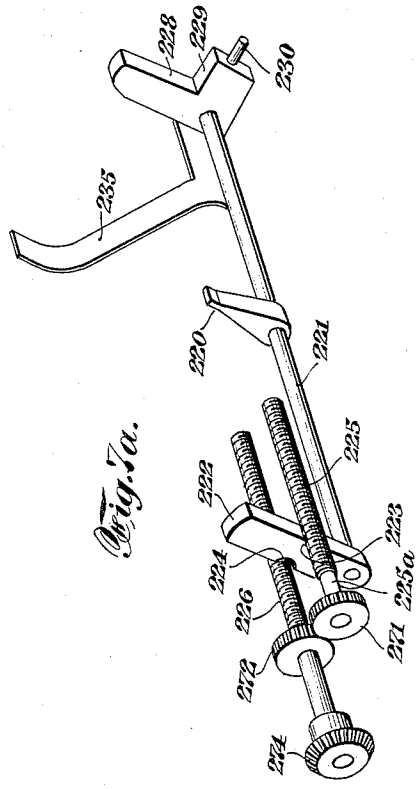
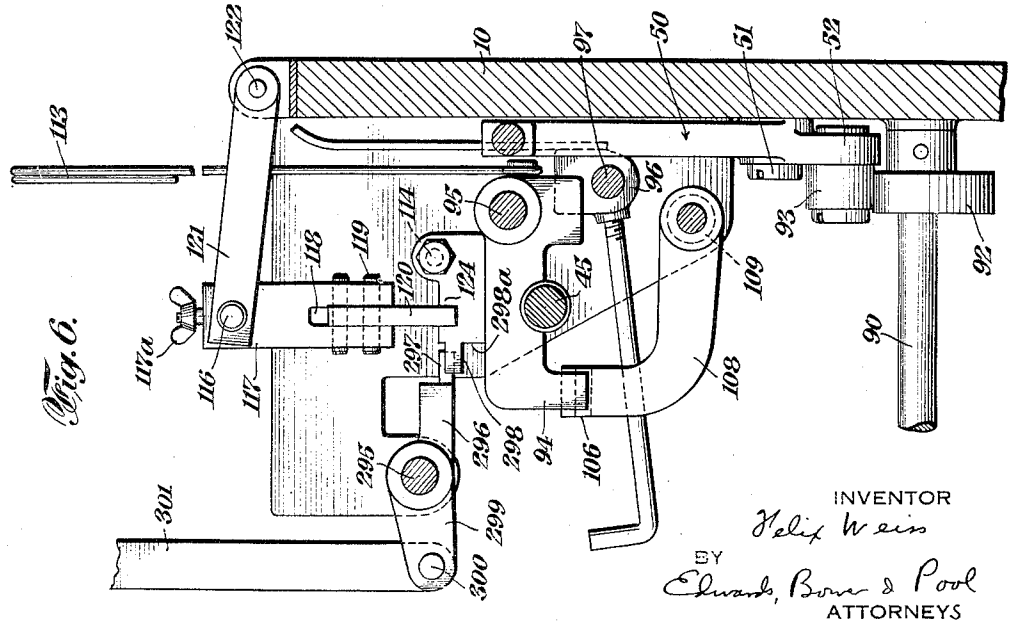


Fig. 6.



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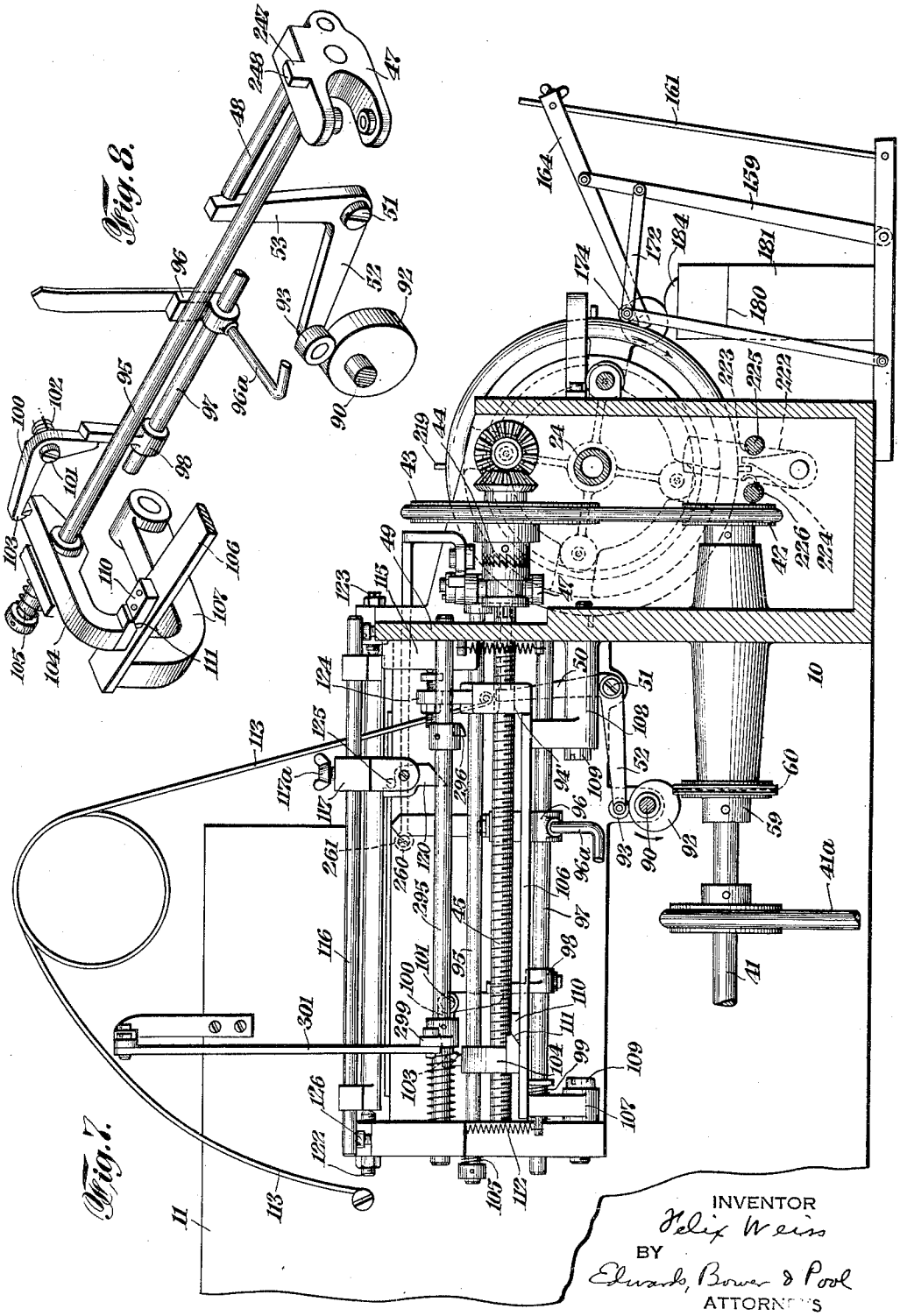


Fig. 8.

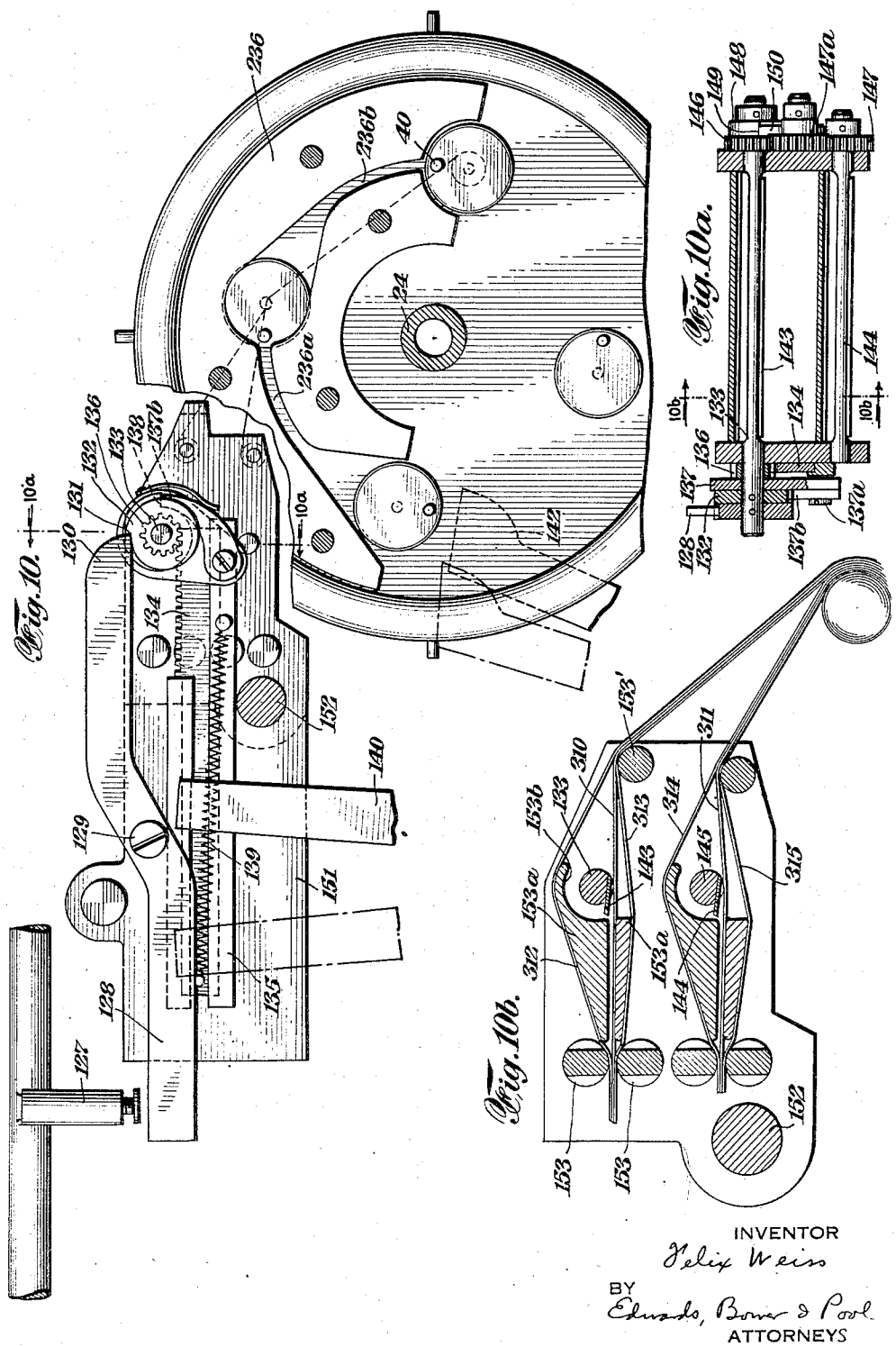
Fig. 7.

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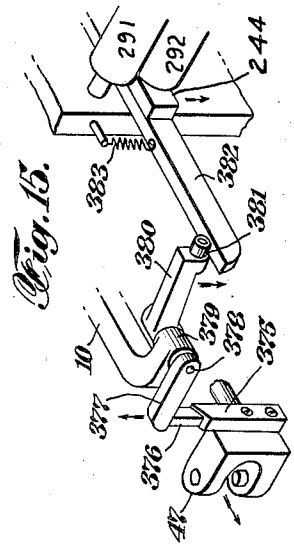


Fig. 15.

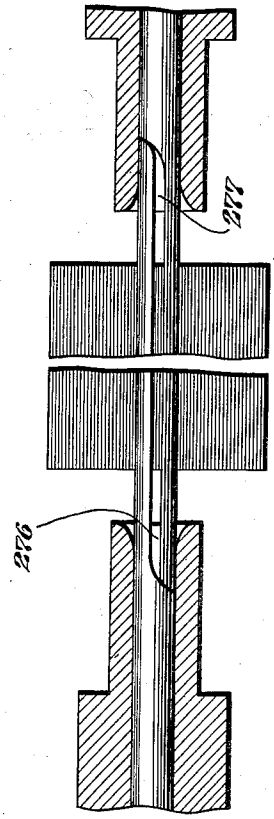


Fig. 12.

Fig. 13.

Fig. 14.

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Fig. 16

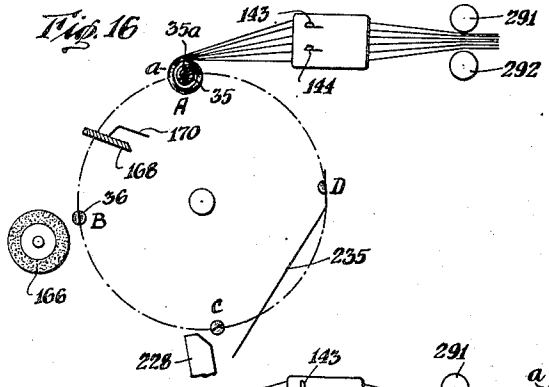


Fig. 17

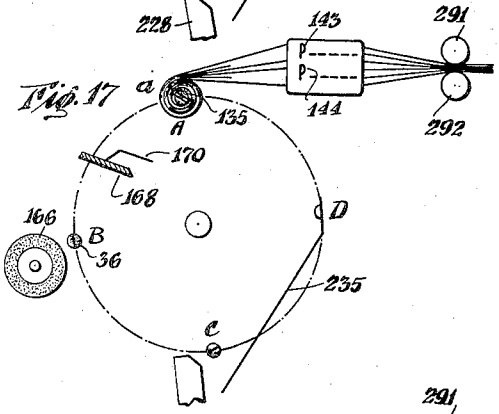


Fig. 18

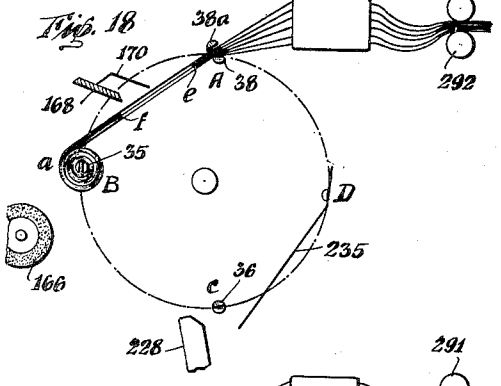


Fig. 19

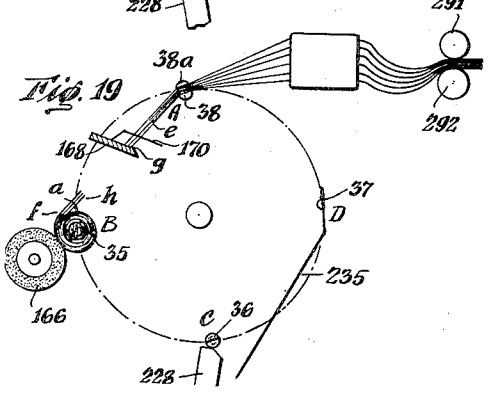


Fig. 20

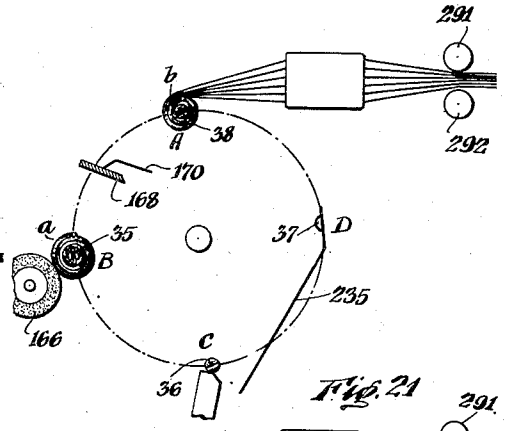


Fig. 21

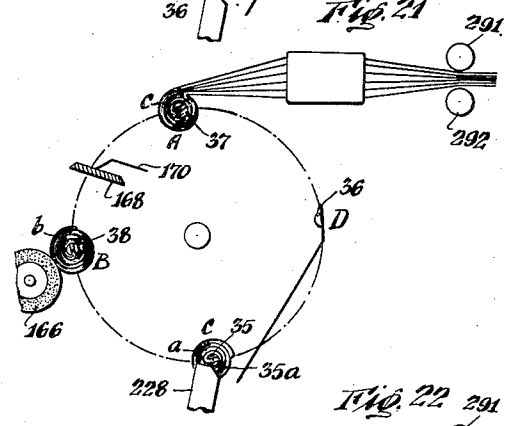
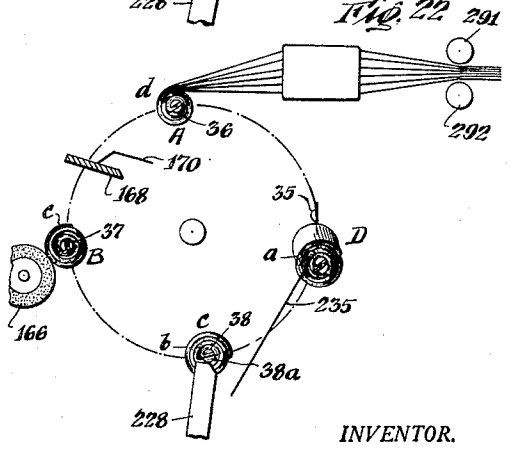


Fig. 22



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Patented Sept. 18, 1945

2,384,983

UNITED STATES PATENT OFFICE

2,384,983

CONDENSER WINDING MACHINE

Felix Weiss, Brookline, Mass., assignor to Cornell-Dubilier Electric Corporation, a corporation of Delaware

Application September 12, 1944, Serial No. 553,773

38 Claims. (Cl. 242—56)

This invention relates to machines for making electrical condenser rolls.

An object is to provide a machine which is capable of automatically feeding foil and paper into the machine, cutting the foil, creating a space between the foil ends and cutting the paper therebetween, automatically sealing and completing the roll-up of the strips, disengaging the mandrel and ejecting the completed condenser in a continuous succession of operations without interruption of the machine.

A related object is to provide a high rate of production while maintaining good precision of the condenser rolls and incurring a low rate of spoiling and breakage of material.

In carrying out the invention a device is provided whereby foil and paper are fed on to a mandrel and wound into rolls at one station, the foil being cut under tension after a predetermined number of turns at the time that the foil and paper are retarded by gripping the feed rollers, and the paper is thereafter cut between the separated ends of the foil upon the mandrel being carried around to a section station where the condenser is sealed and completed. The mandrel is thereafter moved to successive stations where the mandrel is removed and the completed condenser ejected, all in one continuous operation with the respective operations being performed on different condenser rolls at all of the stations at the same time, and is automatically repeated and continued uninterruptedly and without any manual handling of the condensers.

One way to perform the invention is described in the following detailed description and shown in the accompanying drawings, of which:

Fig. 1 shows a plan view of the machine;

Fig. 1*a* shows a mandrel pin latching detail at line 1*a*—1*a* of Fig. 1;

Fig. 1*b* is a perspective view of a lever detail shown in Fig. 1;

Fig. 1*c* shows a detail of a clutch operating mechanism partially shown in Fig. 1;

Fig. 1*d* is a perspective view of a pivoted dog forming part of the mandrel indexing mechanism.

Fig. 2 shows a front elevation of the machine;

Fig. 3 is a side elevation in section of a part of the machine taken along line 3—3 of Fig. 1;

Fig. 4 is a front elevation of a detail taken along line 4—4 of Fig. 1;

Fig. 4*a* is a top view of the apparatus shown in Fig. 4;

Fig. 5 is a sectional elevation taken along line 5—5 of Fig. 1;

Fig. 6 is a sectional elevation taken at line 6—6 of Fig. 1;

Fig. 7 is a rear elevation in section of a part of the machine taken along line 7—7 of Fig. 1;

Fig. 7*a* is a perspective view of a detail shown in Fig. 7;

Fig. 8 is a perspective view of part of the mechanism shown in Fig. 7;

Fig. 9 is an elevation in section of the part of the machine taken along line 9—9 of Fig. 1;

Fig. 10 is a detail looking through line 10—10 of Fig. 1;

Fig. 10*a* is a sectional view taken at line 10*a*—10*a* of Fig. 10;

Fig. 10*b* is a sectional view taken at line 10*b*—10*b* of Fig. 10*a*;

Fig. 11 is a wiring diagram showing the electrical switching and solenoid apparatus for operating a clutch shown in Fig. 1;

Fig. 12 is an enlarged view partially in section of a mandrel and mandrel pin used in the machine;

Fig. 13 is an enlarged view showing the position of the condenser strips and cutting and spiking mechanism during one of the positions of operation;

Fig. 14 illustrates the superimposed condenser strips leading to the condenser roll;

Fig. 15 illustrates a detail of an alternative modification; and

Figs. 16 to 22, inclusive, are operational diagrams illustrating a sequence of operation performed by the machine.

Coil winding mechanism

Mounted on a frame 10, which supports the various parts, is a vertical panel 11 (see Fig. 2) which supports six pins 12 to 17, inclusive, carrying reels 12' to 17', respectively, which support rolls of metal foil and insulating material such as paper. Compression spider springs 18*a*, 19*a*, 20*a*, 21*a*, 22*a* and 23*a* are placed between the hubs of the rolls and respective collars 18*b*, 19*b*, 20*b*, 21*b*, 22*b* and 23*b*, for the purpose of applying a moderate amount of retardation against rotation of the rolls. Rolls 18, 19, 20 and 21 are rolls of paper or insulating strip and rolls 22 and 23 are of foil strip. At the front end of frame 10 there is journaled a shaft 24 (Figs. 1 to 3) to which is fixed a rotatable mandrel support in the form of a head 25 comprising four radial arms 26, 27, 28 and 29 and a rim 30. The four arms respectively carry four hubs 26*a*, 27*a*, 28*a* and 29*a* through which are journaled respective rotatable bushings 31, 32, 33 and 34 into

which are fastened mandrels 35, 36, 37 and 38, respectively, by means of set screws; the conducting and insulating strips 310, 311, 312, 313, 314 and 315 from the insulating and conducting strip rolls being wound up on these mandrels. These mandrels are constructed as part-mandrels each being really half a mandrel in the form of a half cylinder having a flat surface through the longitudinal axis, which is adapted to cooperate with a similar flat surface of a cooperating part-mandrel, or pin, to hold the condenser strips therebetween. At the back end of each bushing, behind the head, there is formed a collar 39 provided with a driving pin 40.

For driving the mandrels there is provided a shaft 41 (Fig. 7) power driven from a belt 41*a* and having fastened to it a pulley 42 which is belted to a pulley 43 fastened to a clutch member 44, the pulley and clutch member being free to rotate on a shaft 45 which is journaled in the frame 10 (Figs. 1 and 7). Another clutch member 46 is splined on shaft 45, and movable endwise along the splines. For the purpose of engaging the two clutch members there is provided a fork 47 placed within a groove 47*a* of the clutch member 46 (Figs. 7 and 8), and the fork has fixed to it a rod 48 protruding through a head 49 fixed on the frame 10. A bell crank 50 is pivoted to the frame at 51 so that when the arm 52 of the bell crank is rotated clockwise (with reference to Fig. 8) its other arm 53 pushes against rod 48 to move the clutch member 46 into engagement with member 44, thereby causing shaft 45 to rotate.

There is journaled to the vertical wall of frame 10 a shaft 54 having fixed at its rear end a bevel gear 55 which engages with a bevel gear 56 fixed to the front end of shaft 45. At the opposite end of shaft 54 is a collar 57 with a driving pin 58 adapted to engage the pin 40 of whichever mandrel bushing collar 39 is placed in driving relation with pin 58.

The mandrel head 25 is rotatable counterclockwise (with reference to Fig. 2) in four successive steps of 90° each, during a full revolution, so that each mandrel is held for a time at each one of four successive stations A, B, C and D, spaced 90° apart, during a complete revolution of the head. During each successive one of these four steps, the next succeeding of the four mandrels is placed in driving relation with shaft 54.

Mandrel indexing mechanism

The 90° indexing movements of the indexing head 25 are carried out by the following mechanism: There is fastened to the power shaft 41 a sprocket 59 which drives by means of a sprocket chain 60 a sprocket 61 fastened to a shaft 62 (Figs. 1, 7 and 9). There is fastened to sprocket 61 a spur gear 63 which drives another spur gear 64 fastened to a shaft 65. Also fastened to shaft 65 is a worm 66 which drives a worm wheel 67 which is loosely rotatable on a shaft 68 (Fig. 9). On the hub of worm wheel 67 is fastened a clutch plate 69 containing internal teeth 70 (Figs. 1 and 1c). There is fastened on shaft 68 a gear 71 having mounted on its hub a pivot 72 on which is pivoted a dog 73 having a projection 74 adapted to engage the internal teeth 70 whenever the dog is released to make the engagement. The dog is normally held in engagement with the teeth by means of a spring 75. On top of the dog is a boss 76 having a bevel 76*a* (Fig. 1*d*) leading up to a lug 76*b* adapted to be engaged by an arm 77 attached to the plunger 79 of a solenoid 80. A compression spring 81 (Fig. 11) holds the arm in its position in the path of boss 76 so that when the boss moves under the arm 77, the bevel 76*a* travels under the lower edge of this arm to depress the dog and disengage its clutch teeth. When the lug 76*b* engages the side of arm 77 the dog and its gear 71 stop rotating. When solenoid 80 is energized, however, the arm is pulled out of engagement with the dog, thereby permitting the dog to rotate under action of spring 75 to engage the clutch teeth.

Also mounted on shaft 68 is a Geneva arm 82 having a pin 83 adapted to engage with the radially extending Geneva slots 84 of a Geneva plate 85 which is fixed to the indexing shaft 24 to which the indexing head 25 is attached. The Geneva plate is provided with four arcuate hubs 86, one being located between each adjacent pair of slots; and the radius of curvature of each of these hubs is equal to the radius of the circular portion of the hub 87, so that when the indexing head 25 is indexed in any one of the four stations, hub 87 engages the corresponding one of the four hubs 86 to lock shaft 24 against rotation. The circular hub 87 of arm 82 is provided with an arcuate cut-out 87*a* to provide clearance for the extremities 86*a* of the hubs 86 when the Geneva arm is rotated to rotate the Geneva plate.

Fixed to shaft 68 is a sprocket wheel 88 which drives a sprocket wheel 89, fixed to a shaft 90, by chain 91, the gear ratio being one-to-one so that there is one revolution of shaft 90 for each revolution of shaft 68. Fastened on shaft 90 is an eccentric 92 on which rides a roller 93 journaled on the end of bell crank arm 52 (Fig. 8). The eccentric 92 is so related to the Geneva arm that the eccentric turns the bell crank to engage the clutch member 46 with clutch member 44 just after the Geneva pin 83 has swept through the Geneva slot to complete the 90° indexing movement of the head 25.

Turns counting mechanism

For determining the number of turns of paper and foil strip to be wound on the mandrels for each condenser roll, there is provided a turns counting mechanism (Figs. 1, 5, 6 and 7). This comprises a half nut 94 slidably pivoted at one side thereof on a rod 95 and engaging the threaded shaft 45 so that when the clutch members 46 and 44 become engaged to roll up the condenser the nut travels to the left (with reference to Fig. 7) until it strikes a stop 96 adjustably fastened to a slidable bar 97 by a set screw 96*a*. There is fastened near the end of bar 97 a dog 98 and a compression spring 99, so that when the stop is pushed by the half-nut, bar 97 is moved endwise against the compression of the spring, and the dog rotates a bellcrank 100, pivoted at 101, against the force of a helical spring 102, thus lifting a catch 103 on the bellcrank from engagement with a head 104 which is fixed to rod 95. The other end of rod 95 is attached to the clutch fork 47. When the catch 103 is lifted from head 104 the latter springs to the left (with reference to Fig. 7) by action of compression spring 105 and thus disengages the clutch member 46 from 44.

A bar 106 is mounted by supports 107 and 108 on rotatable pins 109, and bar 106 has a member 110 with a bevel 111. The under surface of head 104 is adapted to move sideways on and off of member 110 along the bevel 111, so that when the head springs to the left, the head moves off member 110 and allows bar 106 to move up under action of spring 112, thereby lifting the

half-nut out of engagement with the threads on shaft 45 by pivoting the half-nut on bar 95 and permitting the half-nut to slide rapidly home to its initial position where it drops off the right end of bar 106 (Fig. 7) and on the screw shaft 45, by the action of hairpin spring 113 which is attached at one end to the half-nut and at the other end to the frame. A bolt 114 is mounted on the half-nut and a switch 15 having an operating knob 115a is fastened to the frame so that when the nut reaches home the bolt 114 pushes the switch knob which closes switch contacts 115b and 115c to close the circuit through solenoid 80 as long as the nut is home (see wiring diagram, Fig. 11). This pulls arm 77 out of engagement with boss 76, thereby causing dog 73 to engage with clutch teeth 70.

Foil strip severing mechanism

To sever the foil and paper strips during the indexing operation after each mandrel winding, there is provided the following mechanism: There is mounted on a bar 116 (Figs. 6 and 7) a member 117 which has a slot 118 containing a pin 119 on which is pivoted a beveled cam 120. The position of member 117 on bar 116 is adjustable, and the member is fastened in position by a set screw 117a. Bar 116 is part of a frame 121 which is pivoted at 122 and 123 to the main frame 10. The arrangement is such that shortly before the half-nut traveling along shaft 45 strikes stop 96, a camming member 124 mounted on the half-nut engages the pivoted cam 120, moving it against a stop 125, and thereby lifting bar 116 while the nut passes by; after which the bar drops down again on its support 126 (Fig. 5). When the nut returns home it simply kicks the freely pivoted cam 120 in the opposite direction without lifting the bar. Frame 121 has an arm 127 (Fig. 5) which engages the rear end of a latch lever 128 which is pivoted at 129 (Fig. 10), so that when bar 116 is lifted arm 127 is depressed, pivoting the latch to disengage its end 130 from the shoulder 131 of a collar 132 which is fastened to a shaft 133. Shaft 133 is journaled in a cradle or cutter box 151 (Figs. 10, 10a and 10b) mounted on a pin 152 which is held on an arm 152a which in turn is attached to a pin 152b fastened to the frame. Set screws holding the arm 152a to the pins 152 and 152b provide for adjustment of the position of the cradle. Shaft 133 is torque-tensioned by means of a rack 134 slidable in a slide 135 and in engagement with a pinion 136 freely rotatable on shaft 133. Pinion 136 has fastened to it an arm 137 having pivoted on it at 137a a pawl 137b which engages a shoulder 138 on a collar 132 which is fixed to shaft 133. Rack 134 is moved against the tension of a spring 139 by an arm 140 of a bellcrank pivoted at 141, the other arm 142 of which is engaged by the mandrel hubs (Fig. 4) so that at every indexing operation the rack is thus pushed to the left (Fig. 10) which rotates pinion 136 and pawl 137b clockwise until the pawl engages shoulder 138. Under this condition spring 139 is in tension. Then when end 130 of latch 128 is disengaged from shoulder 131, shaft 133 rotates one revolution counterclockwise under the influence of the rack spring until the collar shoulder 131 is again engaged by the latch 130 which in the meantime has dropped again. Shaft 133 has attached to it a knife 143 which operates to cut the foil strip 310 passing under it. Another similar knife 144 attached to a shaft 145 which is geared to shaft 133 by pinions 146 and 147, meshed through an idler pinion 147a, operates at the same time to cut the other foil strip.

To prevent backlash during the tensioning of the rack spring there is attached to shaft 133 a collar 148 having a shoulder 149 engageable by a backlash pawl 150.

The cradle is provided with a number of transverse pins 153 at the rear end and 153' at the forward end and guides 153a between which the condenser strips pass in going from the rolls to the mandrel, as shown in Fig. 10b; and the cutting knives are adapted to rotate within arcuate cut-outs 153b of the guides. To prevent the insulating strips from being cut, they are led through guide spaces out of reach of the knives, as shown.

Up to the point where the strips reach the parting guides 153a each foil strip is held and supported between insulating strips so that the relatively weak foils will not wrinkle or become injured during the feeding operation; and after passing the forward ends of guides 153a the foils again become supported when they are brought together between the insulating strips at the forward pins 153'.

Insulating strip severing and pasting mechanism

There are mounted on the frame a pair of rigid beams 154 and 155 spaced somewhat apart and having extended between them a pair of pins 156 and 157 (Figs. 4 and 4a). Pivoted on pin 156 are a pair of uprights 158 and 159 which have extending between their upper ends a pin 160. Pivoted on pin 157 is an upright member 161, the upper end of which is fastened by a set screw 161a, for adjustment, to a pin 162 which extends between a pair of spaced bars 163 and 164. These two bars 163 and 164 are pivoted on pin 160 at a position forward of pin 162; and the front ends of these two bars carry pin 165 on which is freely rotatable a grooved roller 166.

There is rigidly fastened to bars 158 and 159 a rigid bar 167 having attached beneath it a spring knife 168. An adjusting screw 169 threaded through bar 167 serves to position the knife. One or more needles 170 projects forwardly from bar 167.

Fastened to member 159 is an arm 172 having at its front end a pin 173 on which is a freely rotatable roller 174. Also mounted on the pin 173 is the upper end of a lever 175 which is pivoted at its lower end to the frame at 176. Roller 174 is continuously urged, by means of a spring 178, into contact with a cam 177 fastened to the indexing head so that when the indexing head is indexed in any one of its four indexing positions the roller 174 enters the corresponding one of four indents 179 of the cam 177.

A container of paste 180 is mounted on a stand 181 and the ends of the container are slotted at 182 to receive pins 183 at the ends of a roll 184 adapted to rotate in the paste to smear the paste over the surface of the roll. The rear pin of the roll has mounted on it a pulley 185 which is belted to a pulley 186 fastened near the front end of a shaft 187. Shaft 187 is journaled on the frame and driven from shaft 68 by a train of gears 71, 189, 190 and 191, gears 71 and 191 being fixed respectively to shafts 68 and 167, and gears 189 and 190 being idlers (Figs. 1 and 9).

Whenever the indexing head with its cam 177 is rotated through one of its 90° indexing movements, the roller 174 rides out of the indent on

the surface of the cam, thereby rotating uprights 158 and 159 counterclockwise (with reference to Fig. 4) and correspondingly rotating upright 161. Since the length of upright 161 is greater than that of 158 and 159, the effect of this rotation is to move arms 163 and 164 to bring the roller 166 into contact with the paste roll 184, as shown in dotted lines, to smear paste on roller 166. Then when roller 174 drops into the next indent 179, corresponding to the next indexing position, roller 166 springs back again to its normal position with its grooves in engagement with curved wiper wires 227 which are fixed to the frame at 227*a*, and smearing the paste on the rolled condenser which has just moved down from the winding station A to station B where the roll is in engagement with the wipers 227.

When the roller 174 drops into the indent 179 in station B, the needles 170 spike the insulating strips which now extend from across the mandrel in winding station A to the roll in station B; and an instant later the knife 168 severs them.

Condenser roll-up and ejecting mechanism

Mounted on the frame 10 at some distance in front of the indexing head is a fixed bearing 192 through which is journaled the indexing shaft 24 (Figs. 1 and 3). Shaft 24 has attached to it a pair of supports 193 and 194, support 193 having four radial arms 195, and shaft 194 having four similar radial arms 195*a*. Journaled through the corresponding arms 195 and 195*a* are four barrel shafts 196, 197, 198 and 199 having fastened to their respective ends the four mandrel pins 35*a*, 36*a*, 37*a* and 38*a*, which are constructed as part-mandrels having flat surfaces and adapted to cooperate respectively with part-mandrels 35, 36, 37 and 38. These mandrel pin shafts are aligned with respect to the corresponding half-mandrels extending from the indexing head so that the flat surfaces of the cooperating half-mandrel pins face the corresponding flat surfaces of the half-mandrels (Figs. 12 and 13) when the two are brought together. The barrel shafts are slidable endwise through bushings in their supporting arms so that the disengagable part-mandrels, or pins, may be engaged and disengaged endwise of the related part-mandrels.

On each arm of support 194 is a pivoted latch 200, which is urged in its latching direction by a leaf spring 201, and each mandrel pin shaft has fixed on it a shoulder 202, the arrangement being such that when a barrel shaft is slid endwise to the extreme right (with reference to Fig. 3) it is held in that position by the latch 200 engaging the shoulder 202 until the latch is released in the winding station A by its knob 203 coming into engagement with a cam 204 fixed under the top of an arch 205 which is fastened to the frame (Fig. 1*a*).

In front of support 194 there is fastened to the shaft 24 another support 206 having four radial arms 207, each of these radial arms having a slot 208. There are placed across the slot a pair of pins 209 and 210 on which are freely rotatable pulleys 211 and 212, respectively. Spaced somewhat from support 206 and also fixed to shaft 24 is a head 213. There is passed over each pulley a spring 214 one end of which is fastened to the head 213 at 215, and the other end of which is fastened to a collar 216 freely mounted on the corresponding barrel shaft 196 and held against a shoulder 217 in the shaft. The springs 214 are maintained in tension so that when the latch 200 releases shoulder 202 at station A, the mandrel pin slides into engagement with the mandrel (with the condenser strips between the half-mandrel and pin) and enters recess 276 at the front of the mandrel (Fig. 12); and at the same time recess 277 at the end of the barrel shaft receives the end of the mandrel. This places the mandrel in readiness to roll a condenser.

To insure that when a mandrel goes from station D to station A, the flat surface of the half mandrel shall face up to receive the condenser strips, there is fixed to the frame behind the mandrel support a cam 236 having a cam groove 236*a* which receives pins 40 on the mandrel bushings to hold the bushing at the proper angle of rotation to bring the flat mandrel face up in position A (Figs. 1, 3 and 10). This cam has another groove 236*b* through which pin 40 travels while the mandrel is moving from station A to station B, to keep the wound mandrel from unwinding during this movement.

To insure that the flat surface of the mandrel pin shall always face the flat surface of the mandrel when latch 200 is released at station A, there are provided correlating shafts 282, 283, 284 and 285 journaled in the arms of supporting members 193 and 194 and of a supporting member 286, and parallel with four mandrels and the four barrel shafts 196, 197, 198 and 199, respectively. Each correlating shaft is geared to the respective mandrel by pinions 287 and 288 fastened to the respective mandrel and correlating shaft; and to the respective barrel shaft by fluted gear 289 and pinion 290 fastened respectively to the correlating and barrel shafts. This arrangement is such that the pinion 290 slides along the fluted gear when the barrel shaft slides; and this gearing maintains the flat face of the mandrel pin always toward the flat face of the mandrel.

To roll up the loose strip ends, or "flag," left trailing from a roll on a mandrel at station B after the severing of the insulating strips the shaft 187 carries at its front end a driving pin 218 adapted to engage the pin 40 on the mandrel bushing of that mandrel. Rotation of shaft 187 thus operates to continue the rotation of the mandrel after it is indexed in the B station with the paste already applied to the strips, and thus wind up the loose ends or "flag" to paste it in position. The gearing of shaft 187 is so arranged that shaft 187 stops its wind up rotation to leave the pin 40 above the mandrel shaft (substantially as shown in Fig. 10) so that when the rolled mandrel finally moves from stations D to A the pin will be following the mandrel shaft as the pin travels within groove 236*a*. This insures that the flat part of the mandrel will face up as the mandrel enters station A.

After the next subsequent indexing movement, the condenser winding which has just had its "flag" wound and pasted is carried down to the lowermost station C, and in thus traveling downward rubs against the wiper wires 227, which prevents any unwinding of the condenser during this downward movement.

The rim of the indexing head is provided with four radially extending pins 219 located adjacent the respective mandrels. Each time the head is indexed, the pin 219 corresponding to the mandrel in station C, strikes an arm 220 fixed to a shaft 221 which is journaled in the frame and slidable endwise (Figs. 3 and 4). The rear end of shaft 221 has fixed to it a compound half-

nut 222 having two sets of internal threads 223 and 224 (Figs. 7 and 7a). Two threaded lead screws 225 and 226, also journaled in the frame in parallel relation to the shaft 221, are located adjacent the respective half-nut portions 223 and 224, and the two lead screws are geared together by the spur gears 271 and 272 which are fastened respectively to shafts 225 and 226. The lead screws are driven from shaft 65 by bevel gear 273 on shaft 65 in engagement with bevel gear 274 on shaft 226. The arrangement is such that when shaft 221 is rotated a few degrees in one direction the half-nut portion 223 engages the lead screw 225, and when shaft 221 is rotated in the opposite direction the half-nut portion 224 engages the other lead screw 226. The right end of shaft 221 (with reference to Fig. 3) has fixed to it a bell crank 228, the horizontal leg 229 of which is weighted to hold shaft 221 in its most clockwise position of rotation (with reference to Fig. 7), thus keeping half-nut 222 in engagement with lead screw 225. Lead screw 225 has at its rear end an unthreaded portion 225a, and the threads of the threaded portion are cut in the direction which causes the half-nut, when engaged therewith, to move to or remain at the unthreaded end 225a, thus keeping shaft 221 in its leftmost endwise position (with reference to Fig. 3). But when pin 219 on the indexing head strikes arm 220 the shaft 221 is rotated until the half-nut portion 224 strikes the other lead screw 226. This has its threads cut to feed the half-nut in the opposite direction, causing shaft 221 to slide to the right (with reference to Fig. 3). A pin 230 fixed on arm 229 rides along a platform 231 which is fastened to the frame, thus keeping the half-nut in engagement with lead screw 226 until the pin drops off the right end of the platform, as shown in Fig. 3.

When the half-nut first engages the forward lead screw 226, in the rearmost position of the half-nut, the vertical arm of bellcrank 228 engages the shoulder 232 on the sliding barrel shaft which is in station C. Then when shaft 221 slides to the right it also slides the barrel shaft to the right against the tension of springs 214 until the barrel shaft latches at its shoulder 202, thus leaving the roll 280 on the fixed half mandrel. To keep the condenser roll from being pulled off the fixed half-mandrel when the sliding half-mandrel pin is extracted, an arm 400 fixed to the frame is positioned to obstruct any movement of the condenser roll in an endwise direction. Pin 230 then drops off the right end of platform 231 (with reference to Fig. 3) on to sub-platform 231a so that the weighted arm 229 rotates shaft 221 back to its normal position, engaging the half-nut portion 223 with the return lead screw 225 which slides the shaft 221 to the left until the half-nut runs off the threads in the initial position again. In thus sliding to the left pin 230 slides along sub-platform 231a and continues to rest on it when back in the initial position.

When a wound roll left on a half-mandrel reaches station D, it is removed from the half-mandrel by means of an arm 235 fixed to shaft 221. This arm is of springy metal and is normally in the full line position of Fig. 4. But when a mandrel moves from station C to station D the mandrel engages the arm 235 at a place just back of the rolled condenser and springs out the arm to the position shown in dotted lines in Fig. 4. Then when shaft 221 is rotated to engage the half-nut with the forward lead screw, the upper end of this arm 235 moves along the mandrel behind the condenser, thus pushing the rolled condenser off the half-mandrel. After the condenser is ejected the arm 235 springs back to its original full line position.

Strip advancing mechanism

For the purpose of providing a positive feed of the foil and paper strips to the driven mandrel, at the beginning of a winding, there are provided feed rollers 291 and 292 (Figs. 1, 2 and 5) between which the condenser strips are passed. Roller 291 is an idler and roller 292 is connected with a telescoped shaft 237 through a universal joint 238, the other end of the shaft being joined through another universal joint 239 to a pinion shaft 240 having fixed to it a pinion 241. Pinion 241 is driven from pinion 242 which in turn is driven from a pinion 243 fixed to the end of the indexing shaft 24. Roller 292 is rotatable on a pin 243 which is fixed in a frame 244 and is movable upward to a binding position against roller 291 by means of a pin 245 protruding from the main frame 10 on which frame 244 pivots. The opposite end of frame 244 is weighted by a weight 246 which tends to keep the roller in binding position.

The roller is operated into and out of binding position by the following mechanism (Figs. 1, 2 and 5). A cam arm 247 having a bevel 248 is fixed to the clutch fork 47. There is pivoted to the frame at 249 an arm 250 (Fig. 1b) which carries on it a pin 251 on which is freely rotatable a bell crank 252, one arm 253 of which is beveled at 254 and the other arm 255 of which is adapted to engage a stop 256 fixed to lever 250. A tension spring 257 attached at one end to the bell crank arm 252 and at the other end to a pin 258 fixed on lever 250, tends to keep the bell crank turned against stop 256. Lever 250 has fastened to it an arm 259 to the other end of which is fastened a knob 260. Opposite the knob 260 is a bell crank 261 (Fig. 5) pivoted to the frame at 262 having a pair of shoulders 263 and 264 positioned to engage the front end of lever 244. A tension spring 265 fastened to arm 259 tends to keep arms 250 and 259 rotated counterclockwise (with reference to Fig. 1) on pivot 249 to keep knob 260 withdrawn from bell crank 261. The organization is such that when the clutch member 46 disengages from clutch member 44, cam 247 in moving by cam 254 of bell crank 253, pushes bell crank 253 against pin 256, thus rotating arm 259 clockwise (with reference to Fig. 1) on pivot 249 and consequently rotating bell crank 261 so that lever 244 is released from the lower shoulder 264. This causes frame 244 to rotate under force of weight 246 until it strikes the upper shoulder 263, thereby causing the roller 292 to be brought up to binding relation against the strips held between rollers 291 and 292. In this position, rotation of drive shaft 237 by means of shaft 24 drives the roller 292 to feed the strips toward the mandrel.

When clutch member 46 moves to re-engage with clutch member 44, cam 247 merely rotates bell crank 252 counterclockwise (Fig. 1) against the force of spring 257 without affecting arm 259 or bell crank 261.

For the purpose of releasing feed roller 292 from its binding engagement of the condenser strips against roller 291 after the first couple of turns of the mandrel winding, there is provided a release. This comprises (referring to Figs. 1, 5 and 6) a shaft 295 rotatably journaled in the

frame, to which is attached an arm 296, carrying a camming projection 297. The half nut 94 has mounted on it a corresponding camming projection 298 adapted to engage cam 297 so that after the half nut travels along the screw shaft 45 a distance corresponding to a small number of mandrel turns, cam 298 lifts up cam 297 and thus rotates shaft 295 counterclockwise (Fig. 6) while the half nut is passing, after which shaft 295 rotates back to its original position. There is fastened to shaft 295 an arm 299 carrying a pivot pin 300 on which is pivoted an arm 301. The upper end of arm 301 contains a pin 302 (Fig. 5) on which is pivoted a lever arm 303 having its fulcrum on a pivot pin 304 attached to a bracket 305 which is fastened to the frame. The opposite end of lever 303 carries a pin 306 on which is pivoted an arm 307 depending down to a pin 308 attached to the frame 244 of roller 292 (Figs. 2 and 5), so that every time shaft 295 is rocked by the traveling half nut, the frame 244 is rotated a few degrees counterclockwise on pin 245 (with reference to Fig. 2) which moves the forward end of frame 244 from shoulder 263 down to the lower shoulder 264 on bell crank 261, thereby holding feed roller 292 disengaged from the condenser strips.

Operation

Before starting the machine the foil and insulating strips are led between the feed rollers 291 and 292 and pulled over the half mandrel in station A while holding the mandrel pin retracted, the foil strips 310 and 311 being led through the guides of the foil cutter which take them in the path of the foil cutters, and the insulating strips 312, 313, 314 and 315 through the guides which avoid the foil cutters. According to usual condenser winding practice, all four insulating strips overlie each other. Furthermore, one edge of one foil strip 310 may, if desired, be placed beyond one side of the insulating strips and the opposite edge of the other foil strip 311 may be placed beyond the other side of the insulating strips, the remaining foil edges being sandwiched within the insulating strips, as shown in Fig. 14.

To start the machine, the power driven shaft is rotated by turning on its source of power, and the circuit of solenoid 80 is established by closing switch 316 connecting it with the electrical power wires 318 and 319 (Fig. 11). As the half nut 94 will be at rest in its home position, switch 115 will be closed, producing energization of solenoid 80. This will engage dog 73 with clutch teeth 70 to produce a revolution of shaft 68, during an early part of which Geneva pin 83 sweeps through a Geneva slot 84 (Fig. 9) to produce a 90° indexing rotation of shaft 24 bearing mandrel head 25. Also, during this indexing movement the mandrel hub on head 25, which moves from station C to station D strikes bellcrank arm 142 to pull rack 134 to the left (Fig. 10) thus tensioning it by the engagement of arm 130 against shoulder 131. Immediately upon completion of the 90° indexing rotation of shaft 24, catch 200 (Figs. 1*a* and 3) is operated by fixed cam 204 to allow the barrel shaft 196 to spring toward the mandrel which has just moved from station D to station A, to slide the half mandrel pin over the condenser strips which lie across the half mandrel.

Just after the completion of the indexing movement, which occurs during an early part of the revolution of shaft 68, bell crank 50 is rotated by cam 92 to engage clutch member 46 with 44 (Figs. 8 and 9) and thus start the mandrel in station A rotating and the half-nut 94 traveling along screw 45. This causes the contacts of switch 115 to open and deenergize the solenoid 80, allowing spring 81 to urge arm 77 into the path of lug 76 on dog 73 (Fig. 1c). Shortly thereafter lug 76 engages arm 77, thus disengaging the dog from clutch teeth 70 and stopping the rotation of shaft 68 which has now completed its one revolution.

The rotation of the mandrel rolls up the strips pulling them from their respective supply rolls against the retarding effect of the compression springs pushing against the hubs of the supply rolls. When the mandrel winding is almost completed, the cam 124 on the half nut (Figs. 6 and 7) strikes cam 120, lifting bar 116 off support 126 to pivot latch 128 away from shoulder 131 of collar 132 (Fig. 10). This allows rack 134 to spring endwise to rotate the knife shafts 133 and 145 to sever the foils while they are traveling toward the mandrel. After this severance the foil rolls cease to feed any more foil strip to the mandrel and only the insulating strips continue to feed, so that a space opens up between the severed foil ends. Then, after a desired space of, for example, a few inches has opened up between the severed foil ends, the traveling half-nut strikes stop 96, sliding bar 97 to the left (Fig. 7) and releasing catch 103 from engagement with head 104. This allows head 104 to spring to the left (Fig. 7) and disengage clutch member 46 from 44 to stop the mandrel winding, and at the same time to allow bar 106 to rise and thus lift the half nut off screw 45; and the half nut then immediately springs back to its initial home position. The disengaging movement of clutch member 46 and its fork 47 causes cam 247 to rotate lever 259 which rotates bell crank 261 to disengage shoulder 264 from feed roller frame 244 (Fig. 5), and thus allow roller 292 to bind the strips against roller 291 in preparation for the next indexing movement and condenser winding.

When the half nut reaches home its knob 114 closes the switch 115 which energizes the solenoid 80 to engage the dog 73 with the internal teeth 70 of the one-revolution clutch. This rotates the indexing head through another 90 degrees, advancing the condenser just rolled to station B and pulling the insulating strips across the flat surface of the half mandrel which is moving up from station D into station A, as shown in Fig. 10. Just as soon as the mandrel now to be wound reaches station A, the catch 200 holding shoulder 202 engages cam 204, which releases the catch and causes the half mandrel pin to slide over the condenser strips across the half-mandrel, as shown in Fig. 4. The position of the foil knives is such that when the mandrel is thus set for winding, the leading edges of the foils from the foil rolls just extend through the mandrel, as shown in Fig. 13.

During the revolution of shaft 24 the feed roller 292 which is still binding the strips against roller 291, is rotated by shaft 237 and gears 241, 242 and 243, which are driven by shaft 24 (Fig. 1) to feed the strips toward the mandrel; and it preferably feeds a somewhat greater length of strips than is required to supply the travel from station A to station B, so that the strips hang in a slight loop between the feed rollers and the pins of the foil cutter; after which the beginning of the mandrel winding pulls out this loop.

Also at the beginning of the indexing move-

ment, roller 174 (Fig. 4) is pushed out of the indent 179 in which it had been resting, on to the outer periphery of cam 177 to retract the knife 168 from the path of the wound condenser moving to station B; and just as it reaches station B, at the end of the indexing movement, roller 174 drops into the next indent 179, causing needles 170 to spike the insulating sheets at the area unoccupied by the foil sheets, and causing knife 168 an instant later to sever the insulating sheets at a place between the foil ends, but below the spot where the pin 170 has just spiked the strips to keep them in place after the severing. This is illustrated in Fig. 13.

Simultaneously with this severing operation, roller 166 (Fig. 4) which had been brought into contact with the paste roll 184 while roller 174 was on the outer periphery of cam 177, is brought into contact with the condenser roll at station B, which immediately upon reaching station B, begins to turn to roll up and paste the "flag" due to the engagement of driving pin 218 with pin 40 of the mandrel in this position. The mandrel continues to be rotated for a number of turns in this manner because shaft 187 which is driving it continues to be driven from shaft 68 through train of gears 189, 190 and 191 until dog 73 disengages from clutch teeth 70; and since it takes only about 90 degrees of a revolution of shaft 68 to complete the indexing movement, there remains about 270 degrees for it to continue to drive shaft 187 after the indexing is completed and while the mandrel at station A is being wound. As the roll at station B is in contact with the springy wiper wires 227 at station B, these wires cause the flag to roll up tightly.

Just before the end of a full rotation of shaft 68, eccentric 92 on shaft 90 operates bell crank 50 to engage clutch member 46 with 44 again, and simultaneously to shift bar 95 and head 94 to the right (with reference to Fig. 7) so that the lower surface of head 104 slides over bevel 111 and thereby depresses bar 106 so that the half nut in engagement with the screw shaft 45 can travel to the left upon engagement of the clutch members without being obstructed by bar 106.

After traveling for a couple of screw turns along shaft 45 and before the loop of the condenser strips left hanging between the feed rollers and the foil cutter has been taken up by the winding mandrel, the cam 298 of the half nut strikes cam 297 (Fig. 6), which moves feed roller 292 from its binding position to its free position by rotating the feed roller frame 244 to engage it under shoulder 264 (Fig. 5), so that the strips are pulled freely by the mandrel. (When the half nut slides home after disengagement of the clutch members, cam 298 does not engage cam 297 as it did in traveling out because when sliding home the left side of the half nut (Fig. 6) is raised by bar 106 so that cam 298 is above cam 297, and the slot 298a permits clearance for 297.)

The strips are then severed and the mandrel winding stopped and another indexing movement made in the manner just described.

As each mandrel bearing a rolled condenser reaches station C, the mandrel pin is withdrawn from it by the engagement of bell crank 228 with the shoulder 232 of barrel shaft 198, and the moving to the right of this bell crank (Fig. 3) due to the engagement of half-nut portion 224 with forward lead screw 226 which is driven during the revolution of shaft 68 through gears 67, 66, 273, 274, 272 and 271 (Fig. 9). During this operation the condenser is held on the half mandrel by bar 400. After shaft 221 slides all the way to the right, thus causing the barrel shaft to become latched by catch 200, pin 230 drops off the end of platform 231, causing the other half nut portion 223 to engage with the return lead screw 225 so that shaft 221 slides back home again. The gear ratios and lead screws are so correlated that shaft 221 completes its outward and return sliding movement by the time the driving shaft 68 has completed its single revolution.

The same forward sliding movement of shaft 221 causes its other wiper arm 235 to slide each condenser off the half mandrel at station D, dropping it into a suitable chute 350 and leaving the mandrel ready for another winding when it reaches station A again.

It will be noted that the foil and paper are wound, separately cut, sealed and ejected in a continuous operation with the successive steps being automatically and progressively performed. Referring to Fig. 22 condenser *a* is being ejected from the mandrel at station D while a retracting arm is retracting a mandrel pin from condenser *b* in station C at the same time that condenser *c* is being rolled up and pasted at station B and condenser *d* which is connected to the drive is being wound at station A.

The mandrel upon which a condenser is being wound at station A is stopped after a predetermined number of turns and the foil cut. The feed rollers grip the conducting and insulating strips at a point behind the foil cutting knives during the automatic indexing movement of the mandrel support from station to station. The insulating strips of a condenser which is traveling from station A to station B during the indexing movement are spiked by the needles on the cutting arm so that the insulating strips are held in alinement. An instant later the cutting knife cuts the insulating strips, so that at the time the mandrel reaches station B the loose ends of the insulating strips are ready to be pasted and rolled up at the same time that the various other operations are being performed on other condensers at stations A, C and D.

The sequence of operations can be readily perceived by reference to the diagrams, Figs. 16 to 22, inclusive.

Fig. 16 illustrates condenser *a* in the course of being rolled at station A and before the foil knives 143 and 144 have severed the foils.

Fig. 17 shows the condition of the condenser strips of condenser *a* after the foil knives have been operated and the gaps have been formed between the severed foil ends. The mandrel in station A has now stopped rotating and the feed rollers 291 and 292 have been brought together against the strips therebetween.

In Fig. 18 the roll *a* just wound at station A is shown moving toward station B during the indexing movement. The paper cutting knife 168 and needles 170 have moved back out of the way of the strips being stretched across the new part mandrel moving into station A; the foil gap being the distance between *e*—*f*; and the feed rollers 291 and 292 are feeding the strips forward.

In Fig. 19 the mandrel just wound has reached station B where the pasting roll 166 is moved into contact with the condenser roll *a*; needles 170 have spiked the insulating strips, knife 168 has cut the insulating strip, and the half mandrel 38*a* has snapped into position over the strips across mandrel 38. The paper ends *g* and *h* overlap the foil ends *e* and *f* respectively.

Fig. 20 shows the roll *a* on mandrel 35 rolled up

at the same time that the new mandrel 38 is having a condenser *b* rolled upon it while the feed rollers 291 and 292 have become inoperative again.

In Fig. 21 the roll *a* on mandrel 35 has moved down to station C, and the wound roll *b* on mandrel 38 has moved to station B. The retracting arm 228 has moved into position to retract the half mandrel 35*a* while a new condenser *c* on mandrel 37 is being rolled.

Fig. 22 shows the condenser roll *a* being ejected from the half mandrel 35 in station D by the ejecting arm 235 which has moved into the ejecting position. At the same time the retracting arm 228 is retracting the half mandrel 38*a* from condenser roll *b* in station C; and the roll *c* on mandrel 37 is being completed at station B; and a new condenser *d* is being rolled on mandrel 36 at station A.

The high degree of efficiency of the machine is readily apparent. The operation is completely automatic, and the finished rolls are delivered from the mandrels without the requirement of any manual operation.

The rate of winding the rolls is very rapid, and very little time is lost between successive windings because the stopping of the winding mandrel rotation is followed practically instantaneously by the very rapid indexing movement, after which the succeeding winding commences. Successive windings do not await the many finishing steps of rolling up the flag and pasting it and retacting the pin and ejecting the roll, because all these finishing steps are being performed in the succeeding mandrel stations B, C and D at the time rolls are being wound at station A. Even the very short time of the indexing movement is not wasted because during it the insulating strips are being spiked and severed in making ready for the succeeding winding.

The machine furthermore delivers substantially perfect condensers because all the condenser strips are automatically maintained in their proper alignment and without any human element creeping in which might tend to misalign the strips and produce defective condensers. The operation of the spiking needle 170, together with the fact that the insulating and foil supply rolls are properly aligned and offset to give the strip alignment shown in Fig. 14, automatically insures the maintenance of the alignment.

Although in the specific embodiment of the machine which has been illustrated and described there are shown specific forms of mechanical parts such as clutches, gears and driving elements, it should be understood that the invention is not limited to the use of these specific forms of parts, but extends to the use of suitable equivalent parts performing the functions disclosed.

For example, the clutch members 44 and 46 need not be of the engaging tooth construction illustrated in Figs. 1 and 7, but might be of a well known friction type in which a friction surface or cone on element 46 engages a corresponding friction surface or cone on element 44. Furthermore, if it be desired to have the clutch member 46 always stop at the same position of rotation after each clutch disengagement, member 46 might be provided with a lug which engages whenever the clutch is disengaged, with a corresponding lug fastened to the frame at the position in which it is desired the clutch member 46 shall stop. Again, the foil cutting mechanism need not necessarily be operated by the specific camming elements 124 and 120 and associated frame shown in Figs. 6 and 7, but instead, a micro switch operating a solenoid might be substituted. Such a micro switch arrangement would comprise a switch contact mounted on the half-nut 94 and a cooperating switch contact located along the path of travel of the half-nut about where cam 120 is located, and connection of these switch contacts while the half nut is travelling could be arranged to close a circuit from an electrical source through a solenoid so that the solenoid plunger would operate on member 128 (Fig. 10) of the foil cutter like arm 127 does, to produce the cutting operation.

Another modification which might be made if desired is to cause the strip feed rollers 291 and 292 to engage upon the disengagement of the mandrel driving clutch and then to disengage when the driving clutch engages, so that these feed rollers are engaged only during the indexing movement. Such a modification is illustrated in Fig. 15. In that figure the clutch fork 47 is provided with a cam element 375 adapted to engage a corresponding cam 376 fastened to a lever 377 which is mounted on a shaft 378. Shaft 378 can be journaled in any suitable manner within a bearing 379 attached to the main frame 10. The opposite end of shaft 378 has attached to it an arm 380 which may have freely mounted at its outer end an anti-friction roller 381 adapted to rest on a bar 382. Bar 382 is attached to the frame member 244 for the lower feed roller 292. In the operation of this modification, when the clutch fork 47 is moved to the clutch disengaging position, its cam 375 moving away from cam 376 allows arm 377 to drop and rotate shaft 378 counterclockwise (with reference to Fig. 15), which lifts the roller 381 allowing bar 382 to be lifted under action of tension spring 383. This moves roller 292 into engaging position against the cooperating roller 291 so that the rollers thus feed the strips during the indexing movement of the indexing head; and when the clutch fork 47 is moved again to the clutch engaging position for the next winding, cam member 375 lifts cam 376, causing the feed roller 292 to disengage again from roller 291.

While this invention has been described in connection with a specific embodiment, it is not confined thereto and various modifications may be resorted to within the scope of the appended claims.

Instead of the latch or trigger finger 200 for holding the mandrels open, a segment of a cam may be employed, the lower end of which is formed as a hinge or latch. The cooperative part mandrel (to the right Fig. 3) has a roller attached to it and as the mandrels are opened at the bottom or third position this part mandrel catches behind the cam latch when in maximum open position. This follows around in the open position being held open by that segment of a cam for about fifty degrees. For the next thirty-nine degrees the part mandrel slowly closes until the tips of the two cooperative part mandrels are in line with each other. This modified latching means avoids any heavy shock from long quick travel of the cooperative part mandrel, taking place as the head 25 is indexed through two positions.

The pins or needles 170 (Fig. 4) may be replaced by a felt pad holding the papers after severing and provided with springs for cushioning. This pad engages across the entire web of paper pressing toward the slot in a cutting anvil. A catch may also be added to hold the frame 244 (Fig. 5) tilted and thus hold the feed rollers 291, 292 open until the driving clutch is entirely disengaged and

hits its stop. This prevents these rollers from closing until the winding has stopped and avoids breakage of the paper. The clutch stop is assembled with a shoulder shaft and spring acting as a cushioner and also as a trip mechanism for the catch.

Separate motors may be used on the indexing and winding mechanisms, and the rate of winding may be varied for instance by the travel of the half nut 94 (Fig. 7). An insulated contact on this nut making contact to a commutator. The first position of this commutator is connected on series with a rheostat, the second runs the whole length of the worm 45, and the third position is adjustable for the whole length of the worm and when adjusted, cuts out some of the second position. This third position is a metal piece insulated from the second position and slidably mounted so that the contactor will make contact with this third position through the last part of the winding. This gives an accelerated speed in the beginning of the winding, a predetermined speed in the middle and a decelerated speed at the end of the winding.

This application is a continuation-in-part of my co-pending application Serial No. 375,584, filed January 23, 1941, now abandoned.

I claim:

1. In a condenser winding machine, a mandrel support having journaled in it a part-mandrel, a drive for rotating said part-mandrel, a second part-mandrel adapted to engage with the first mentioned part-mandrel to hold and roll on said engaging part-mandrels a condenser when said first-mentioned part-mandrel is placed in cooperating relation with said drive, a disengaging device for disengaging the part-mandrels from each other, and an ejecting device for moving the rolled condenser off the part-mandrel on which it is held, said support being movable to set the part-mandrels successively in successive stations, in the first of which the part-mandrels are set in cooperative relation with said drive, and in another of which the second part-mandrel is set in cooperative relation with said disengaging device, and in another of which said condenser is set in cooperative relation with said ejecting device.

2. In a machine for winding condenser rolls a mandrel support having journaled in it a plurality of mandrels in different stations, a mandrel pin for cooperating with each of the mandrels to hold in the strips of insulating and conducting material to be rolled on the mandrel, a drive for rotating said mandrels at the first station, cutting means for severing the conducting strips at a position which has not yet reached the mandrel so that a space opens up between the severed conducting strip ends, a second cutting means located within operating range of the path which said mandrels take in moving from the first to a second station for severing the insulating strips trailing from the mandrel which has been wound in the first station, a drive for completing the winding of the trailing ends on the roll on the mandrel at said second station, a retracting lever for retracting the pins at a third station, a catch for latching the pins in their retracted state, an ejecting lever for ejecting the wound rolls from the mandrel at a fourth station, a release for releasing the catch at the first station, and means for urging each pin into engagement with its mandrel after its catch is released, said mandrel support being movable to move all the mandrels successively from the first to the second, to the third and to the fourth stations and subsequently to the first station again.

3. In a machine for winding condenser rolls, a mandrel support having journaled in it a plurality of part-mandrels, a drive for rotating said part-mandrels, said support being rotatable to move each part-mandrel to successive stations including a station in operating relation with said drive, a cooperating part-mandrel in cooperating relation with each of the first mentioned part-mandrels, a holder mounted on the rotatable support for holding each of said cooperating part-mandrels so that it may move into engagement with its related one of said first mentioned part-mandrels at the drive station, a disengaging arm operative in a mandrel station subsequent to the drive station to disengage the cooperating part-mandrel from its related journaled part-mandrel, and an ejecting arm operative to move the condenser roll endwise off the part-mandrel on which it is held.

4. Apparatus according to claim 3 in which there is provided means for exerting a tendency for the cooperating part-mandrels to move into engagement with their corresponding journaled part-mandrels, a latch for latching each cooperating part-mandrel in its disengaged position after it is moved out of engagement by said disengaging arm, and a release operated to release each latch when its corresponding part-mandrel reaches the drive station.

5. In a winding machine, a mandrel support having journaled in it a plurality of mandrels, mandrel pins for cooperating with the mandrels, a drive for said mandrels, said support being movable to a number of stations in one of which the mandrels are successively moved into operating relation with said drive, a clutch for connecting the drive with a source of power, an operating arm for engaging and disengaging said clutch from the power source and an indexing drive operatively connected with a power source upon the disengagement of said clutch to move the mandrel support to the next station, a lever operated by the indexing drive after said next station is reached, to move said operating arm to engage the clutch again, a disengageable arm operable at a mandrel station subsequent to that in which the mandrel is in cooperating relation with said drive to disengage the mandrel pin from the mandrel and an ejecting device located in ejecting relation with the wound condenser rolls in a position subsequent to that in which they are in cooperating relation with said drive, said ejecting device being operated to eject the roll from the mandrel while another roll is being wound at the drive station.

6. In a winding machine, a mandrel support having journaled in it a plurality of part-mandrels, a drive for said part-mandrels, said support being rotatable to move each part-mandrel to successive stations including a station in operating relation with said drive, a clutch for connecting the drive with a source of power, an operating arm for engaging and disengaging said clutch from the power source, an indexing drive operatively connected with a power source upon the disengagement of said clutch to rotate the mandrel support to the next station, a cooperating part-mandrel in cooperating relation with each journaled part-mandrel, each of said cooperating part-mandrels being held on a holder mounted on the rotatable support so that the cooperating part-mandrel may disengage from its related

journaled part-mandrel, a retracting arm operated in a mandrel station subsequent to the drive station to move the corresponding cooperating part-mandrel out of engagement with its related journaled part-mandrel, and an ejecting arm operated in a subsequent station to move the condenser roll endwise off the part-mandrel on which it is held.

7. In a machine for rolling up strips of material, a mandrel support, a winding mandrel journaled in said support for rolling up said strips, a cam movable by said support, a rider on said cam, and a pasting device operated by said rider, said mandrel support being movable to move the mandrel from its winding position along a path which carries the strips trailing from the wound roll, within the operating range of said pasting device, said cam and rider being correlated with respect to the mandrel to move said pasting device into pasting engagement with the trailing strips.

8. In a machine for rolling up strips of material, a rotatable mandrel support, a winding mandrel journaled in said support for rolling up said strips, a knife and a pasting device, said mandrel support being movable to move the mandrel from its winding position along a path which carries the strips trailing freely from the wound roll to within the operating range of said knife and said pasting device, and means correlated with the movement of said support to move said knife into cutting engagement with the trailing strips and to move said pasting device into pasting engagement with said trailing strips.

9. In a machine for rolling up strips of material, a mandrel support, a winding mandrel journaled in said support for rolling up said strips, a cam movable by said support, a rider on said cam, a pasting device operated by said rider, and a paste container, said mandrel support being movable to move the mandrel from its winding position along a path which carries strips trailing from the wound roll within the operating range of said pasting device, said cam and rider being correlated with respect to the mandrel to move said pasting device into contact with the paste container and then into pasting engagement with the trailing strips.

10. In a machine for rolling up strips of material, a mandrel support, a winding mandrel journaled in said support for rolling up said strips, a cam movable by said support, a rider on said cam, a pasting device operated by said rider, and a source of paste, said mandrel support being movable to move the mandrel from its winding position along a path which carries strips trailing from the wound roll within the operating range of said pasting device, said cam being formed with respect to the mandrel so that the rider moves said pasting device into contact with the source of paste after the mandrel has moved out of its winding position and then moves the pasting device into pasting engagement with the trailing strips.

11. In a winding machine, a mandrel, a mandrel pin for cooperating with the mandrel, a pin holder for holding the pin, said pin holder being movable to move the pin into and out of cooperating engagement with said mandrel, a device for urging the pin holder in the direction which maintains the pin engaged with the mandrel, a device for operating the pin holder to disengage the pin from the mandrel against the force of said first-mentioned device, a catch for latching the pin holder in a position in which the pin is disengaged from the mandrel, and a release for unlatching the catch to allow the pin to engage with the mandrel.

12. In a winding machine comprising a mandrel for winding a plurality of insulating and conducting strips into a roll, a mandrel support in which a part-mandrel is journaled, a cooperating part-mandrel in cooperating relation with the journaled part-mandrel, said mandrel support being movable to successive stations in one of which the mandrel is placed in operative relation with a drive, a drive for rotating the mandrel, a clutch for connecting the mandrel with the drive, means for engaging the clutch to rotate the mandrel, means for disengaging the clutch after a predetermined number of mandrel turns is wound, means for moving the mandrel support to the next succeeding station after disengagement of said clutch, means for re-engaging said clutch after said succeeding station is reached, means for disengagement of the cooperating part-mandrel from the journal part-mandrel and means for ejecting the rolled condenser from its mandrel at a station subsequent to the drive station.

13. A condenser winding machine comprising means for holding strips of conducting material and insulating material, a mandrel support, a plurality of part-mandrels journaled on said support, said support being movable to place said part-mandrels successively in a winding position, cooperating part-mandrels adapted to engage with said journaled part-mandrels to hold the strips therebetween, a drive for rotating the engaged part-mandrels in the winding position, means for applying moderate tension on the strips, a strip feeding device located between said strip holding means and the part-mandrel in the winding position and correlated with said drive to feed the strips together toward the part-mandrels in the winding position, strip separators located between said feeding device and the part-mandrels for separating the conducting strips from the insulating strips, cutters operative in correlation with the drive to cut the conducting strips when the winding is near completion where the conducting strips are separated from the insulating strips, means operative in correlation with the drive to move the mandrel support after the cutting of the conducting strips to carry the wound part-mandrels out of the winding position and to carry a second of the part-mandrels into winding position and thus create a space between the cut foil ends, means for turning said second part-mandrel into position to receive the strips, a cutter operated in correlation with the mandrel support to cut the insulating strips at a place between said wound and said second part-mandrels, a strip fastener applying device operative to apply strip fastening means to the rolled strips to prevent unrolling of the condenser roll on the first mandrel while the second mandrel is winding, a device operative in correlation with the mandrel support and the drive for separating the cooperating part-mandrel from the wound journaled part-mandrel while a condenser is being wound in the winding position, and an ejecting device operative in correlation with the mandrel support and the drive for ejecting the condenser roll from the part-mandrel while a condenser is being wound in the winding position.

14. A condenser winding machine comprising means for holding strips of conducting material and insulating material, a mandrel support, a plurality of part-mandrels journaled on said sup-

port, said support being movable to place said part-mandrels successively in a winding position, cooperative part-mandrels adapted to engage with said journaled part-mandrels to hold the strips therebetween, a drive for rotating the engaged part-mandrels in the winding position, cutters operative in correlation with the drive to cut the conducting strips when the winding is near completion, means operative in correlation with the drive to move the mandrel support to carry the wound part-mandrels out of the winding position and to carry a second of the part-mandrels into winding position, a cutter operative in correlation with the mandrel support to cut the insulating strips at a place between said wound and said second part-mandrels, a device operative in correlation with the mandrel support and the drive for separating from the wound journaled part-mandrel its cooperating part-mandrel while a condenser is being wound in the winding position, and an ejecting device operative in correlation with the mandrel support and the drive for ejecting the condenser roll from the part-mandrel while a condenser is being wound in the winding position.

15. A condenser winding machine comprising means for holding a plurality of rolls of insulating strip and conducting strip, a rotatable mandrel support having journaled in it four part-mandrels, said mandrel support being movable into four successive stations during each revolution of the support, each of said mandrels being connected with a drive when at the first station, a mandrel pin for cooperating with each of the mandrels to hold said strips in the mandrel, a source of driving power, a disengageable clutch for transmitting power from said source to the drive, said clutch being disengaged after each mandrel winding, a device for moving the mandrel support to the second station after each mandrel winding, a pair of feed rollers operable to feed all the strips toward the mandrel while the mandrel support is being moved, a cutting device for severing the conducting strips at a position which has not yet reached the mandrel so that a space opens up between the severed conducting strip ends, a cutting means located within operating range of the path which said mandrels take in moving from the first to the second station for severing the insulating strips trailing from the mandrel which has been wound at the first station, means for applying adhesive to the strips in the second station, a retracting lever operative in the third station for retracting the mandrel pin of the mandrel reaching said third station, a catch for latching the pins in their retracted state, an ejecting lever for ejecting the wound rolls from the mandrels in the fourth station, a release for releasing the catch of each pin as it reaches the first station again, and means for urging each pin into engagement with its mandrel after its catch is released.

16. In a winding machine, a mandrel support, a mandrel journaled in said support, said support being movable to place said mandrel successively in a plurality of operating stations, a drive, a first clutch which when engaged connects said mandrel with said drive to rotate said mandrel when said mandrel is in a first of said stations, a second clutch which when engaged connects said mandrel support with said drive to carry said mandrel to the next station, a solenoid, a switch, said switch being closable to close a circuit through said solenoid after the disengagement of said first clutch, a plunger in said solenoid having a portion which operates to engage said second clutch when said switch is closed, and means for opening said switch to disengage said second clutch after said mandrel support has been moved.

17. In a condenser winding machine, a mandrel support having journaled in it a mandrel for winding condenser rolls, a drive for rotating said mandrel to wind the condenser roll, an arm for ejecting from the mandrel the wound condenser roll, said support being movable to a plurality of stations in one of which the mandrel is placed in operating relation with said mandrel drive and in another of which the wound condenser roll is placed in cooperating relation with said ejecting arm, a clutch for connecting the mandrel drive with a source of power, means for engaging and disengaging said clutch from said power source, an indexing drive operatively connected with a power source after each disengagement of said clutch to move the mandrel support to the next succeeding station, said indexing drive comprising a driven shaft which first moves the mandrel support to said succeeding station and means operated by said indexing drive to re-engage said clutch, an ejecting arm drive driven from said indexing drive for moving said ejecting arm in the direction to eject the condenser roll from the mandrel in cooperating relation with said ejecting arm, and a device for disconnecting the indexing drive from its power source after re-engagement of said clutch.

18. In a machine for rolling up strips of material, a mandrel support, a winding mandrel journaled in said support for rolling up said strips when the mandrel is placed by the support in a winding position, a knife operated upon movement of said support, and a pin attached to said knife, said mandrel support being movable to move the mandrel from its winding position along a path which carries the strips trailing from the wound roll within range of said knife, the operation of said knife being correlated with respect to the mandrel to move said knife into cutting engagement with said trailing strips, and to cause said pin to pierce the strips when the knife cuts them, the said piercing being at a position on the side of the knife cut which is remote from the wound mandrel.

19. In a machine for winding a succession of condenser rolls, a plurality of rotatable mandrels mounted on a support movable to place the mandrels successively in operating relation with a power drive, a mandrel pin engageable with each mandrel, means for leading a plurality of insulating and conducting strips in interleaved relation to the mandrel related to the drive, means operated in correlation with the drive for cutting the conducting strips, after winding of the strips, and separating the cut ends, means correlated with the drive for moving the mandrel support, after the parting of the conducting strips, to place the next succeeding mandrel in operating relation with the drive and to move the mandrel just wound in a direction to pull the strips over said succeeding mandrel so that the separation between the parted conducting strips lies at a place between the two last-mentioned mandrels, means correlated with the drive for engaging with said succeeding mandrel the corresponding mandrel pin, a knife operated from the drive in predetermined relation with said movement for severing the insulating strips, after said mandrel pin engagement, at a position between the said two last-mentioned mandrels and between the separated

conducting strip ends, and means operated from the drive after the operation of said knife for rolling up the trailing severed ends of all the strips on the mandrel just wound.

20. In a machine for winding a succession of condenser rolls, a plurality of rotatable mandrels mounted on a support movable to place the mandrels successively in operating relation with a power drive, a mandrel pin engageable with each mandrel, means for leading a plurality of insulating and conducting strips in interleaved relation to the mandrel related to the drive, means operated in correlation with the drive for cutting the conducting strips after winding of the strips, means for retarding the conducting strips on the side of the cuts remote from the mandrel so that the cut ends separate, means correlated with the drive for moving the mandrel support, after the cutting of the conducting strips, to place the next succeeding mandrel in operating relation with the drive and to move the mandrel just wound in a direction to pull the strips over said succeeding mandrel so that the separation between the cut conducting strips lies at a place between the two last-mentioned mandrels, means correlated with the drive for feeding the conducting strips to said succeeding mandrel during said movement, means correlated with the drive for engaging with said succeeding mandrel the corresponding mandrel pin, a knife operated from the drive in predetermined relation with said movement for severing the insulating strips, after said mandrel pin engagement, at a position between the said two last-mentioned mandrels and between the separated conducting strip ends, and means operated from the drive after the operation of said knife for rolling up the trailing severed ends of all the strips on the mandrel just wound.

21. In a machine for winding roll condensers, a drive, a rotatable support carrying a plurality of mandrels which may be placed successively in rotating relation with the drive, means for supplying interleaved conducting and insulating strips to the mandrel related with the drive to form a condenser roll, a roll ejector, and means for moving the said support to shift the rolled mandrel from the drive into operating relation with the ejector and an unrolled mandrel into rotating relation with the drive, said ejector being operated from the drive to eject the condenser roll from its mandrel while the mandrel moved into relation with the drive is being rotated.

22. In a machine for winding conducting and insulating strips into roll condensers, a plurality of part-mandrels located at respective stations, an engageable part-mandrel for cooperating with each of the first mentioned part-mandrels to grasp the condenser strips, a power drive, means operating from the drive for rotating the part-mandrels in the first station, an arm for disengaging the engageable part-mandrel from its cooperating part-mandrel in a second of the stations, an arm for ejecting the rolled condenser from the mandrel in a third of the stations, and control means operated in correlation with the mandrel in the first station for advancing said mandrels from one station to the next, and for operating said disengaging and ejecting arms while the mandrel is being rotated in the first station.

23. In a machine for winding roll condensers, a plurality of part-mandrels, supporting means for holding the part-mandrels in respective stations, a part-mandrel for cooperating with each of the first mentioned part-mandrels, a mandrel drive at a first of the stations, a lever for disengaging said cooperating part-mandrels at a second of the stations, means for latching said cooperating part-mandrels in their disengaged position, a lever for ejecting the condenser rolls in a third of the stations while the cooperating part-mandrels are retracted, a release for releasing the latching means in the first station, means for urging each cooperating part-mandrel into engagement with its related part-mandrel after its latching means is released, and control means correlated with the mandrel driven in the first station for operating the supporting means to advance the mandrels to the succeeding stations and for operating the disengaging and ejecting levers while a mandrel is being driven at the first station.

24. Mechanism according to claim 23 in which there is provided a knife and a pasting device located within operating distance of the path of the mandrels in moving from the first to the second station so that strips trailing from the mandrels may be cut and pasted to the wound roll.

25. In a machine for winding condenser rolls, a mandrel support having journaled in it a plurality of part-mandrels, a drive for said part-mandrels, said support being rotatable to move each part-mandrel to successive stations including a station in operating relation with said drive, a clutch which when engaged connects the mandrel with the drive, means operatively connected with the drive upon the disengagement of said clutch to rotate the mandrel support to the next position, a disengageable part-mandrel in cooperating relation with each of the first mentioned part-mandrels, a disengaging arm operable at a mandrel station subsequent to the drive station to disengage the corresponding disengageable part-mandrel from its related journaled part-mandrel, and an ejecting arm operable subsequent to the part-mandrel disengagement to move the condenser roll off the part-mandrel on which it is held.

26. In a machine for winding roll condensers, a mandrel support having journaled in it a plurality of part-mandrels, a drive for rotating said part-mandrels, said support being rotatable to move each part-mandrel to successive stations including a station in operating relation with said drive, a clutch for connecting the part-mandrel in the drive position with the drive, means operatively connected with the drive upon the disengagement of said clutch to rotate the mandrel support to the next station, a retractable part-mandrel for cooperating with each journaled part-mandrel and being held on a slidable rod on the support so that it may move endwise with respect to the journaled part-mandrel, a retracting arm, a lever operated from the drive to move the retracting arm to retract the corresponding retractable part-mandrel in a mandrel station subsequent to the drive station, an ejecting arm, and a lever operated from the drive to move the ejecting arm to eject the condenser roll from the part-mandrel on which it is held in a mandrel station subsequent to that in which the retractable part-mandrel was retracted from the journaled part-mandrel.

27. In a machine for winding roll condensers, a plurality of mandrels, movable supporting means for holding the mandrels at respective stations, means for supplying interleaved conducting and insulating strips to the mandrel in a first station, a power drive, means operated from the drive for rotating the mandrel in the first station, conducting strip severing means, control means operated in correlation with the mandrel

in the first station for operating said severing means after the winding of a roll, so that a gap forms between the severed conducting strip ends, means operated from the drive for moving the supporting means to carry the rolled mandrel from the first to a second station and an unrolled mandrel into the first station so that the insulating strips are extended across the unrolled mandrel and the gap is placed between the rolled and unrolled mandrels; and insulating strip-severing means located adjacent said extended strips and means operated in correlation with the movement of said support for severing the insulating strips at said gap.

28. In a machine for winding roll condensers, a plurality of mandrels, engageable mandrel pins for cooperating with the mandrels, a movable support for holding the mandrels at respective stations, means for supplying alternate conducting and insulating strips to a mandrel in a first station, a power drive, means operated from the drive for rotating the mandrel in the first station, conducting strip severing means, control means operated in correlation with the mandrel in the first station for operating said severing means after the winding of a roll, normally inoperative conducting strip feeding means located between the severing means and the supply operated at a time interval after the severing means for feeding the conducting strips to the mandrel after a gap has formed between the severed ends, means operated from the drive for moving the mandrel support to carry the rolled mandrel from the first to a second station and an unrolled mandrel into the first station so that the insulating strips extending across the unrolled mandrel and the gap are placed between the rolled and unrolled mandrels, means operated in correlation with the support for engaging the cooperating mandrel pin with the unrolled mandrel to bind the strips, said conducting strip cutting means being located adjacent said extended strips, means operated after said mandrel pin engagement for cutting the insulating strips at said gap, and means for rotating the mandrel at the second station to roll up the trailing strip ends while a roll is being wound on the mandrel at the first station.

29. In a machine for winding roll condensers, a plurality of part-mandrels, supporting means for holding the part-mandrels in respective stations, a part-mandrel for cooperating with each of the first-mentioned part-mandrels, a mandrel drive at the first of the stations, severing means operable in correlation with the drive to cut and separate the conducting strips when the winding is near completion, means for carrying the supporting means to a succeeding station, an arm with needles and a cutter so adjusted that the needles spike the insulating strips to keep them in place just prior to the cutting thereof, means relatively moving said arm to cause said cutter to sever the insulating strips after the movement of the supporting means to the succeeding station.

30. In a machine for winding conducting and insulating strips into roll condensers, a drive, a mandrel support having journaled in it a plurality of mandrels, said support being movable to a number of stations in which the mandrels are successively brought into operating relation with said drive, cutting means operable in correlation with said drive to sever and separate the conducting strips after a predetermined number of turns, means to carry the supporting means to successive stations, needles so positioned on a cutting device as to spike the insulating strips to keep them in alinement, a cutting device carrying a cutting knife so arranged on the cutting device as to cut the insulating strips after the same have been spiked by the needles.

31. In a conducting and insulating winding machine, a drive, a rotatable mandrel support having journaled in it four part-mandrels with each mandrel movable into four successive stations with each revolution of the support, the first station including a conducting and insulating strip feeding and winding mechanism correlated with a conducting strip cutting device, the second means for pasting and rolling up a condenser, the third means for disengaging a mandrel from the rolled condenser and the fourth means for ejecting a completed condenser roll, a cutting device correlated with the drive to cut the insulating strips between the first and second stations, means correlated with the drive for moving each mandrel progressively into and out of engagement at each of the four successive stations with each revolution of the support.

32. A machine for automatically winding complete condenser rolls including a first station containing means for winding conducting and insulating strips on mandrels and means for cutting the conducting strips at predetermined times during retardation of the winding, a second station containing means for applying adhesive and rolling up the condensers, a third station containing a device for disengaging the mandrels from the rolled condensers and a fourth station containing a device for ejecting the completed condenser rolls, a drive, a cutting device operable in correlation with the drive for automatically cutting the insulating strips between the first and second stations, a rotatable support in which the mandrels are journaled, means including the support in correlation with the drive for carrying the mandrels into and out of engagement at each station with each revolution of the support.

33. A condenser winding machine comprising means for holding strips of conducting material and insulating material, a mandrel support, a plurality of part-mandrels journaled on said support, said support being movable to place said part-mandrels successively in a winding position, cooperative part-mandrels adapted to engage with said journaled part-mandrels to hold the strips therebetween, a drive for rotating the engaged part-mandrels in the winding position, cutters operative in correlation with the drive to cut the conducting strips without cutting the insulating strips when the winding is near completion, a strip feeding device correlated with said drive to feed the strips together toward the part-mandrel in the winding position for a time interval after said cutting and after a gap has been formed between the cut ends of the conducting strips, means operative in correlation with the drive to move the mandrel support to carry the wound part-mandrels out of the winding position and to carry another of the part-mandrels into the winding position, a cutter operative in correlation with the mandrel support to cut the insulating strips at a place between said wound mandrel and said succeeding part mandrel, a device operative in correlation with the mandrel support and the drive for separating the cooperating part-mandrel from the wound journaled part-mandrel while a condenser is being wound in the winding position, and an ejecting device operative in correlation with the

mandrel support and the drive for ejecting the condenser roll from the part-mandrel while a condenser is being wound in the winding position.

34. A condenser roll machine as set forth in claim 27 in which each mandrel is supported at both ends during the winding operation.

35. A condenser roll machine as set forth in claim 27 in which the conducting-strip cutting means is positioned and operated to complete its operation before completion of the corresponding condenser.

36. A condenser roll machine as set forth in claim 27 in which there is feeding means for the condenser strips operating to feed the strips at a greater rate of movement than the rate of the mandrel from one position to the other so as to prevent undue tension on the strips during such movement.

37. A condenser roll machine as set forth in claim 27 in which the insulating strip cutting means operates between the first and second stations and has cooperating with it a holding means for retaining the cut ends of the strips of the next condenser in position until gripped by the following mandrel.

38. A condenser roll machine as set forth in claim 27 in which the finished condenser roll is ejected during the formation of the following condenser roll.

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