March 19, 1935. L. E. POOLE 1,995,105

COIL WINDING MACHINE

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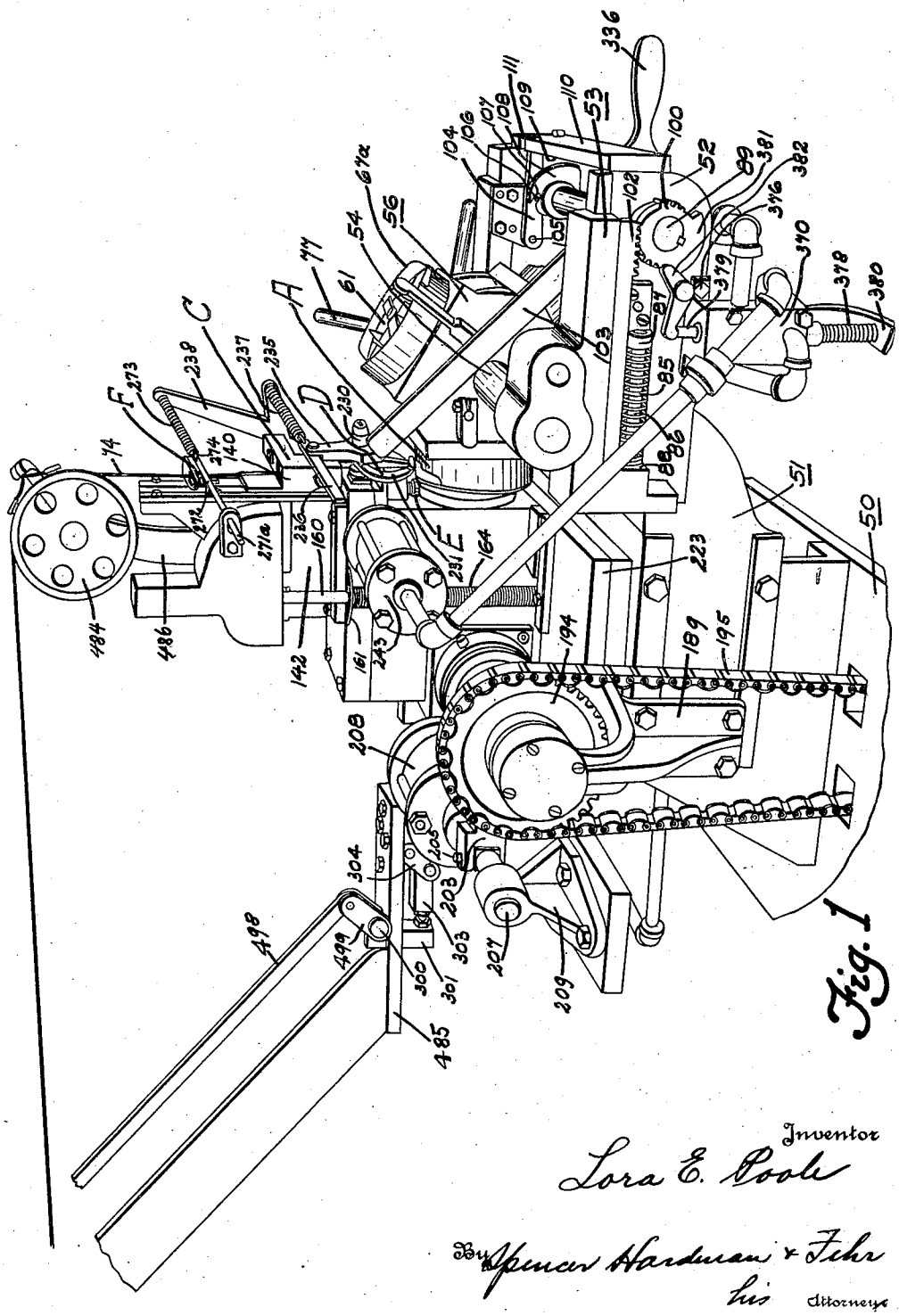

Fig. 1

Inventor

Lora E. Poole

By Spencer Hardman & Fehr

his Attorneys

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COIL WINDING MACHINE

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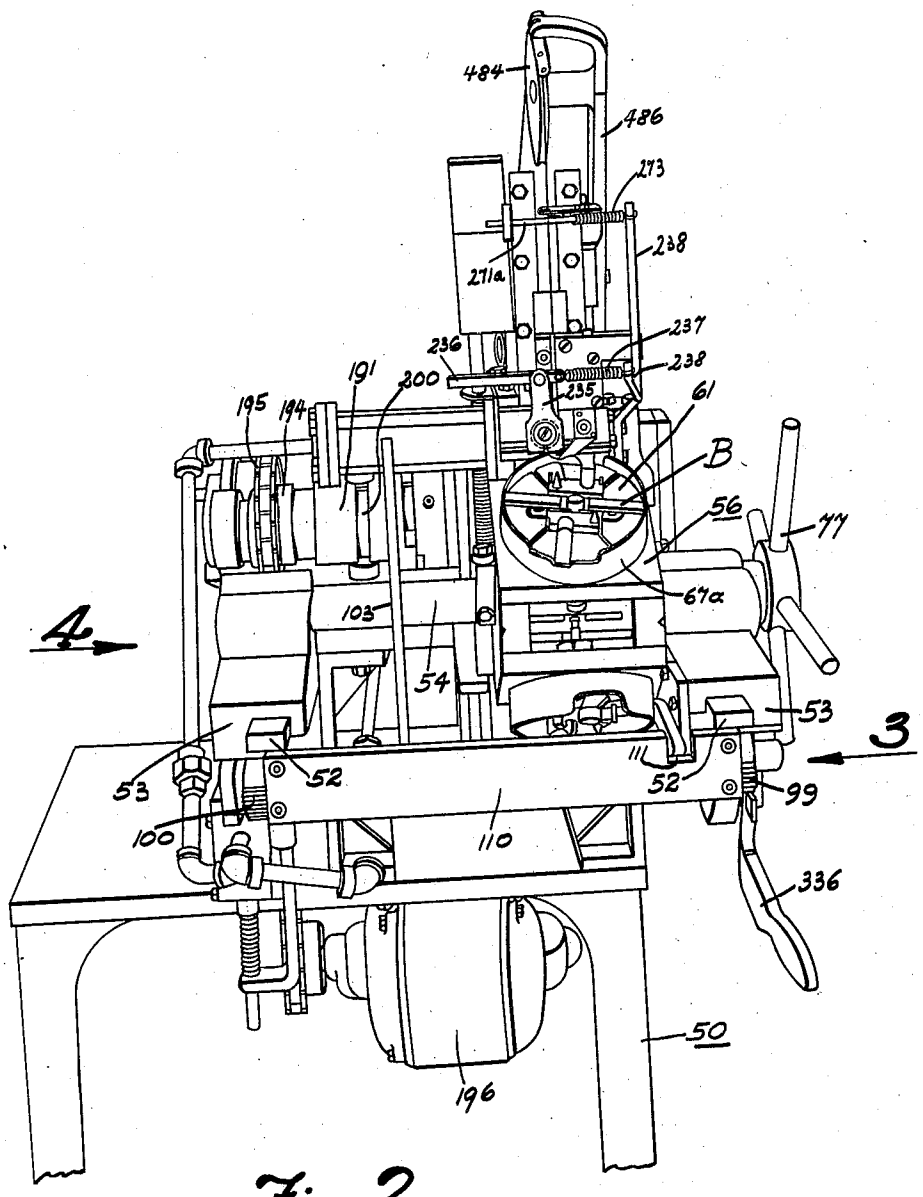

Fig. 2

Inventor

Lora E. Poole

By Spencer Hardman & Fehr

his Attorneys

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COIL WINDING MACHINE

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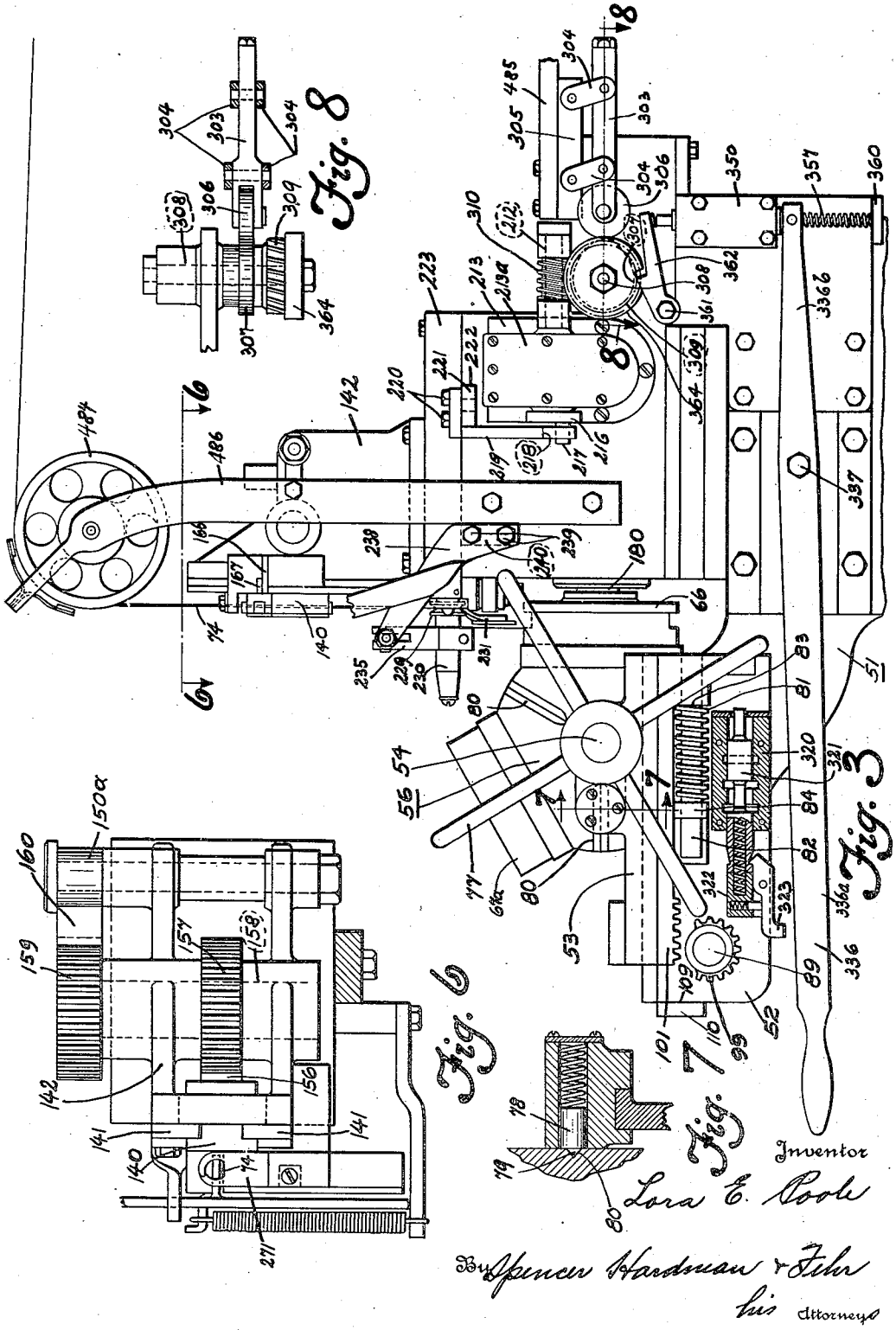

Fig. 3

Fig. 6

Fig. 7

Inventor
Lora E. Poole
By Spencer Hardman & Fehr
his Attorneys

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COIL WINDING MACHINE

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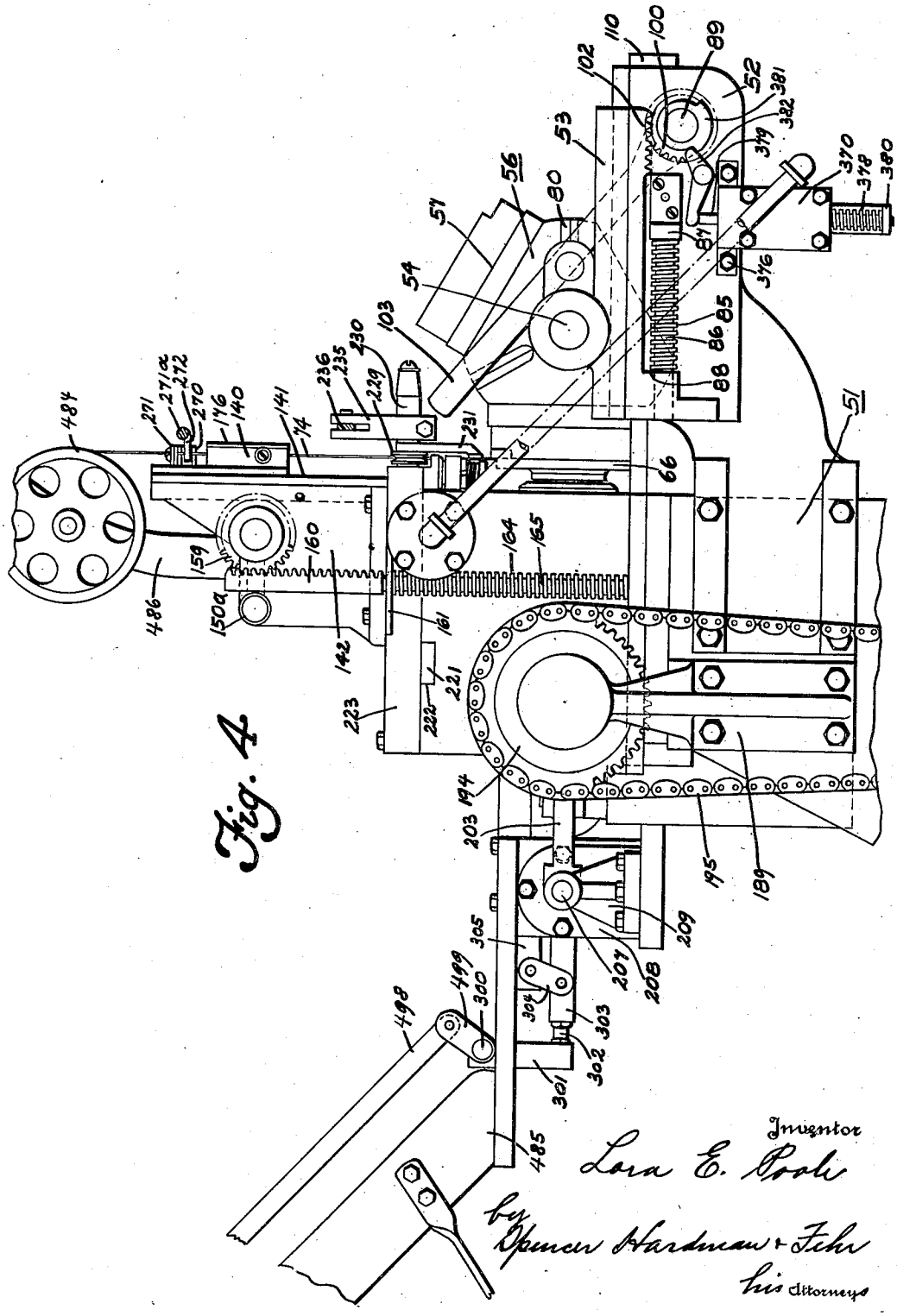

Fig. 4

Inventor
Lora E. Poole
by Spencer Hardman & Fehr
his Attorneys

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COIL WINDING MACHINE

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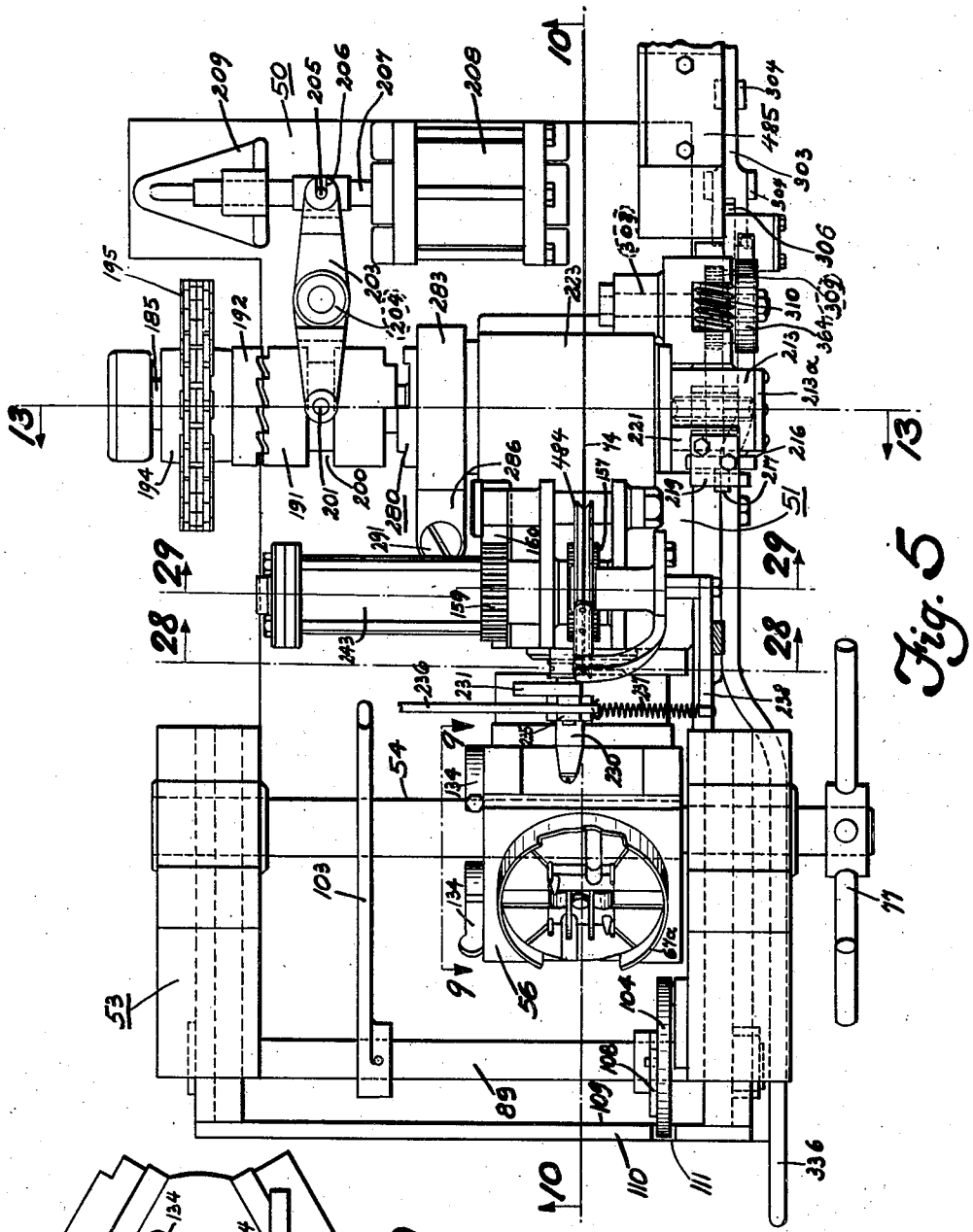

Fig. 5

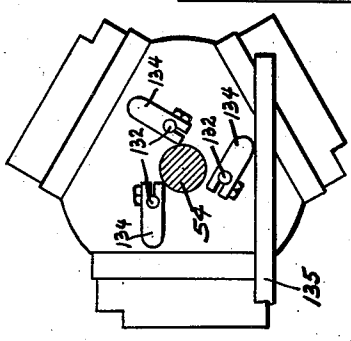

Fig. 9

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Lora E. Poole
By Spencer Hardman & Fehr
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COIL WINDING MACHINE

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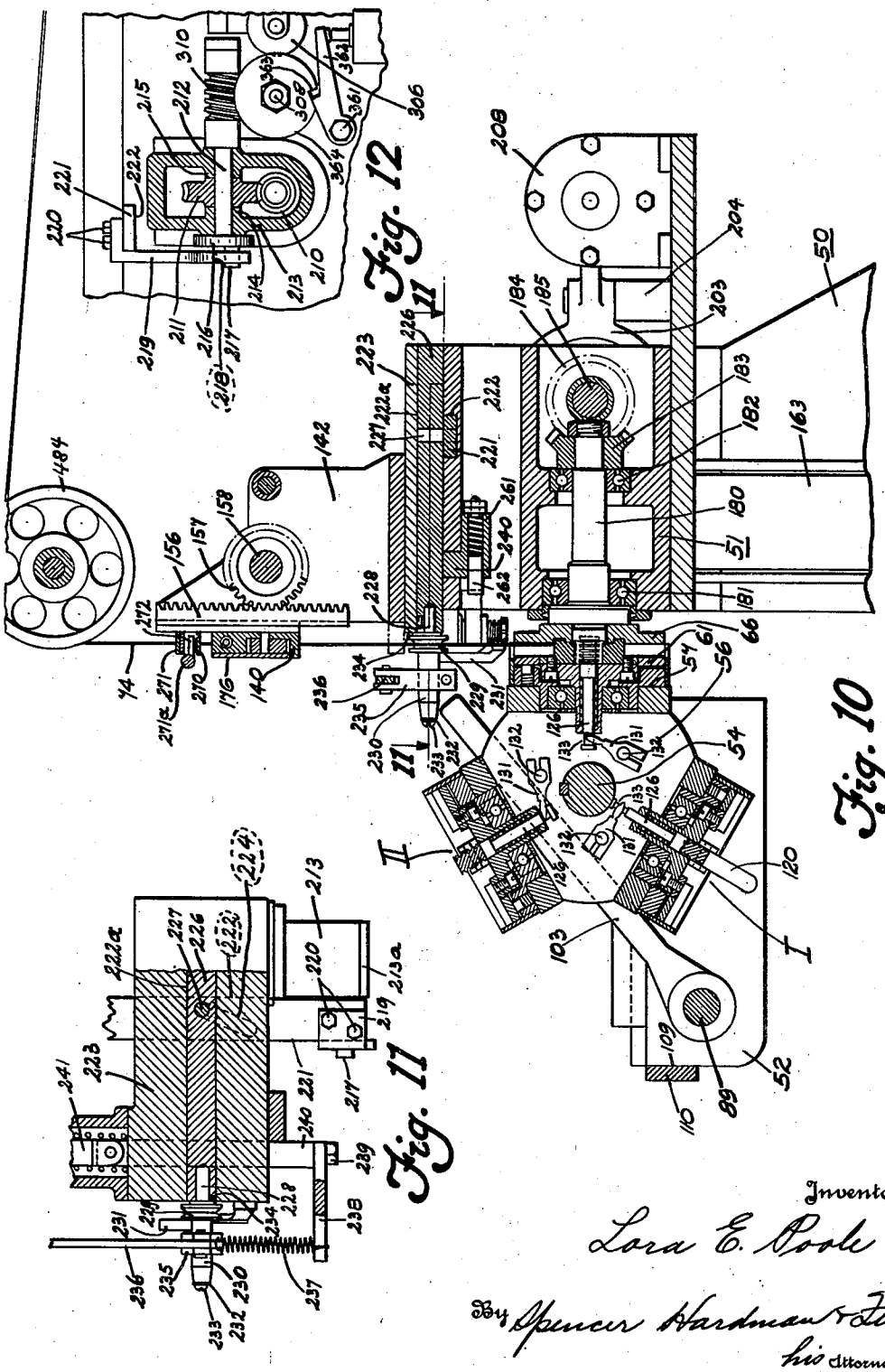

Fig. 10

Fig. 11

Fig. 12

Inventor

Lora E. Poole

By Spencer Hardman & Fehr

his Attorneys

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COIL WINDING MACHINE

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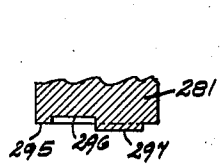

Fig. 15

Fig. 14

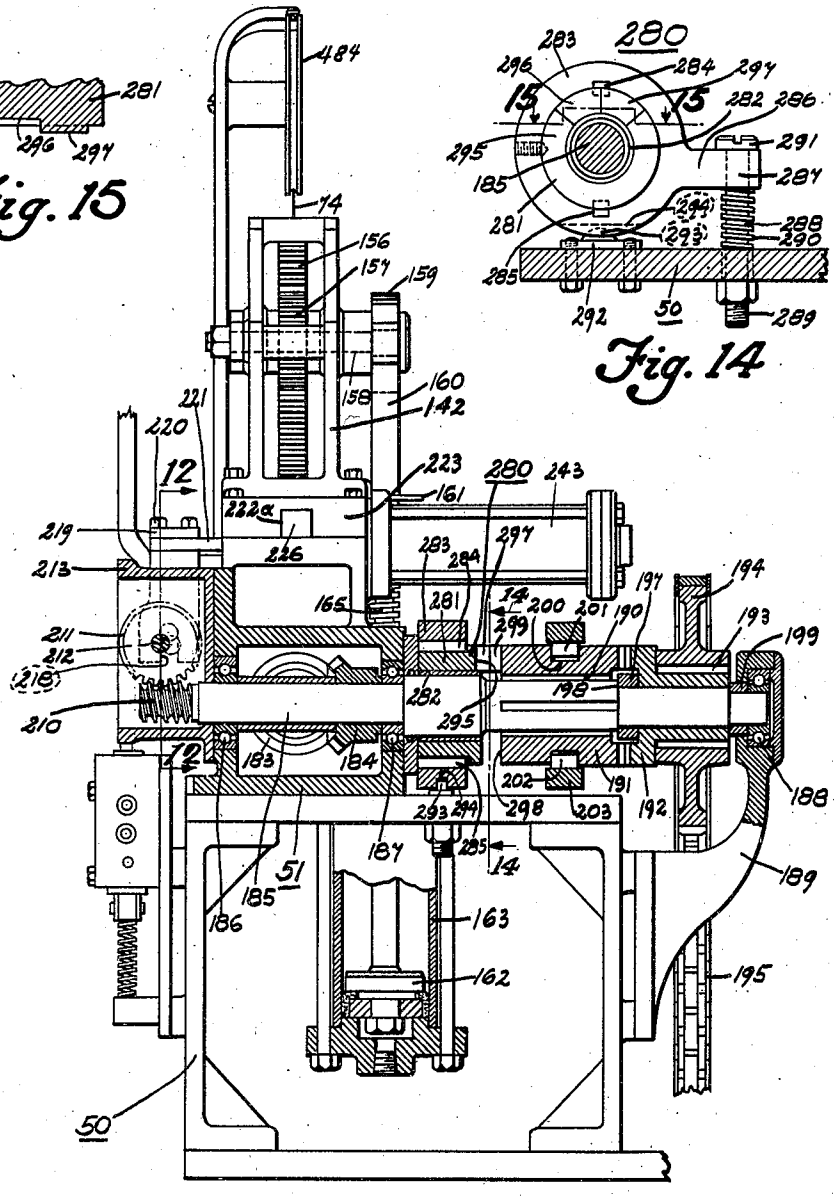

Fig. 13

Inventor

Lora E. Poole

By Spencer Hardman & Fehr

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COIL WINDING MACHINE

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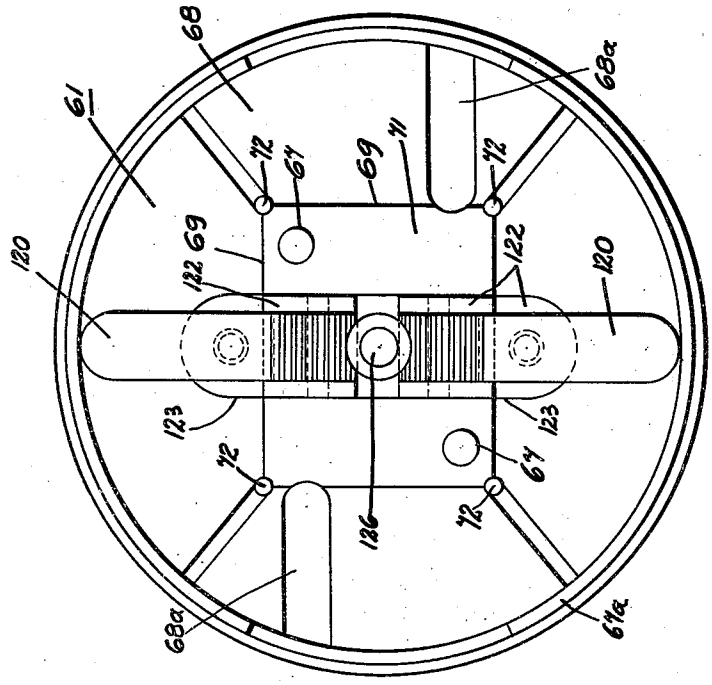

Fig. 17

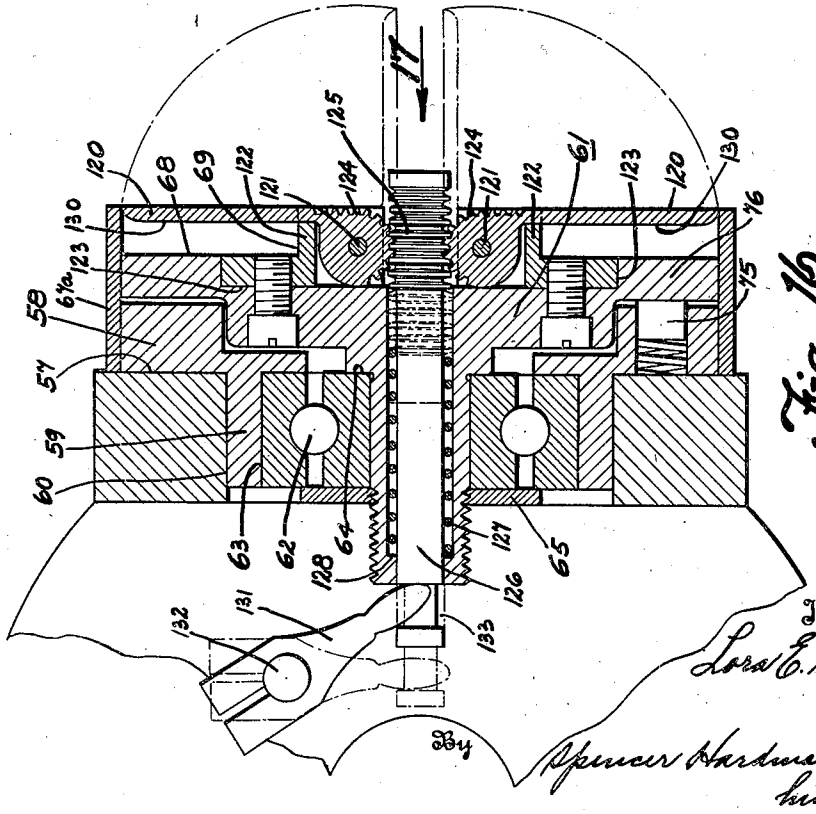

Fig. 16

Inventor
Lora E. Poole

By Spencer Hardman & Fehr
his Attorneys

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COIL WINDING MACHINE

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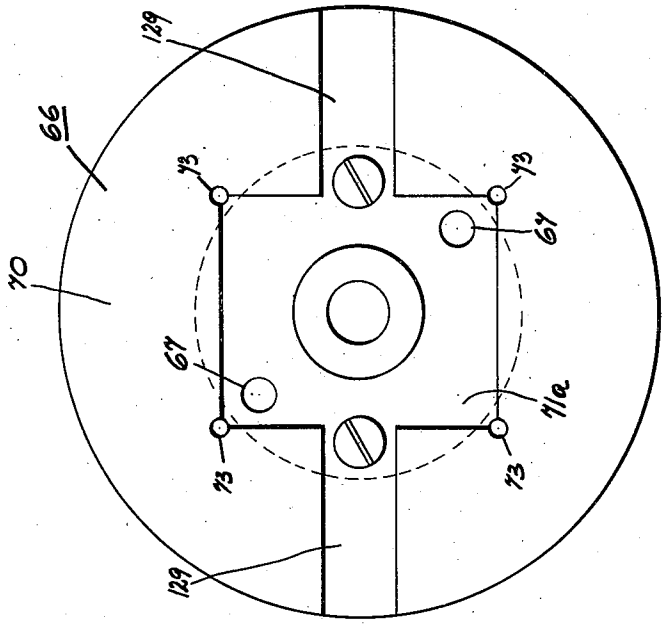

Fig. 19

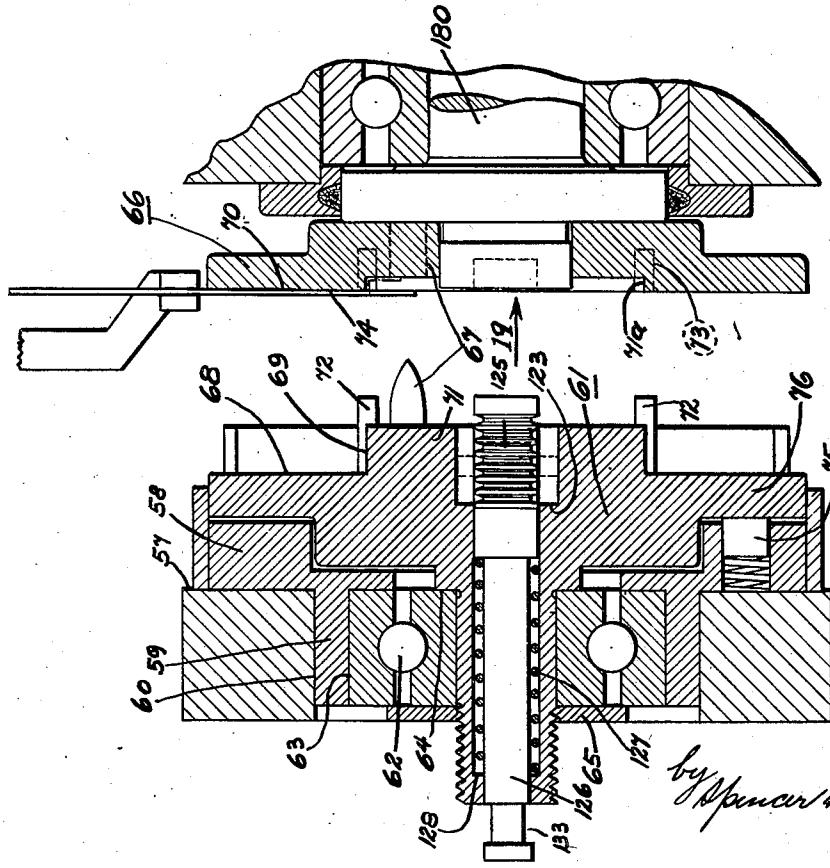

Fig. 18

Inventor
Lora E. Poole

by Spencer Hardman & Fehr
his Attorneys

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COIL WINDING MACHINE

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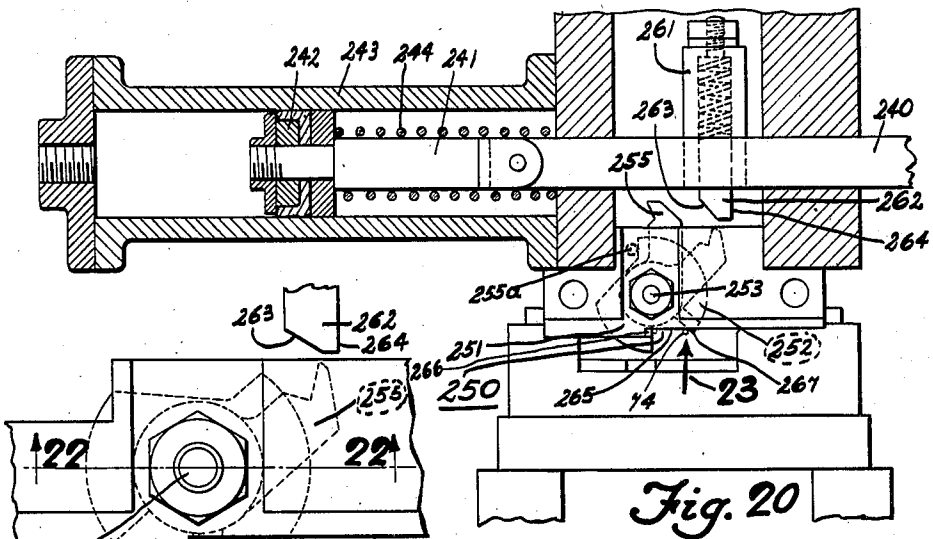

Fig. 20

Fig. 21

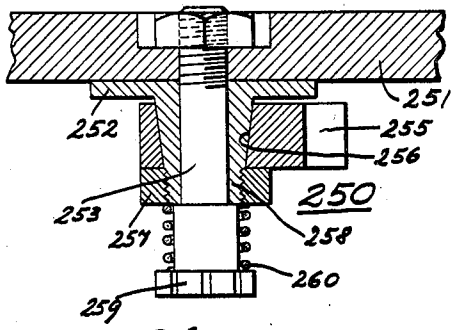

Fig. 22

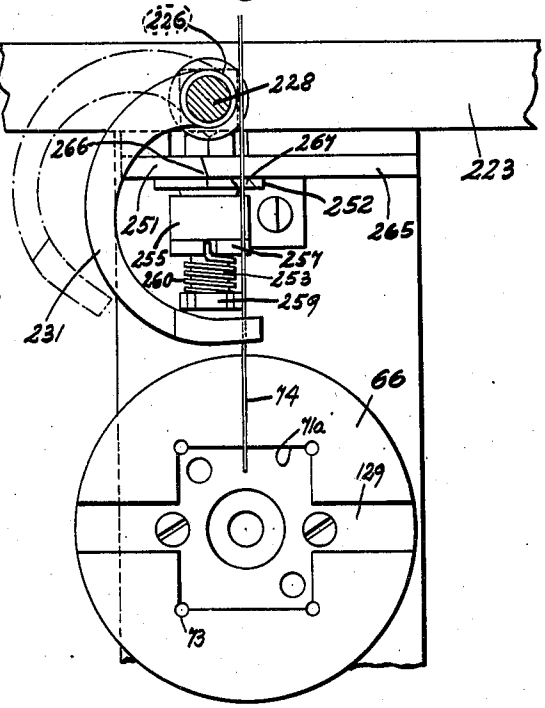

Fig. 23

Inventor
Lora E. Poole

By Spencer Hardman & Fehr
his Attorneys

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COIL WINDING MACHINE

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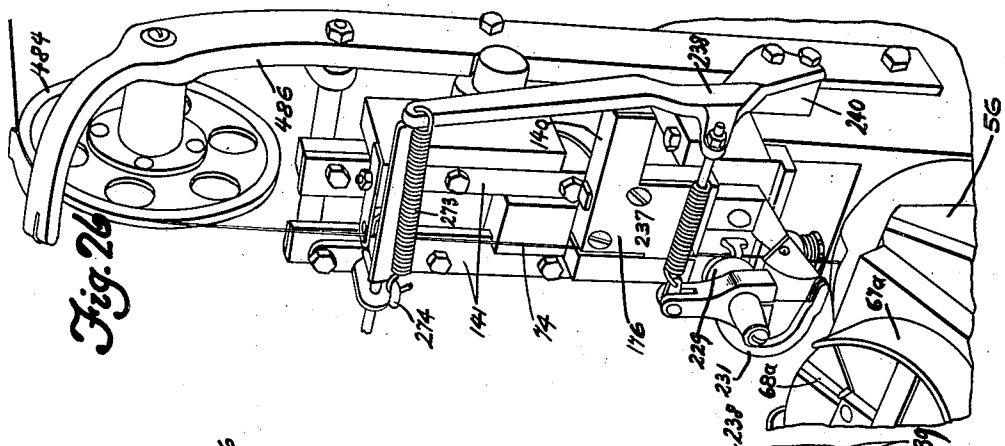

Fig. 26

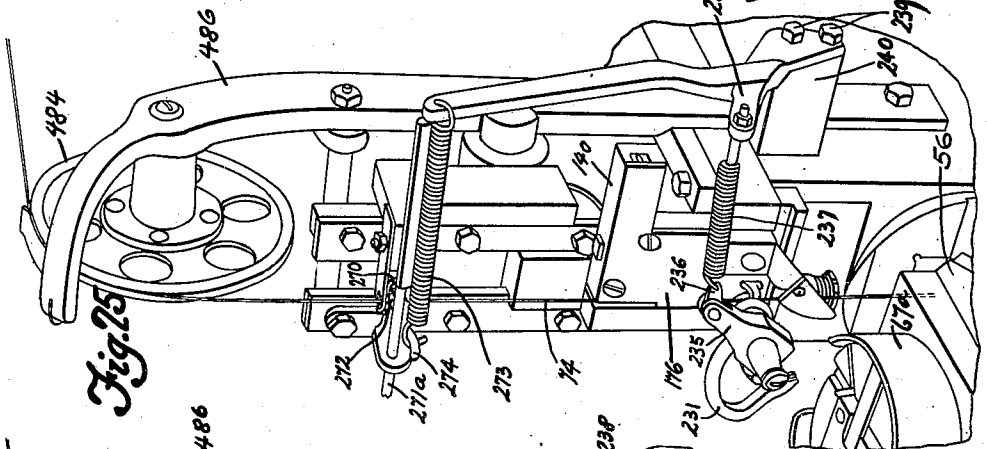

Fig. 25

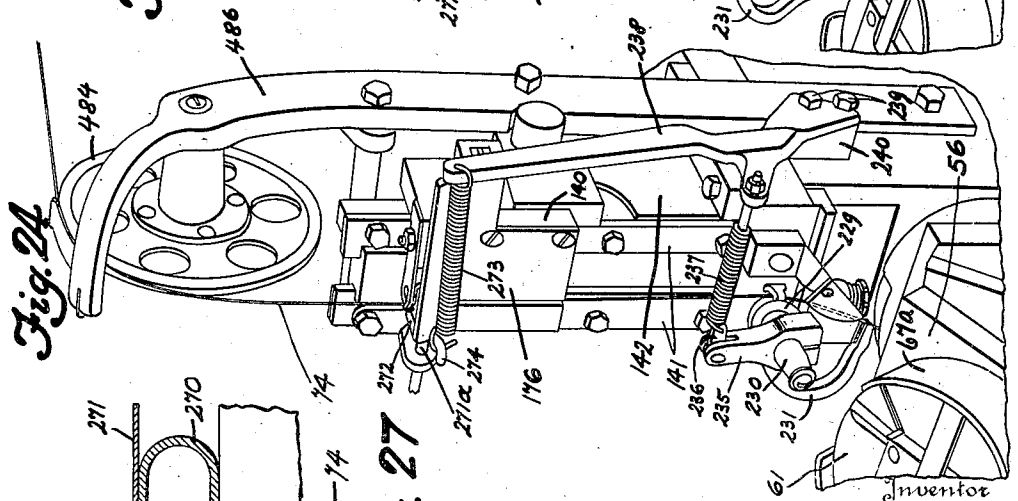

Fig. 24

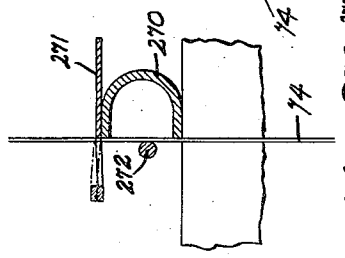

Fig. 27

Inventor

Lora E. Poole

by Spencer Hardman & Fehr

his Attorneys

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COIL WINDING MACHINE

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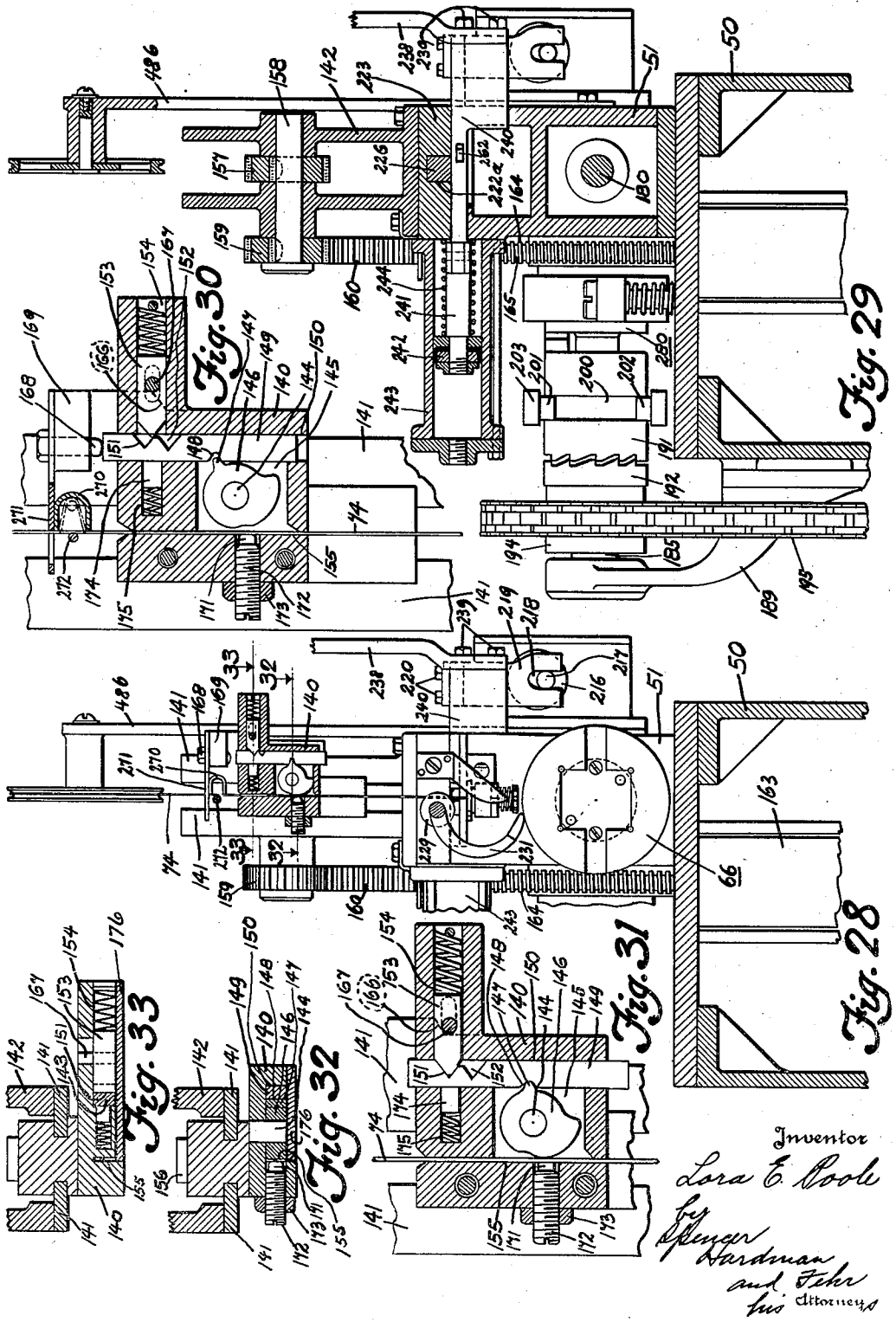

Inventor
Lora E. Poole
by
Spencer Hardman
and Fehr
his Attorneys

March 19, 1935. L. E. POOLE 1,995,105

COIL WINDING MACHINE

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Fig. 35

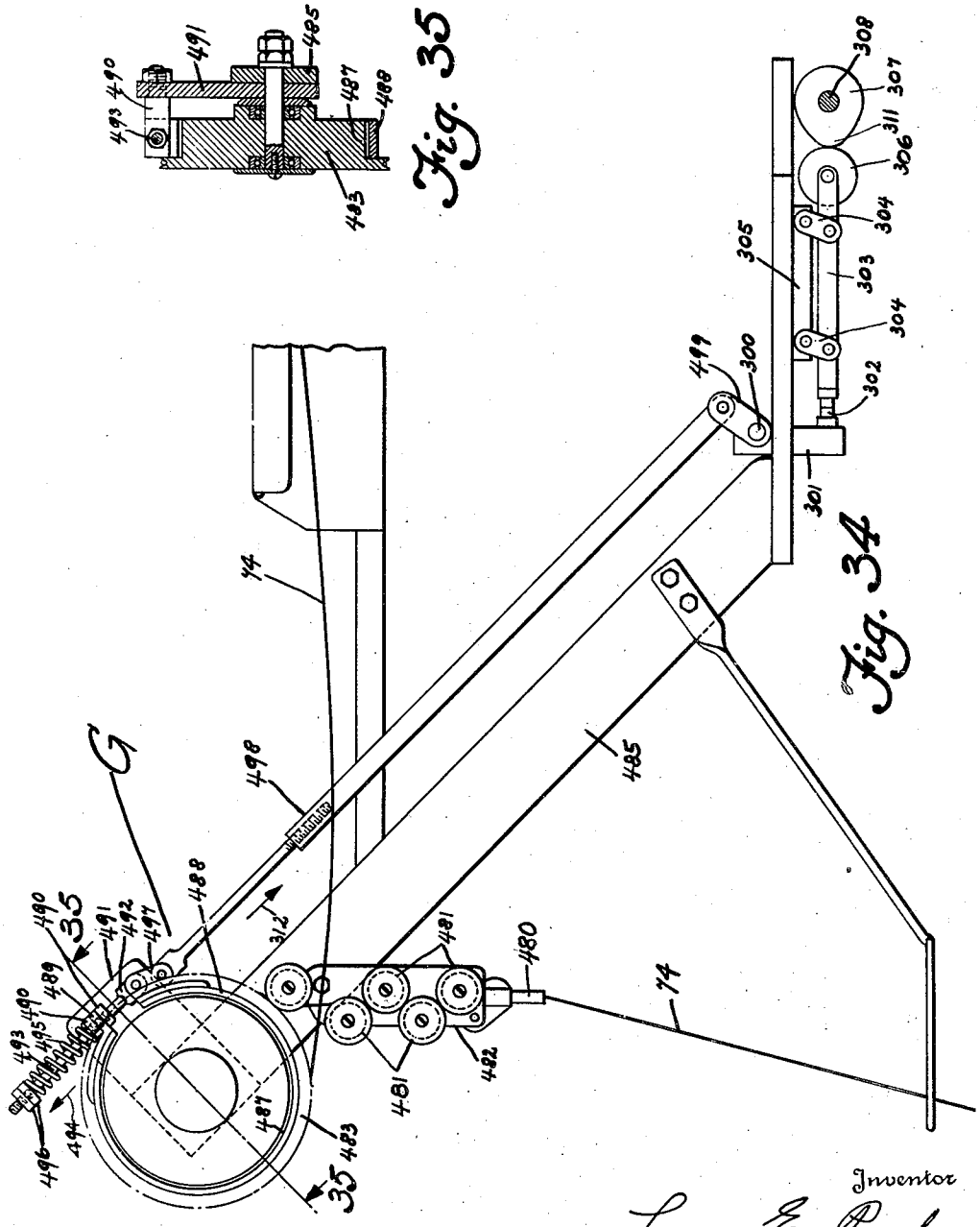

Fig. 34

Inventor
Lora E. Poole

By Spencer Hardman & Fehr
his Attorneys

March 19, 1935. L. E. POOLE 1,995,105

COIL WINDING MACHINE

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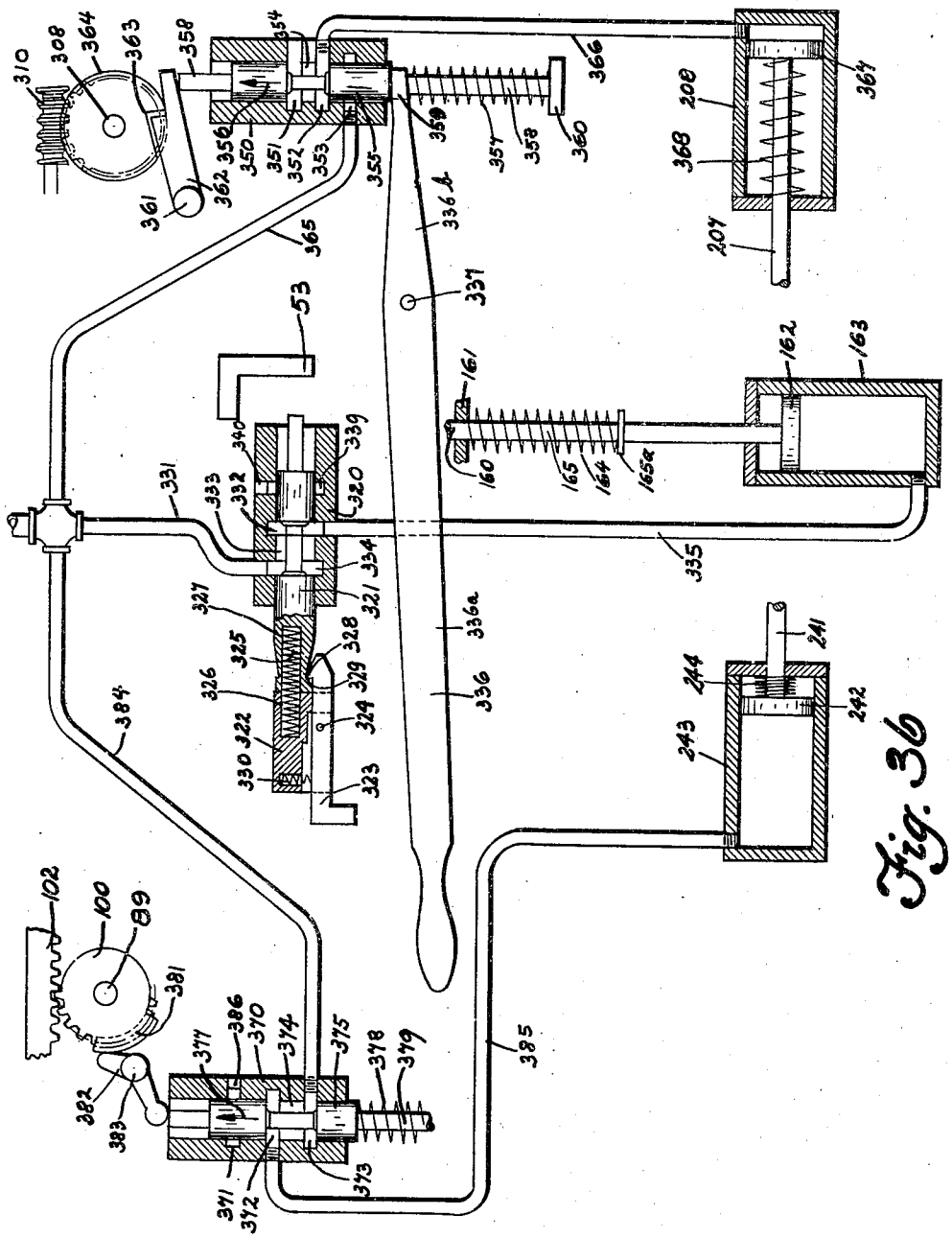

Fig. 36

INVENTOR
Lora E. Poole
BY
Spencer Hardman & Fehr
his ATTORNEYS

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COIL WINDING MACHINE

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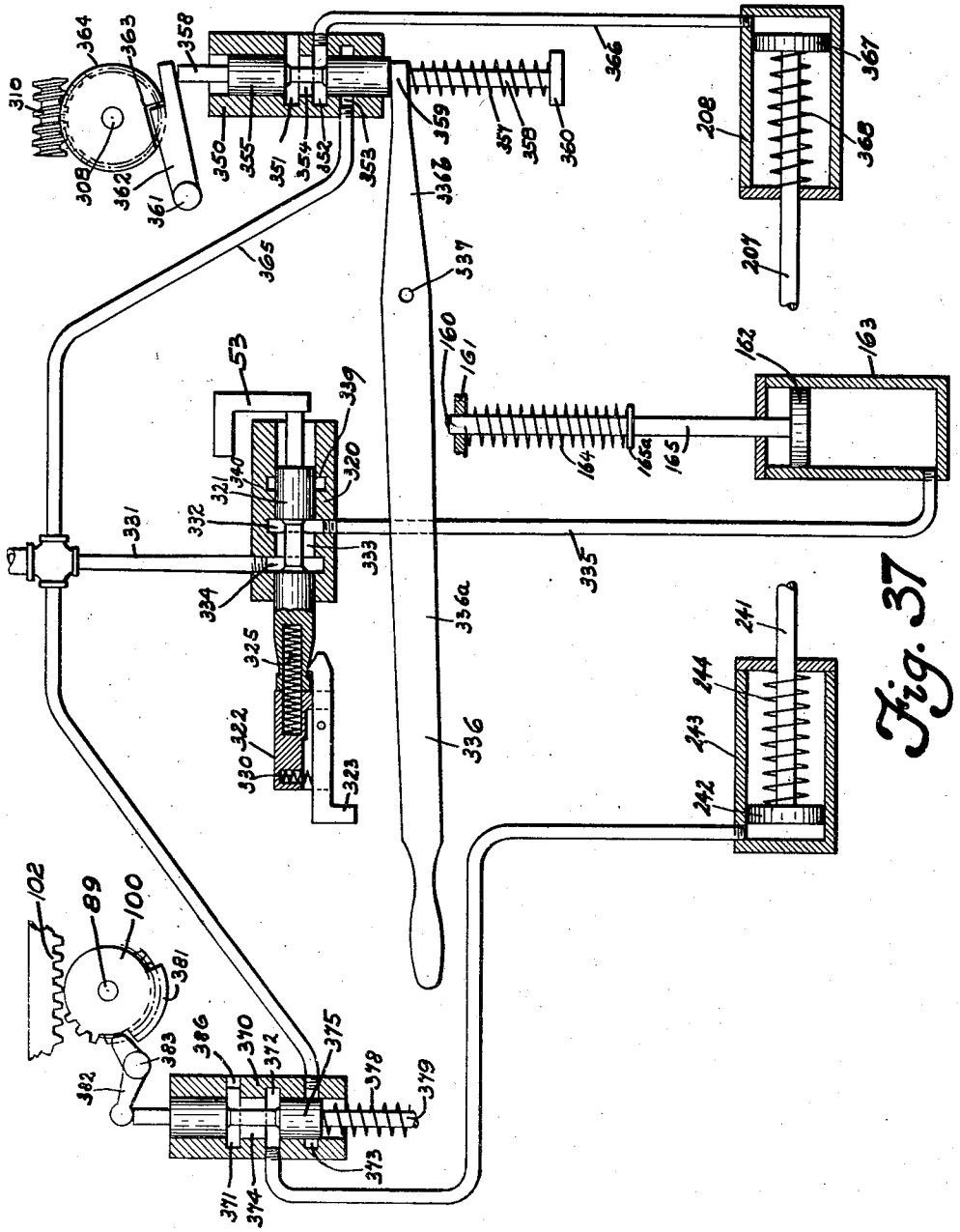

Fig. 37

Inventor

Lora E. Poole

By Spencer Hardman & Fehr

his Attorneys

March 19, 1935. L. E. POOLE 1,995,105

COIL WINDING MACHINE

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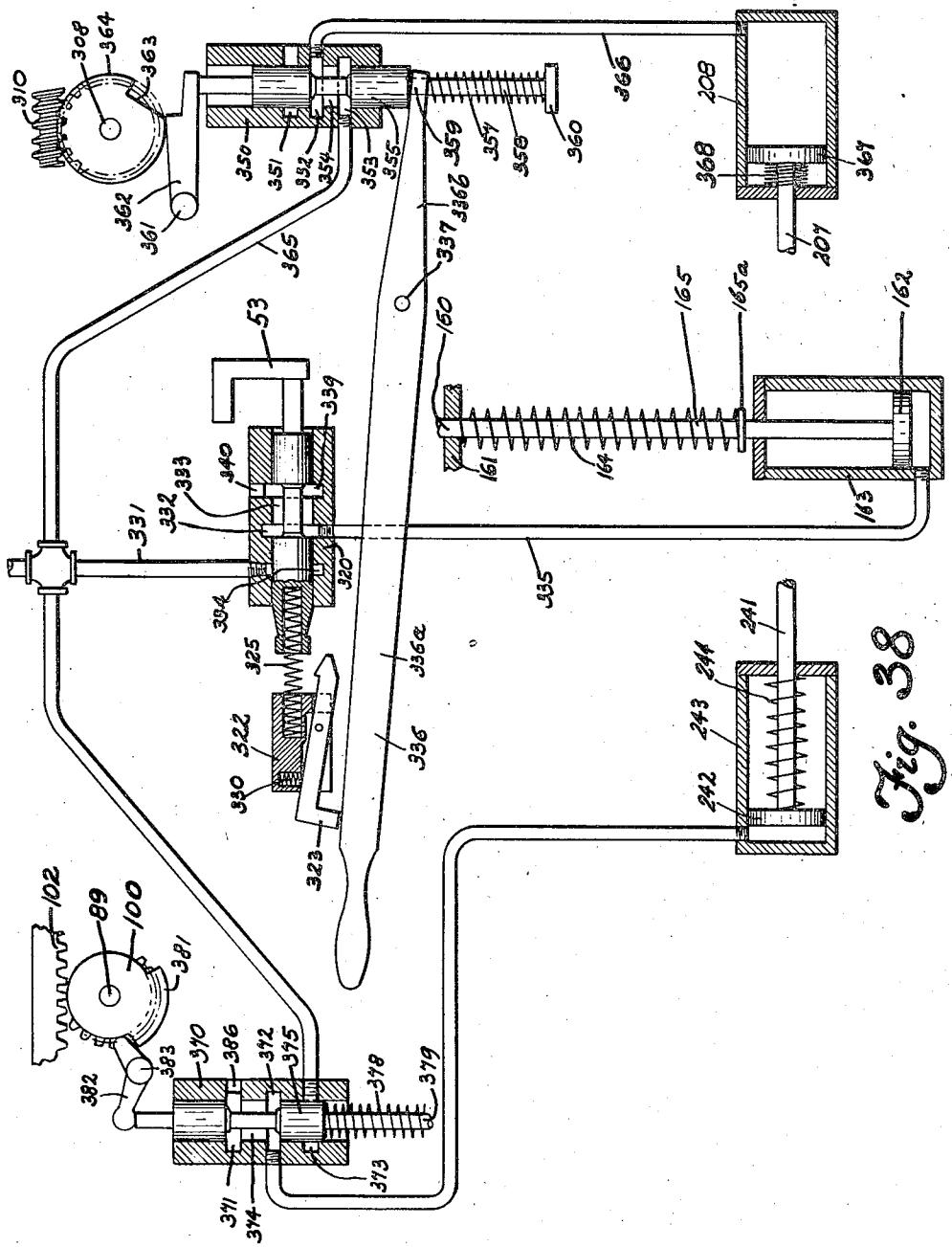

Fig. 38

Inventor

Lora E. Poole

By Spencer Hardman & Fehr

his Attorneys

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COIL WINDING MACHINE

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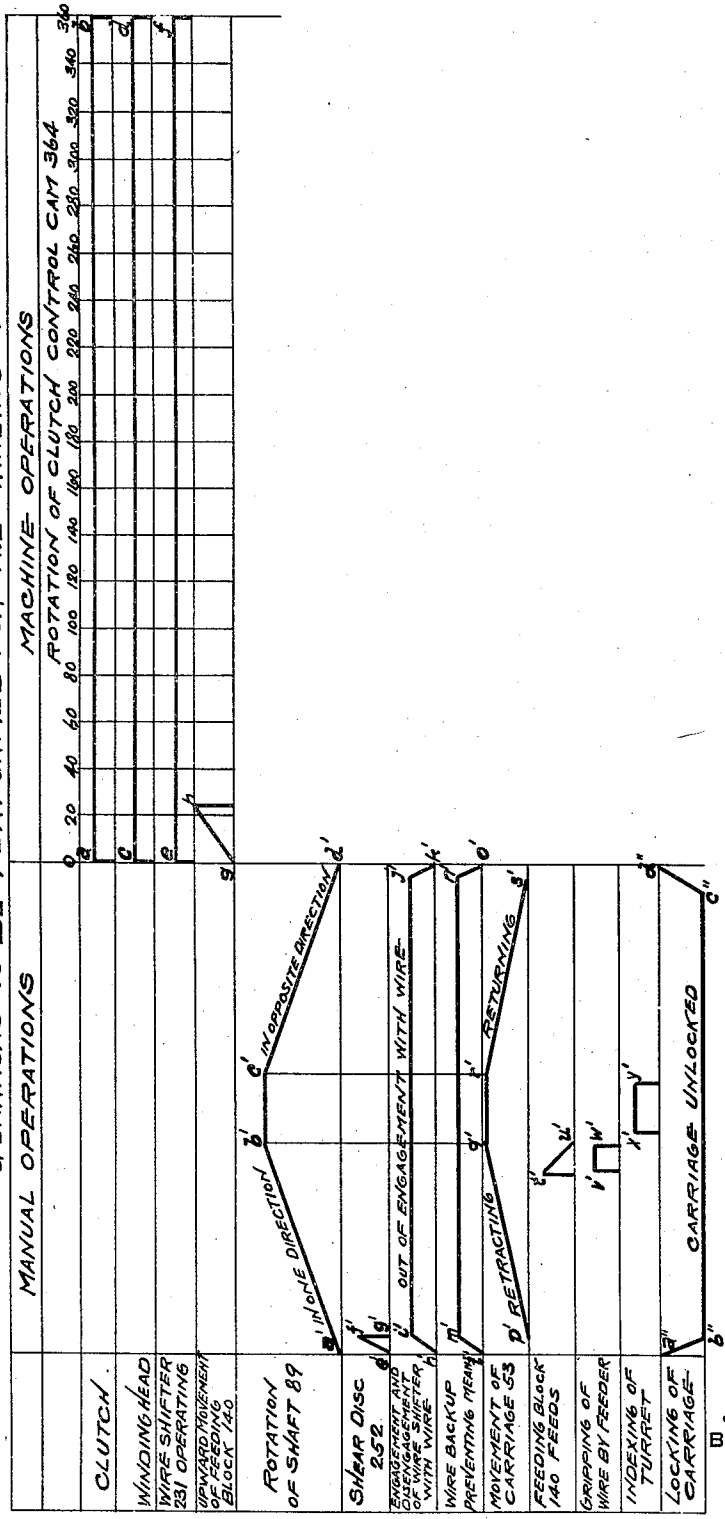

Fig. 39

INVENTOR
Lora E. Poole
BY Spencer Hardman & Fisher
his ATTORNEYS

Patented Mar. 19, 1935

1,995,105

UNITED STATES PATENT OFFICE

1,995,105

COIL WINDING MACHINE

Lora E. Poole, Anderson, Ind., assignor, by mesne assignments, to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application January 26, 1933, Serial No. 653,602

136 Claims. (Cl. 140—92.2)

This invention relates to coil winding machines.

It is among the objects of the present invention to provide certain improvements in a machine for winding a wire coil of a predetermined number of turns.

One object of the present invention is to provide for inspection of a wound coil while on its winding form during the winding of another coil on another winding form.

Another object is to provide for automatic ejection of an inspected coil.

In order to accomplish the two previous objects there is provided a carriage supporting a turret on which a plurality of freely rotatable winding forms are mounted which may be brought successively into cooperative engagement with a driving winding head and each of which is provided with means for retaining a wound coil until it reaches an ejecting station in which the coil retaining means is rendered ineffective and the coil descends from the winding form by gravity.

Another object of the present invention is to provide for severing a wound coil from a supply of wire in response to movement of the carriage in a direction to separate a winding form from the winding head.

Another object is to provide for feeding the severed end of the supply wire adjacent the winding head in response to movement of the carriage in a direction to separate a winding form from the winding head.

Another object is to provide for anchoring the fed end of the supply wire to a cooperating winding form and winding head in response to movement of the carriage in a direction to approach said winding form to the winding head.

Another object is to move a wire shifter out of the path of movement of the severed end of a coil carried by a winding form, in response to movement of the carriage in a direction to separate said winding form from the winding head, and to return the wire shifter into engagement with the supply wire immediately after the end thereof has been anchored.

Another object is to prevent backing up of the supply wire while unanchored.

Another object of the present invention is to provide a control device which by a single manipulation connects the winding head with a power driver and interrupts such driving connection at the end of a winding operation.

Another object is to provide for automatic tensioning of the supply wire during a winding operation.

Another object of the present invention is to provide for automatic braking of the rotating winding head after disconnection from the power driver and to return the winding head into a predetermined angular position prior to the separation of a winding form therefrom.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings·

Fig. 1 is a perspective view of the machine embodying the present invention.

Fig. 2 is another perspective view of the machine, showing the front thereof.

Fig. 3 is a side elevation of the machine looking in the direction of arrow 3 in Fig. 2.

Fig. 4 is another side elevation of the machine looking in the direction of arrow 4 of Fig. 2.

Fig. 5 is a plan view of the machine.

Fig. 6 is an enlarged sectional view taken on the line 6—6 of Fig. 3.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 3.

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 3.

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 5.

Fig. 10 is a sectional view taken substantially on the line 10—10 of Fig. 5.

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 10.

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 13.

Fig. 13 is a sectional view taken substantially along the line 13—13 of Fig. 5.

Fig. 14 is a sectional view taken on the line 14—14 of Fig. 13.

Fig. 15 is a fragmentary sectional view taken along the line 15—15 of Fig. 14.

Fig. 16 is a cross-sectional view of one of a plurality of winding forms.

Fig. 17 is a view of one of the winding forms looking in the direction of arrow 17 in Fig. 16.

Fig. 18 is a fragmentary sectional view of a cooperating winding form and winding head in separated position.

Fig. 19 is a view of the winding head looking in the direction of arrow 19 in Fig. 18.

Fig. 20 discloses the coil severing means and its actuator, the latter in section.

Fig. 21 is an enlarged fragmentary view of the coil severing means, showing the same in operation.

Fig. 22 is a sectional view taken on the line 22—22 of Fig. 21.

Fig. 23 is an enlarged fragmentary view looking in the direction of arrow 23 in Fig. 20 and disclosing the relative positions of the winding head, the coil severing means and the wire shifter.

Figs. 24 to 26 inclusive, are fragmentary perspective views of part of the machine illustrating the cooperation between the wire feeding means and the wire shifter.

Fig. 27 is a transverse sectional view of the wire back-up preventing means.

Fig. 28 is a sectional view taken substantially on the line 28—28 of Fig. 5.

Fig. 29 is a sectional view taken substantially along the line 29—29 of Fig. 5.

Figs. 30 and 31 are enlarged transverse sectional views of the wire feeding means in wire releasing and wire gripping positions, respectively.

Figs. 32 and 33 are enlarged sectional views taken on the lines 32—32 and 33—33, respectively, of Fig. 28.

Fig. 34 is a view disclosing the wire tensioning device.

Fig. 35 is a sectional view taken on the line 35—35 of Fig. 34.

Figs. 36 to 38 inclusive, are diagrammatic views illustrating the operation of certain controls for various mechanisms of the machine.

Fig. 39 is a chart illustrating the timed relationship between the manual and automatic operation of various mechanisms during one complete winding operation of the machine.

A coil is wound in a winding groove formed by a power driven head and a drivingly engageable form.

There is provided a plurality of winding forms which may be successively brought into driving engagement with a winding head. The end of a supply wire is anchored between the winding head and a drivingly engaging winding form. A wire shifter properly locates the individual turns of the coil in the winding groove and the head rotation is automatically stopped upon a completed winding operation. The next following winding form is then brought into driving engagement with the head by manual operation and in response to such operation the wound coil is automatically severed from the supply wire, the wire shifter is automatically moved out of the path of movement of the severed end of the coil which is retained on the retracting winding form, the end of the supply wire is automatically fed adjacent the winding head, the fed end of the supply wire is anchored between the winding head and a cooperating winding form, the wire shifter is automatically returned into wire shifting position, and a previously wound coil is automatically released from its winding form and descends by gravity. The machine is now ready for a new winding operation and by a single manipulation the head starts to rotate again.

As best shown in Figs. 1, 2 and 34 a machine table 50 supports a frame 51 on which various mechanisms are mounted such as coil forming means A, coil retaining means B, a wire feeding device C, wire shifting means D, coil severing device E, wire back-up preventing means F, wire tensioning device G and various controls for the various devices and means just mentioned.

Coil forming means A

Referring more particularly to Figs. 1 to 4 inclusive, the frame 51 comprises parallel ways 52 for guiding a carriage 53 for movement in horizontal direction. Mounted on a shaft 54, which is rotatably but longitudinally immovably supported by the carriage 53, is a turret 56 which has three equi-angularly spaced peripheral flat surfaces 57. As best shown in Figs. 10, 16 and 18, a member 58 rests against each flat surface 57 and is properly located thereon by a reduced cylindrical portion 59 which is press-fitted in an annular recess 60. A winding form 61 is rotatably supported within a ball bearing 62 which in turn is properly located in an annular recess 63 of member 58. Winding form 61 is held against longitudinal movement relative to ball bearing 62 by a shoulder 64 of the winding form and a nut 65 which is threaded upon the end of the winding form. Cooperating with a winding form 61 is a winding head 66 which may be drivingly connected by several (preferably two) pin and hole connections 67. A winding form 61 defines one side wall 68 and the bottom 69 of the winding groove which determines the shape of the coil, whereas winding head 66 defines the opposite side wall 70 of said winding groove. Each winding form has two recesses 68*a* which receive one leg of a coil clip (not shown) which is attached to the coil after a winding form has been separated from the winding head in order to prevent unreeling of the turns of the coil. A cylinder 67*a* surrounds member 58 and projects beyond the winding groove formed by a winding form and the cooperating winding head. As better shown in Figs. 17 and 19, that part 71 of the winding form 61 which defines the bottom of the winding groove is rectangular and extending from the four corners thereof are spikes 72 which during driving engagement between the winding head and a winding form protrude into apertures 73 of the winding head. These spikes around which the coil develops support only the corners of the coil thereby maintaining the same clear out of engagement with the rectangular part 71 of the winding form whereby the friction to be overcome at the ejection of the coil is reduced to a minimium. It will also be noticed from Fig. 18 that the rectangular portion 71 of a winding form during engagement of the winding head extends into a correspondingly shaped recess 71*a* of the winding head thereby anchoring the end of a supply wire 74 in the manner disclosed in Fig. 18. It may be stated in advance that winding head 66 is the driver and a cooperating winding form is driven thereby. In order to prevent a winding form from rotating while the same is out of driving engagement with the winding head, a spring urged friction member 75 which is slidably carried by member 58 engages a flange-like portion 76 of each winding form 61. The turret carrying shaft 54 is manually rotated by a hand wheel 77 and the turret is yieldingly arrested in proper intermittent resting positions by a spring urged plunger 78, located in the carriage 53 and detailedly disclosed in Fig. 7. This spring urged plunger 78 has a beveled point 79 which is received in one of three beveled radial grooves 80 of the turret. Carriage 53 is yieldingly urged toward the right as viewed in Fig. 3 and toward

the left as viewed in Fig. 4 by two compression springs 81 and 85. Spring 81 surrounds a bar 82 of the carriage and is interposed between a shoulder 83 of the carriage and a lug 84 of frame 51, and spring 85 surrounds a rod 86 carried by a lug 87 of the carriage 51 and is interposed between said lug and a shoulder 88 of the carriage. In order to move the carriage toward the left as viewed in Fig. 3 and against the tendency of springs 81 and 85, a shaft 89, journaled in frame 51 is provided with gear segments 99 and 100 (see Figs. 3 and 4), which upon rotation of shaft 89 in a counter-clockwise direction as viewed in Fig. 3, mesh with racks 101 and 102, respectively, of the carriage 53. Shaft 89 may be rotated in either direction by a manually operable lever 103. To prevent even the slighest movement of a winding form away from the drivingly engaged winding head 66, the carriage is positively locked against receding movement by a lever 104 (see Fig. 1) pivoted to the carriage as at 105 and having a pin 106 which upon actuation by a cam slot 107 of a disc 108, mounted on rotatable shaft 89 will be rocked into either one of two positions. Upon rotation of shaft 89 in counter-clockwise direction as viewed in Fig. 1, the cam slot 107 will after a winding form has been moved into driving engagement wth the winding head, move lever 104 into a position in which its free end engages a beveled surface 109 of a bar 110 attached to the guideways 52. Upon rotation of shaft 89 in the opposite direction, cam slot 107 will rock lever 104 counter-clockwise as viewed in Fig. 1 and out of engagement from beveled surface 109 and into alignment with a slot 111 in bar 110. Upon continued clockwise rotation of shaft 89 the gear segments 99 and 100 will mesh with the racks 101 and 102 respectively, and retract the carriage. It follows from the preceding that upon rotation of lever 103 in one direction the retracted carriage is moved into a position in which an aligned winding form on the turret comes into driving engagement with the winding head and then the locking lever 104 is rocked into locking position, and upon rotation of lever 103 in the opposite direction, locking lever 104 is first moved out of locking position and then the carriage starts to retract.

Winding head 66 is suitably mounted on a horizontal shaft 180, journaled in ball bearings 181 and 182, provided by frame 51 as best shown in Fig. 10. The end of shaft 180 opposite the winding head is provided with a bevel gear 183 which meshes with another bevel gear 184 mounted on a horizontal shaft 185 which is shown in Fig. 13 is journaled in ball bearings 186, 187 and 188, provided by frame 51 and a bearing bracket 189, respectively. Bearing bracket 189 is attached in any suitable manner to frame 51. Splined to shaft 185 as at 190 is a shiftable clutch member 191 which is adapted to cooperate with a driving clutch member 192 which is freely rotatable upon shaft 185. Keyed as at 193 to the clutch member 192 is a spocket wheel 194 which through a chain connection 195 may be driven from a suitable source of mechanical power such as an electric motor 196 (see Fig. 2). Endwise movement of driving clutch member 192 is prevented by a spacer 197 interposed between a shoulder 198 of shaft 185 and one end of said clutch member and a spacer 199 interposed between ball bearing 188 and the opposite end of said clutch member 192. Clutch member 191 is provided with a peripheral groove 200 adapted to receive pins 201 and 202 of a clutch shifter lever 203 (see also Figs. 5 and 10) which is pivoted to a column 204 carried by the table 50. Upon engagement of the clutch members, motion is transmitted from the electric motor 196 through chain 195, sprocket wheel 194, clutch members 192, 191, shaft 185, bevel gears 184, 183, shaft 180 to the winding head. As best shown in Fig. 5, the free end of clutch shifter lever 203 is connected by a pin 205 and slot 206 with a piston rod 207 of a single acting piston received by a cylinder 208, mounted on table 50. A bearing bracket 209 mounted also on table 50 slidably supports the free end of piston rod 207. Upon admission of fluid pressure to the cylinder the clutch will be engaged, and upon discharge of the fluid pressure from the cylinder, a compression spring therein causes the piston to move in a direction in which to cause disengagement of the clutch.

Immediately upon disengagement of clutch member 191 from clutch member 192, rotation of clutch member 191 and therewith of shaft 185 and the winding head driven thereby, is stopped by a brake 280. This brake consists of a brake member 281 loosely mounted upon a bushing 282 which surrounds shaft 185, and a ring member 283 which is keyed to the brake member at 284 and 285 and is provided with an arm 286 having a forked end 287 which receives the shank 288 of a bolt 289 secured to the table 50. Interposed between the forked end of arm 286 and the table 50 and surrounding the shank 288 of bolt 289 is a compression spring 290 which tends to maintain said forked end of arm 286 in engagement with the head 291 of bolt 289. Longitudinal movement of ring member 283 and therewith of brake member 281 relative to shaft 185 is prevented by a plate member 292 attached to table 50, which has a lug 293 projecting into a peripheral slot 294 of ring member 283. The front surface 295 of brake member 281 is provided with a sector-like recess 296 immediately followed by a sector-like projection 297 (see Fig. 15), and the rear surface 298 of clutch member 191 is provided with a projecting sector-like lug 299 which may be received by recess 296 of brake member 281. While clutch member 191 is in driving engagement with clutch member 192, the lug 299 of clutch member 191 clears projection 297 of brake member 281. Upon movement of clutch member 191 toward the left as viewed in Fig. 13, i. e. out of engagement with clutch member 192, lug 299 of clutch member 191 will first engage the front surface 295 of brake member 281 upon alignment with the recess 296 thereof will drop therein and drive brake member 281 and therewith ring member 283. Such rotation of the brake member and ring member is, however, yieldingly resisted by compression spring 290 which first yields until the ring member 283 and parts connected therewith come to rest, then expands and returns the ring member and parts connected therewith into a certain position which is determined by the reengagement of forked end 287 of arm 286 with the bolt head 291. If the sector-like recess 296 in brake member 281 into which during a braking operation the lug 299 of clutch member 191 projects, were omitted, then the expanding spring might return the ring member and parts connected therewith into a position which is past a desired position as can be readily understood. The reason for returning the winding head into a certain angular position after disengagement of the clutch will be more fully described later.

Coil retaining means B

Referring more particularly to Figs. 10 and 16 to 18 inclusive, each winding form 61 is provided with a pair of cooperating coil retaining fingers 120, which are pivotally mounted at 121 to brackets 122, located in recesses 123 of each winding form 61. Each of these coil retaining fingers 120 is provided with gear teeth 124 which are permanently in mesh with the gear teeth 125 of a bar 126 which is slidable longitudinally in winding form 61. A spring 127 surrounding bar 126 and being interposed between an annular shoulder 128 of the winding form 61 and the gear teeth 125 normally tends to move bar 126 toward the right as viewed in Fig. 16 thereby moving coil retaining fingers 120 from the dot and dash position into the full line coil retaining position. In order that the coil retaining fingers might not interfere with the winding of a coil, they project into corresponding recesses 129 of the drivingly engaging winding head (see Fig. 19) so that the surface 130 of each finger 120 is flush with the side wall 70 of the winding groove, formed by winding head 66. It is evident that upon withdrawal of a winding form from the winding head after a finished winding operation the coil is retained on the winding form by the fingers 120. In order to eject a coil from a winding form a shifter bar 131, secured to a shaft 132, rotatably supported on the turret, projects into an annular groove 133 of bar 126. As best shown in Fig. 9, each one of these shafts 132 carries also a lever 134, one of which during the indexing of the turret strikes a stationary bar 135, thereby rocking shaft 132 clockwise as viewed in Fig. 16 whereby bar 126 is shifted toward the left against the tendency of spring 127, and by the gear-connection 124 and 125 the coil retaining fingers 120 are rotated from the full line position into the dot and dash position disclosed in Fig. 16. It will further be noticed from Fig. 9 that such power movement of the coil retaining fingers 120 takes place in a position of the winding form where the coil will descend by gravity therefrom.

Wire feeding device C

Referring more particularly to Figs. 6, 24 to 26 inclusive 28 and 30 to 33 inclusive, a feeding block 140 is guided for vertical movement in guideways 141 provided by a bracket 142 which is mounted on a platform 223 overlying frame 51. Pivoted at 144 to the feeding block and located in a recess 145 thereof is cam like disc 146 having a nose 147 projecting into a notch 148 of a bar 149 slidable longitudinally in a recess 150 of the feeding block. This bar 149 is provided with two closely approximated beveled notches 151 and 152, either one of which may receive the beveled end of a spring urged plunger 153 located in a recess 154 of feeding block 140. As best shown in Fig. 31, the cam-like disc 146 clamps the supply wire 74 to a surface 155 of the feeding block when the beveled end of plunger 153 projects into the beveled notch 151. When the beveled end of plunger 153 projects into the beveled notch 152, the cam-like disc 146 is clearly out of engagement with the supply wire 74 and the same may freely pass the block surface 155. The feeder is adapted to move the end of supply wire 74 into the position shown in full lines in Fig. 18 ready to be anchored between the winding head and an approaching winding form. In order to move feeding block 140 upwardly or downwardly, the feeding block is provided with a rack 156 (see Fig. 6) which meshes with a gear 157 mounted on a shaft 158 supported by bracket 142 and carrying another gear 159 which meshes with a rack 160 whose shank 165 is slidable through a guide bracket 161 and whose lower end is provided with a piston 162 (see Fig. 13) received by a cylinder 163 secured to the table 50 in any suitable manner. A roller 150*a*, carried by bracket 142, engages rack 160 and maintains the same in mesh with gear 159. Fluid pressure is admitted by means to be described later to the lower surface of piston 162 in order to move the rack 160 upwardly whereby due to the gears 159 and 157 the feeder block 140 is moved downwardly; feeding block 140 is yieldingly urged upwardly by a compression spring 164 surrounding the shank 165 of rack 160 and being interposed between guide bracket 161 and a collar 165*a* on shank 165, which spring urges rack 160 downwardly. Referring more particularly to Fig. 30 there is shown a beveled surface 166 provided by bracket 142 which in an uppermost position of the feeding block retains spring urged plunger 153 in the position shown in Fig. 30 by means of a pin 167, carried by the plunger and engaging the camming surface 166. Upon movement of the feeding block from the position shown in Figs. 25 and 26, into that shown in Fig. 30, an adjustable screw 168 threaded into a lug 169 of bracket 142 stops bar 149 slightly before the feeding block reaches its uppermost position which is determined by the piston stroke. The slight relative movement between feeding block 140 and bar 149 places the latter into a position in which notch 151 may receive spring urged plunger 153, however, plunger 153 is prevented from completely entering notch 151 by the camming surface 166 and the cooperating pin 167. Upon movement of the feeding block downwardly pin 167 rides down the camming surface 166 whereupon the plunger by its spring tension compels notch 151 of bar 149 to shift into alignment with the beveled end of the plunger so that the same may completely enter said beveled notch 151 in which case the disc 146 clamps the wire 74 to the block surface 155. Bar 149 while being shifted by the plunger from the position shown in Fig. 30 to that shown in Fig. 31 rotates cam-like disc 146 into the position shown in Fig. 31. Therefore, immediately upon downward travel of the feeding block, the supply wire is automatically gripped and caused to follow the feeding block, until bar 149 is stopped prior to the downwardly moving feeding block by the projecting base of bracket 142 (see Fig. 10). The thus resulting relative movement between bar 149 and feeding block 140 causes notch 152 of bar 149 to align with and be entered by plunger 153 in which position of the bar 149 the wire clamping disc 146 is out of engagement with the supply wire 74. To make up for different diameters of wire used and for slight wear of wire clamping disc 146, the latter clamps wire 74 to the hardened end 171 of a screw 172 threaded into the feeding block and locked in properly adjusted position by a nut 173. In order to prevent premature shifting of the bar 149 from the position shown in Fig. 30 to the position shown in Fig. 31 by its own momentum or gravity, a spring urged plunger 174 of any suitable braking material is located in a recess 175 of the feeding block and permanently frictionally engages bar 149. The various recesses in the feeding block containing various described means

are covered by a cover plate 176 which is secured to the feeding block in any suitable manner.

Wire shifting means D

Referring more particularly to Figs. 10 to 13 inclusive, shaft 185 is provided with a worm 210, meshing with a worm gear 211 mounted on a shaft 212 which is rotatably supported in bearings provided by a casing 213 which is secured to frame 51 in any suitable manner and closed by a cover 213*a*. Endwise movement of worm gear 211 and therewith of shaft 212 is prevented by opposite bosses 214 and 215 of casing 213 between which said worm gear is located. Attached to one end of shaft 212 outside of casing 213 is a disc 216 which carries a pin 217, eccentrically located with respect to the shaft 212. This eccentric pin 217 is received by a vertical slot 218, provided by an angle 219, attached by screws 220 to a horizontally slidable bar 221 which is slidably supported in a rectangular groove 222 provided by frame 51, and retained in said groove by the overlying platform 223. Bar 221 is provided with an oblong slot 224 which is inclined with respect to the direction of movement of bar 221. Guided for movement transverse to the direction of movement of bar 221 in a rectangular groove 222*a* of platform 223 is another bar 226 which carries a pin 227, the end of which is received by slot 224 of bar 221. Secured in any suitable manner to bar 226 is a stub shaft 228 on which a grooved wire wheel 229 is loosely mounted. Also loosely mounted to said stub shaft 228 is a sleeve 230 having a depending arm 231 whose lower end terminates into a wire shifter in form of a fork which receives the wire and shifts the same in a direction parallel to the axis of the rotation of the winding head upon oscillation of bars 226 and 221. Sleeve 230 and wire guide wheel 229 are prevented from longitudinal movement relative to the stub shaft 228 by a washer 232 and a screw 233 which maintain the sleeve in engagement with wheel 229 and the latter in engagement with the end surface 234 of bar 226. It follows from the preceding that upon engagement of the clutch member 191 and 192 the wire shifter arm 231 is oscillated through intermediation of shaft 185, worm 210, worm gear 211, shaft 212, eccentric pin 217, angle 219, bar 221, inclined slot 224 and cooperating pin 227 and bar 226.

In order to move the wire shifter out of engagement with the severed end of the wound coil which is carried by a retracting winding from 61, the sleeve 230 has clamped thereto a bracket 235 whose upper forked end receives a horizontally slidable bar 236 which by a spring 237 (see Fig. 1) is connected to an arm 238 secured by screws 239 to a bar 240 which is slidable horizontally in frame 51 as best shown in Fig. 29. Bar 240 is attached in any suitable manner to a piston rod 241 provided with a piston 242 which is received by a cylinder 243 attached in any suitable manner to frame 51. Bar 240 is normally urged toward the left as viewed in Fig. 29 by a compression spring 244 interposed between piston 242 and frame 51 and surrounding piston rod 241, whereby the wire shifter arm 231 is normally urged into engagement with the supply wire. At the proper time fluid pressure is admitted to the left hand side of cylinder 243 whereby piston 242, piston rod 241, bar 240 and arm 238 are urged toward the right as viewed in Fig. 29 whereby spring 237 rocks the wire shifter out of engagement with the supply wire.

Coil severing device E

Referring more particularly to Figs. 20 to 23, a coil severing device 250 is carried on the underside of the platform 223. This severing device consists of a stationary shear plate 251 and a cooperating rotatable shear disc 252, the stationary shear plate 251 being secured in any suitable manner to the platform 223 and the cooperating shear disc being rotatable about a bolt 253 which is secured to the stationary shear plate 251. In order to rotate shear disc 252 into cooperation with the shear plate, an arm 255 is clamped to a conical portion 256 of the shear member 252 by a nut 257 which is threaded over the hub 258 of shear disc 252. Bolt 253 is provided with a slotted head 259, one of these slots receiving the extending end of a torsion spring 260 the other end of which is projecting into a slot of nut 257, whereby this torsion spring normally returns the said shear member from the position shown in Fig. 21 to that shown in Fig. 20. Bar 240 provides an extension 261 which carries a spring urged plunger 262 having a beveled end surface 263. This spring urged plunger upon movement of bar 240 toward the right as viewed in Fig. 20 engages with its surface 264 the arm 255 and rotates shear disc 252 from the position in Fig. 20 to that shown in Fig. 21 in order to sever the end of a coil from the supply wire. Upon movement of bar 240 toward the left as viewed in Fig. 20 the beveled end surface 263 of plunger 262 engages a correspondingly beveled surface of arm 255 and due to the fact that shear disc 252 is prevented from further counter-clockwise rotation by a stop pin 255*a*, plunger 262 rides over arm 255 into position for the next severing operation. As will be noticed from Fig. 20, the wire to be severed is located adjacent the surface 265 of the stationary shear member 251 prior to the severing operation, and in such position the wire adjoins the winding groove wall 70 provided by the winding head 66; therefore, at the end of a winding operation the wire shifter 231 is in the right end position as viewed in Fig. 11. Upon rotation of the shear disc 252 in clockwise direction as viewed in Figs. 20 and 21 the wire 74 is moved from the position in Fig. 20 between the stationary cutting edge 266 of shear plate 251 and the cutting edge 267 of shear disc 252 whereupon the severing operation occurs. It is evident that immediately after the spring urged plunger 262 during its movement toward the right as viewed in Fig. 20 moves out of engagement with arm 255, the latter together with the shear disc 252 is returned from operating position into inoperative position shown in full lines in Fig. 20 by means of torsion spring 260.

Wire back-up preventing means F

As best shown in Figs. 24 to 28 inclusive, and Fig. 30, a U-shaped bar 270 is secured in any suitable manner to a flat-spring member 271 which in turn is attached to the lug 169 of bracket 142. The supply wire 74 normally passes both legs of said U-shaped bar 270. In order to prevent backing up or recoiling of the supply wire between winding operations and more particularly at any time while the end of the supply wire is not anchored between the winding head and a cooperating winding form, a bar 271*a* which is properly guided for horizontal movement in front of bracket 142 and carries a depending finger 272

which upon movement toward the right from the position shown in Fig. 27 to the dot and dash position shown in Fig. 30 bends the supply wire within the U-shaped bar 270. Upon movement of the bar 271*a* toward the left as viewed in Fig. 25, the wire will straighten out at the start of a new winding operation. The movement of bar 271*a* in either direction results from a driving connection between said bar and the arm 238, which driving connection consists of a tension spring 273 one end of which is connected to the arm 238 and the other end to a projecting finger 274 of bar 271*a*, and said spring urging bar 271*a* into engagement with arm 238 at all times.

Wire tensioning device G

With particular reference to Figs. 34 and 35 the wire 74 is fed from a supply spool (not shown) through a funnel 480 and between wire pre-tensioning rolls 481, supported by a plate 482, over a wheel 483 and from there over another wheel 484 (see Figs. 24 to 26 inclusive) to the wire feeder. Plate 482 is mounted on and wheel 483 is rotatably supported by a bracket 485 which is secured in any suitable manner to frame 51, whereas wheel 484 is rotatably mounted on an arm 486, secured to frame 51 in any suitable manner. Wheel 483 is provided with a cylindrical portion 487 which is surrounded by a metal band 488, one end of which is secured by an angle 489 between lugs 490 which are attached to a plate 491, secured in any suitable manner to bracket 485, and the other end is pivotally mounted on the clevis 492 of a rod 493 which passes through both lugs 490 and the angle 489, and is normally urged in the direction of arrow 494 by a compression spring 495 which surrounds rod 493 and is interposed between one of the lugs 490 and nuts 496 which are threaded over the end of rod 493. Spring 495 therefore has a tendency to urge band 488 into braking engagement with the cylindrical portion 487 of wheel 483 and brake the same, the initial compression of spring 495 having been so selected that during a winding operation, spring 495 sufficiently brakes wheel 483 so that the wire 74 between said wheel and the winding form is properly yet safely tensioned so that the same will not break. A link 497 connects the clevis 492 with a longitudinally adjustable bar 498 whose other end is pivotally connected to a crank 499 which is firmly mounted on a horizontal shaft 300 rotatably mounted in bearings provided by bracket 485. Attached to the opposite end of shaft 300 is a lever 301 which is in constant engagement with an adjustable screw 302 carried by a rod 303 which, by links 304, is movably mounted on a lug 305 of bracket 485. One end of rod 303 carries an anti-friction roller 306 adapted to cooperate with a cam 307 mounted on a stub shaft 308 which, as shown in Figs. 3 and 8, carries a worm gear 309 which meshes with a worm 310 mounted on shaft 212 (see Fig. 12). The ratio between worm gear 309 and worm 310 is such that upon a predetermined number of revolutions of shaft 212 (i. e. during power rotation of the winding head), shaft 308 makes one complete revolution and during the greater part of such revolution, cam 307 does not interfere with the tendency of spring 495 to brake wheel 483, however, at the end of a winding operation the lobe 311 of cam 307, approaches roller 306 and moves rod 303 toward the left, thereby rocking shaft 300 clockwise and moving bar 498 in the direction of arrow 312 as viewed in Figs. 34, whereby rod 493 is moved also in the direction of arrow 312 and the band 488 is moved out of braking engagement with the wheel 483 as can be readily understood. Upon renewed rotation of the winding head at the beginning of a new winding operation, cam 307 rotates again and cam lobe 311 thereof moves away from cam roller 306, whereupon spring 495 again urges band 488 into braking engaging with wheel 483 during the winding operation. It is therefore evident, that between winding operations wheel 483 is free to rotate; this is very desirable because the feeding of the supply wire into anchoring position takes place between winding operations and it is impracticable to tension the wire during such feeding, as usually and also here the wire is yieldingly carried by a feeder. A recoiling of the wire from anchoring position after the same is released from the feeder and prior to the anchoring thereof is impossible due to the provision of the already explained wire back-up preventing means.

Various controls for the operation of various means and devices of the machine

Referring particularly to Figs. 3 and 36 to 38 inclusive, the controller for the wire feeder comprises a valve body 320, a valve 321 therein, a block 322, and a latch 323 pivotally mounted at 324 on block 322. Valve body 320 and block 322 are mounted on frame 51. Valve 321 is normally urged into the position shown in Figs. 37 or 38 by a compression spring 325, located in recesses 326 and 327 of block 322 and valve 321 respectively. Valve 321 is arrested in the position shown in Fig. 36 by latch 323 whose nose 328 engages a shoulder 329 of said valve. Latch 323 is normally urged into latching position shown in Fig. 36 by a spring 330. Valve 321 is urged into latching position by carriage 53 during movement in a direction to separate a winding form from the winding head, and during such position of valve 321 fluid pressure from any suitable source (not shown) is admitted to one side of cylinder 163 through conduit 331, valve chamber 334, bore 333, valve chamber 332 and conduit 335 whereupon piston 162 therein, and rack 160 is moved against the tendency of spring 164 in a direction to move feeding block 140 downwardly toward the winding head. Upon rocking of latch 323 out of latching position by a hand lever 336 which is pivoted at 337 to frame 51, valve 321 will be shifted from the position shown in Fig. 36 to that shown in Fig. 38 whereby communication between conduit 335 and conduit 331 which is in constant communication with the fluid pressure supply is intercepted by valve 321 and the fluid pressure in cylinder 163 is then in communication with the atmosphere through conduit 335 valve chamber 332, bore 333 and valve chamber 339 which by a duct 340 communicates with the atmosphere. In the position of valve 321 shown in Fig. 38 spring 164 is free to expand and move piston 162 and rack 160 downwardly whereby the feeding block 140 is moved upwardly into the position shown in Fig. 30.

Referring particularly to Figs. 3 and 36 to 38 inclusive, the controller for the admission of fluid to the clutch actuating cylinder 208 comprises a valve body 350 having chambers 351, 352 and 353 which are in communication with each other by the bore 354 which receives a valve 355. Valve 355 is normally urged in the direction of arrow 356 by a compression spring 357 surrounding valve rod 358 and being interposed between the forked end 359 of hand lever 336 and a collar

360 which is attached to valve rod 358. Pivotally mounted at 361 to the frame 51 is a lever 362 which rests against the end surface of valve rod 358 and projects between winding operations into a depression 363 of a generally annular cam 364 which is mounted on shaft 308 (see Fig. 3). In the position of valve 355 shown in Fig. 36 conduit 365 which is in permanent communication with the fluid pressure supply is intercepted from communication with conduit 366 which leads to the cylinder 208, so that piston 367 is urged into the position shown in Fig. 36 by a compression spring 368 which surrounds piston rod 207 and is interposed between the left end of cylinder 208 and piston 367. Movement of piston 367 and piston rod 207 into the position shown in Fig. 36 causes disengagement of the clutch members 191, 192 as has been previously explained. One arm 336*a* of hand lever 336 is much longer than the other arm 336*b* which engages valve 355, this hand lever therefore, acts upon said valve with a counter clockwise movement of rotation at all times which when unresisted overcomes the weight of valve 355 and normally urges valve 355 in the direction of arrow 356 which in turn urges lever 362 into engagement with cam disc 364. Upon rocking of lever 336 from the position shown in Fig. 36 to that shown in Fig. 38 the forked end 359 of said lever through intermediation of compression spring 357 moves valve 355 from the position shown in Fig. 36 to that shown in Fig. 38 whereby conduit 365 is in communication with conduit 366 whereupon the fluid pressure admitted to the cylinder 208 urges piston 367 and piston rod 207 against the tendency of spring 368 whereby the clutch members 191, 192 will be engaged. As previously explained shaft 308 makes one complete revolution during the actual winding of a coil, so at the end of one complete revolution of cam disc 364 lever 362 will be urged into the cam depression 363 and valve 355 will shift from the position shown in Fig. 38 to that shown in Fig. 36, in which latter position of the valve the clutch will be disengaged.

Referring particularly to Figs. 1, 4 and 36 to 38 inclusive, the controller for the admission of fluid pressure to cylinder 243 comprises a valve body 370 having chambers 371, 372 and 373 which are in communication with each other by a bore 374 receiving a sliding valve 375. Valve body 370 is attached by screws 376 to frame 51. Valve 375 is normally urged in the direction of arrow 377 by a spring 378, surrounding valve rod 379 and being interposed between valve 375 and a lug 380 integral with valve body 370 as best shown in Fig. 4. Upon manual rotation of shaft 89 in a direction to retract the carriage from the winding head and prior to the retraction of the carriage, a cam portion 381 of gear segment 100 carried by shaft 89 rocks a bell crank lever 382, pivoted at 383 to frame 51, from the position shown in Figs. 37 and 38 to that shown in Fig. 36 whereby valve 375 is depressed against the tendency of springs 378. Immediately upon the return of the carriage into the position shown in Fig. 4 and while shaft 89 is still rotated in counter-clockwise direction as viewed in Fig. 36, the cam portion 381 of gear segment 100 is returned into the position shown in Figs. 37 and 38 whereupon valve 375 under the tendency of spring 378 is returned from the position shown in Fig. 36 to that shown in Figs. 37 or 38. In the position of valve 375 shown in Fig. 36, fluid pressure is admitted to cylinder 243 through conduit 384 which is in permanent communication with the fluid pressure supply, valve chamber 373, bore 374, valve chamber 372, and conduit 385, whereby piston 242 and piston rod 241 is moved toward the right as viewed in Figs. 29 and 36 against the tendency of spring 244. During such movement of piston 242 and piston rod 241 shear disc 252 is actuated, the wire shifter is moved out of engagement with the supply wire and the wire backup preventing means is actuated. In the position of valve 375 shown in Figs. 37 or 38 the fluid pressure in cylinder 243 is free to escape to the atmosphere and spring 244 expands, thereby moving piston 242 and piston rod 241 toward the left as viewed in Fig. 37 whereby the fluid pressure in cylinder 243 escapes through conduit 385, chamber 372, bore 374, chamber 371, and a duct 386 to the atmosphere. During movement of the piston and piston rod caused by the expanding spring 244, the wire guide is returned into engagement with the supply wire and the wire back-up preventing means is rendered ineffective.

Sequence of operations

Having described detailedly the construction of the winding machine, there will now be described the proper sequence of operations performed by the entire machine and an operator. Assuming a new winding form has been brought into cooperative engagement with the winding head, the operator then will rock hand lever 336 clockwise as viewed in Figs. 3, 36 and 37 into the position shown in Fig. 38, whereby, as previously explained the clutch is caused to engage and simultaneously therewith the feeder block 140 is moved into uppermost position without gripping the supply wire which is now unreeled from the supply spool by the winding head and the cooperating winding form. During engagement of the clutch members 191, 192 the head together with a winding form rotate, the wire shifter reciprocates at a prearranged speed and the wire tensioning device G is effective until at the end of one complete revolution of shaft 308, lever 362 is urged into the depression 363 of cam disc 364 whereupon the clutch members are disengaged and the driven clutch member is automatically braked and returned into a predetermined angular position whereby the winding head and cooperating winding form is returned into a predetermined angular position relative to the wire severing means E. Due to the already explained fact that the wire shifter reciprocates in response to rotation of the winding head, the former is returned also into a certain end position in which the supply wire is shifted into cooperative engagement with the wire severing means E ready to be severed thereby. After one complete revolution of shaft 308 the lobe 311 of cam 307 also returns into a position in which the wire tensioning device is rendered ineffective thereby. Next the operator will rock lever 103 in a direction to retract carriage 53 from the winding head. However, before the gear segments 99 and 100 actually mesh with carriage racks 101 and 102 respectively, cam portion 381 of gear segment 100 first rocks bell crank lever 382 from the position shown in Fig. 37 or 38 to that shown in Fig. 36 thereby shifting valve 375 into the position of Fig. 36, whereby bar 240 (see Fig. 29) is moved toward the right thereby causing the coil severing means E to sever, the wire shifter to move out of engagement with the supply wire and the wire back-up means F to become effective. During such rotation of the gear

segments prior to their actual meshing with the carriage racks, the cam slot 107 of disc 108 on shaft 89 moves locking lever 104 out of engagement with locking surface 109. Note that during a winding operation the feeder block 140 is in uppermost position and that the actuating piston 162 is then in lowermost position. The retracting carriage 53 during its latter part of movement engages and shifts valve 321 from the position shown in Fig. 38 to that shown in Fig. 37 whereby the wire feeding block 140 is moved from uppermost to lowermost position, during which movement of the feeder block the wire is fed into the position shown in full lines in Fig. 18. While the carriage is in most retracted position the operator indexes the turret 56, whereby one of the levers 134 strikes the stationary bar 135 thereby moving a pair of coil retaining fingers 120 from the full line position to the dot-and-dash position shown in Fig. 16, thus allowing a previously wound coil to slide by gravity from the spikes 72 of a winding form 61 shortly before arriving at station I (see Fig. 10). After the indexing of the turret 56 the carriage is moved into the position shown in Fig. 3 or 4 and immediately after the carriage reaches that position and while the gear segments move out of mesh with the carriage racks, cam portion 381 returns into the position shown in Fig. 37 or 38 whereby valve 375 under the compression of spring 378 moves into the position shown in Fig. 37 or 38 thereby permitting bar 240 to move in such direction that the wire shifter is returned into wire engaging position and the wire back-up preventing means is rendered ineffective. Simultaneously with the last two mentioned operations cam slot 107 of disc 108 on shaft 89 returns locking lever 104 into carriage locking position. During the last stage of approaching movement of a winding form toward the winding head, the fed end of the supply wire 74 is anchored in the manner disclosed in Fig. 18. The machine is now ready for a new winding operation and upon rocking by the operator of hand lever 336 in the described manner, a new winding operation takes place. The operator during the winding of a coil will inspect the previously wound coil while at station II (see Fig. 10).

In Fig. 39 a chart illustrates the timed relationship between the manual and automatic operations, performed by the machine. It appears from the preceding description that prior to the actual winding of the coil the carriage has to be retracted, the turret has to be indexed and the carriage returned into position for winding by an operator. Movement of the carriage in either direction is affected by manual rotation of shaft 89. Rotation of shaft 89 in one direction as represented by the line *a' b'* results in a retracting movement of the carriage, such movement being represented by the line *p' q'*. While the carriage is in retracted position the turret is indexed as represented by a line *x' y'*. Thereafter shaft 89 is rotated in the opposite direction as represented by line *c' d'*, which results in a returning movement of the carriage into coil winding position as represented by line *r' s'*. Immediately after shaft 89 is rotated in said one direction and before the carriage starts to retract, shear disc 252 is automatically rotated into coil severing position, such rotation of the shear disc being represented by a line *e' f'*, whereas rotation of the shear disc into operative position is represented by line *f' g'*. Simultaneously with the rotation of the shear disc 252 into coil severing position, the wire shifter 231 is automatically moved out of engagement with the supply wire, such movement being represented by the line *h' i'*. The wire shifter is held out of engagement with the supply wire until after the carriage has been returned into the coil winding position and is then returned into engagement with the supply wire during the last stage of rotation of shaft 89 in said opposite direction. Movement of the wire shifter into wire engaging position is represented by line *j' k'*. Simultaneously with the movement of the wire shifter out of engagement with the supply wire, the wire bending finger 272 moves into wire bending position, such movement being represented by the line *l' m'*, and this finger 272 is held in wire bending position until after the carriage has been returned into coil winding position whereupon in response to continued rotation of shaft 89 in said opposite direction wire bending finger 272 is moved out of bending position, such movement of the finger 272 being represented by a line *n' o'*. During the latter part of retracting movement of the carriage feeder block 140 is moved downwardly, such movement of the feeding block being represented by the line *t' u'*. During practically the entire downward movement of the feeding block the wire is gripped thereto, such gripping being represented by a line *v' w'*. During rotation of shaft 89 in said one direction and before the carriage actually starts to retract, the carriage locking lever 104 is moved from locking position into unlocking position, such movement of the locking lever being represented by line *a'' b''*, and locking lever is returned into locking position immediately after the carriage has been returned into coil winding position and while shaft 89 is still rotating in said opposite direction. Movement of locking lever 104 into locking position is represented by line *c'' d''*. After the operator has performed his operations and after the mentioned responsive operations took place, he will start the machine by rocking hand lever 336, whereby the clutch members 191, 192 are engaged and remain engaged during 360° rotation of clutch control cam 364. Line *ab* represents the time during which the clutch members are engaged. While the clutch members are engaged the winding head rotates and the wire shifter reciprocates a predetermined number of times. The time during which the winding head rotates and the wire shifter reciprocates is represented by lines *cd* and *ef*, respectively. Simultaneously with the engagement between clutch members 191, 192 the wire feeding block 140 is moved into uppermost position, such movement being represented by a line *gh*.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; and means for indexing the turret so as to align consecutive form members with the head member.

2. In a coil winding machine, the combination of a rotatable head member; a rotatable turret;

a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutively form members with the head member; and means for driving cooperating members.

3. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving one of the cooperating members.

4. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving the head member.

5. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separation and cooperation between aligned members; and means for indexing the turret so as to align consecutive form members with the head member.

6. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separation and cooperating between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means for driving cooperating members.

7. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separating and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving one of the cooperating members.

8. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving the head member.

9. In a coil winding machine, the combination of a rotatable head member; a turret rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means for driving cooperating members.

10. In a coil winding machine, the combination of a rotatable head member; a turret rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving one of the cooperating members.

11. In a coil winding machine, the combination of a rotatable head member; a turret rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving the head member.

12. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction parallel to the axis of rotation of the latter so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means for driving cooperating members.

13. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction parallel to the axis of rotation of the latter so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between co-

operating members; and means for driving one of the cooperating members.

14. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret; means for causing relative bodily movement between the turret and head member in a direction parallel to the axis of rotation of the latter so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving the head member.

15. In a coil winding machine, the combination of a rotatable head member; a turret rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means for driving cooperating members.

16. In a coil winding machine, the combination of a rotatable head member; a turret rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; and means for driving one of the cooperating members.

17. In a coil winding machine, the combination of a rotatable head member; a turret rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret; means for causing relative bodily movement between the turret and head member in a direction transverse to the axis of rotation of the turret so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member, a driving connection between cooperating members; and means for driving the head member.

18. In a coil winding machine, the combination of a head member; a rotatable and bodily movable turret; a plurality of form members mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; and means for indexing the turret so as to align consecutive form members with the head member.

19. In a coil winding machine, the combination of a rotatable head member; a rotatable and bodily movable turret; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; and means for driving engaged members.

20. In a coil winding machine, the combination of a rotatable head member; a rotatable and bodily movable turret; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving one of the engaged members.

21. In a coil winding machine, the combination of a rotatable head member; a rotatable and bodily movable turret; a plurality of form members rotatably mounted on said turret; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving the head member.

22. In a coil winding machine, the combination of a head member, a turret linearly movable and rotatable about an axis transverse to its direction of movement; a plurality of form members mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; and means for indexing the turret so as to align consecutive form members with the head member.

23. In a coil winding machine, the combination of a rotatable head member; a turret linearly movable and rotatable about an axis transverse to its direction of movement; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; and means for driving engaged members.

24. In a coil winding machine, the combination of a rotatable head member; a turret linearly movable and rotatable about an axis transverse to its direction of movement; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving one of the engaged members.

25. In a coil winding machine, the combination of a rotatable head member; a turret linearly movable and rotatable about an axis transverse to its direction of movement; a plurality of form members rotatably mounted on said turret; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form member with the head member; a driving connection between engaged members; and means for driving the head member.

26. In a coil winding machine, the combination of a rotatable head member; a turret bodily

movable and rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form member with the head member; and means for driving engaged members.

27. In a coil winding machine, the combination of a rotatable head member; a turret bodily movable and rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving one of the engaged members.

28. In a coil winding machine, the combination of a rotatable head member; a turret bodily movable and rotatable about an axis transverse to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving the head member.

29. In a coil winding machine, the combination of a rotatable head member; a turret rotatable and bodily movable in a direction parallel to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; and means for driving engaged members.

30. In a coil winding machine, the combination of a rotatable head member; a turret rotatable and bodily movable in a direction parallel to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving one of the engaged members.

31. In a coil winding machine, the combination of a rotatable head member; a turret rotatable and bodily movable in a direction parallel to the axis of rotation of the head member; a plurality of form members rotatably mounted on said turret; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving the head member.

32. In a coil winding machine the combination of a rotatable head member; a turret bodily movable in a direction parallel to the axis of rotation of the head member and rotatable about an axis transverse to the axis of rotation of said head member; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; and means for driving engaged members.

33. In a coil winding machine, the combination of a rotatable head member; a turret bodily movable in a direction parallel to the axis of rotation of the head member and rotatable about an axis transverse to the axis of rotation of said head member; a plurality of form members rotatably mounted on said turret, the head member together with an engaging form member defining a winding form; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving one of the engaged members.

34. In a coil winding machine, the combination of a rotatable head member; a turret bodily movable in a direction parallel to the axis of rotation of the head member and rotatable about an axis transverse to the axis of rotation of said head member; a plurality of form members rotatably mounted on the turret; means for moving the turret to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between engaged members; and means for driving the head member.

35. In a coil winding machine, the combination of a head member; a support; a turret rotatably mounted on the support; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative movement between the support and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means carried by the support for yieldingly arresting the turret against rotation in intermittent resting positions.

36. In a coil winding machine, the combination of a head member; a support; a turret rotatably mounted on the support and having a plurality of angularly spaced depressions; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative movement between the support and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and a spring urged plunger carried by the support and adapted to register with one of the depressions of the turret when a form member is in alignment with the head member thereby yieldingly arresting the turret against rotation.

37. In a coil winding machine, the combination of a head member; a support; a turret rotatably mounted on the support and having an end surface rectangular to the axis of rotation of the turret and a plurality of angularly spaced radial grooves in said end surface; a plurality of form

members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative movement between the support and head member to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and a spring urged plunger carried by the support and extending parallel to the axis of rotation of the turret, said plunger being adapted to register with one of the grooves when a form member is in alignment with the head member thereby yieldingly arresting the turret against rotation.

38. In a coil winding machine, the combination of a head member; a carriage; a turret rotatably mounted on the carriage; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the carriage to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; and means for locking the carriage in a position in which a form member cooperates with the head member.

39. In a coil winding machine, the combination of a rotatable head member; a carriage; a turret rotatably mounted on the carriage; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the carriage to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; means for locking the carriage in a position in which a form member cooperates with the head member; and means for driving cooperating members.

40. In a coil winding machine, the combination of a head member; a carriage; a turret rotatably mounted on the carriage; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the carriage to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; means for locking the carriage in the position in which a form member is cooperating with the head member; and means operable in order successively to move the carriage in one direction in which an aligned form member approaches the head member and to actuate the locking means, and also operable in order successively to cause the locking means to release the carriage and to move the latter in the opposite direction.

41. In a coil winding machine, the combination of a rotatable head member; a carriage; a turret rotatably mounted on the carriage; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the carriage to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; means for locking the carriage in the position in which a form member is cooperating with the head member; means operable in order successively to move the carriage in one direction in which an aligned form member approaches the head member and to actuate the locking means, and also operable in order successively to cause the locking means to release the carriage and to move the latter in the opposite direction; and means for driving cooperating members.

42. In a coil winding machine, the combination of a guide bracket having a shoulder; a carriage supported and guided for movement by said bracket; a rack carried by the carriage; a rotatable shaft carrying a cog-wheel which cooperates with the rack and is adapted to cause movement of the carriage upon rotation of the shaft through a predetermined cycle; a lever pivotally mounted on the bracket; and a cam on the shaft for rotating the lever into engagement with the shoulder upon continued rotation of the shaft beyond said predetermined cycle thereby preventing reverse movement of the carriage.

43. In a coil winding machine, the combination of a guide bracket having a shoulder; a carriage supported and guided for movement by said bracket; a rack carried by the carriage; a rotatable shaft carrying a cog-wheel which cooperates with the rack and is adapted to cause movement of the carriage upon rotation of the shaft through a predetermined cycle; a lever pivotally mounted on the bracket; and a cam on the shaft adapted to rotate the lever into engagement with the shoulder upon continued rotation of the shaft after the teeth of the cog-wheel demeshed from the rack thereby preventing reverse movement of the carriage, and adapted to withdraw the lever from said shoulder upon reverse rotation of the shaft and before the teeth of the cog-wheel re-mesh with the rack whereupon the carriage is free to move in said reverse direction.

44. In a coil winding machine, the combination of a guide bracket having a shoulder; a carriage supported and guided for movement by said bracket; a rack carried by the carriage; a rotatable shaft carrying a cog-wheel which cooperates with the rack and is adapted to cause movement of the carriage upon rotation of the shaft through a predetermined cycle; a lever pivotally mounted on the bracket and having a projecting pin; and a cam on the shaft for actuating the locking lever, said cam having a cam slot receiving the pin of the lever and rotating the latter into engagement with the shoulder upon continued rotation of the shaft after the teeth of the cog-wheel demeshed from the rack thereby preventing reverse movement of the carriage, and withdrawing the lever from said shoulder upon reverse rotation of the shaft and before the teeth of the cog-wheel re-mesh with the rack whereupon the carriage is free to move in said reverse direction.

45. In a coil winding machine, the combination of a head member, a carriage; a turret rotatably mounted on the carriage; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the carriage to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; means yieldingly arresting the turret against rotation in intermittent resting positions; and means for locking the carriage in a position in which a form member cooperates with the head member.

46. In a coil winding machine, the combination of a rotatable head member; a carriage; a turret rotatably mounted on the carriage; a plu-

rality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the carriage to engage and withdraw a form member from the head member; means for indexing the turret so as to align consecutive form members with the head member; means yieldingly arresting the turret against rotation in intermittent resting positions; means for locking the carriage in a position in which a form member cooperates with the head member; and means for driving cooperating members.

47. In a coil winding machine, the combination of a rotatable head member; a rotatable and reciprocable form member, the head member together with the engaging form member defining a winding form; means for rotating the engaged members; a reciprocable wire shifter; and means operable to sever a wound coil from a supply wire, said means being so located that during each reciprocation of the wire shifter the wire moves into operative engagement with the severing means.

48. In a coil winding machine, the combination of a rotatable head member; a rotatable and bodily movable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the turret in order to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; means for driving cooperating members; a reciprocable wire shifter; and means operable to sever a wound coil from a supply wire, said means being so located that during each reciprocation of the wire shifter the wire moves into operative engagement with the severing means.

49. In a coil winding machine, the combination of a rotary winding form; a reciprocable wire shifter; and means operable to sever a wound coil from a supply wire, said means comprising a stationary and a cooperating rotatable shear disc, said shear discs being so located with respect to the wire shifter that during each reciprocation of the latter the wire moves into operative engagement with the shear discs.

50. In a coil winding machine, the combination of a rotary winding form; a reciprocable wire shifter; means operable to sever a wound coil from a supply wire, said means comprising a stationary and a cooperating rotatable shear disc, said shear discs being so located with respect to the wire shifter that during each reciprocation of the latter the wire moves into operative engagement with the shear discs; means for rotating the rotatable shear disc into cooperation with the stationary shear disc for a severing operation; and yielding means urging the rotatable shear disc out of cooperation with the stationary shear disc.

51. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turrent, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and the head member in order to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means for anchoring the end of a supply wire to one of the cooperating members upon relative movement between the turret and the head member in a direction to cause cooperating between both members.

52. In a coil winding machine, the combination of a head member; a rotatable and bodily movable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the turret in order to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; and means for anchoring the end of a supply wire to one of the cooperating members upon movement of an aligned form member into cooperation with the head member.

53. In a coil winding machine, the combination of a head member; a reciprocable form member; means for moving the form member into and out of engagement with the head member, the latter together with the engaging form member defining a winding form; and means provided by both members and cooperating upon movement of the form member into engagement with the head member for anchoring the end of a supply wire to one of the members.

54. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means provided by all members and cooperating upon relative movement between aligned members into cooperation with each other for anchoring the end of a supply wire to one of the cooperating members.

55. In a coil winding machine, the combination of a head member; a rotatable and bodily movable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for moving the turret in order to approach and withdraw a form member from cooperation with the head member; means for indexing the turret so as to align consecutive form members with the head member; and means provided by all members and cooperating upon movement of an aligned form member into cooperation with the head member for anchoring the end of a supply wire to one of the cooperating members.

56. In a coil winding machine, the combination of a form member having a projecting boss; a head member having a recess adapted to receive the projecting boss of the form member; means for causing relative approaching and withdrawing movement between both members, the head member together with the engaged form member defining a winding form, and said projecting boss of the form member clamping the end of a supply wire against the bottom of the recess of the head member upon relative approaching movement between the members thus anchoring the supply wire to the head member.

57. In a coil winding machine, the combination of a reciprocable form member having a projecting boss; a head member having a recess adapted to receive the projecting boss of the form member, the head member together with the engaging

form member defining a winding form; and means for moving the form member into and out of engagement with the head member, said projecting boss of the form member clamping the end of a supply wire against the bottom of the recess of the head member upon movement of the form member into engagement with the head member, thus anchoring the supply wire to the head member.

58. In a coil winding machine, the combination of a head member; a form member, the head member together with the engaged form member defining a winding form; means for causing relative approaching and withdrawing movement between both members; means for anchoring the end of a supply wire to one of the members upon relative approaching movement between both members; and means for feeding the supply wire into position to be anchored by the anchoring means.

59. In a coil winding machine, the combination of a head member; a reciprocable form member, the head member together with the engaging form member defining a winding form; means for moving the form member into and out of engagement with the head member; means for anchoring the end of a supply wire to one of the members upon movement of the form member into engagement with the head member; and means for feeding the supply wire into position to be anchored by the anchoring means.

60. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means for anchoring the end of a supply wire to one of the cooperating members upon relative movement between the turret and head member in a direction to cause cooperation between aligned members; and means for feeding the supply wire into position to be anchored by the anchoring means.

61. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; a driving connection between cooperating members; means for driving one of the cooperating members; means for anchoring the end of a supply wire to one of the cooperating members upon relative movement between the turret and head member in a direction to cause cooperation between aligned members; and means for feeding the supply wire into position to be anchored by the anchoring means.

62. In a coil winding machine, the combination of a head member; a form member defining together with the engaged head member a winding form; means for causing relative approaching and withdrawing movement between both members; means for anchoring the end of a supply wire to one of the members upon relative approaching movement between both members; means for feeding the supply wire into position to be anchored by the anchoring means; and means operable to sever a wound coil from the supply wire.

63. In a coil winding machine, the combination of a head member; a form member, the head member together with the engaged form member defining a winding form; means for causing relative approaching and withdrawing movement between both members; means for anchoring the end of a supply wire to one of the members upon relative approaching movement between both members; means operable to sever a wound coil from the supply wire; and means for feeding the supply wire into position to be anchored by the anchoring means and into operative engagement with the severing means.

64. In a coil winding machine, the combination of a rotatable head member; a rotatable form member, the head member together with the engaged form member defining a winding form; means for causing relative approaching and withdrawing movement between both members; means for driving the engaged members; a reciprocable wire shifter; means operable to sever a wound coil from a supply wire, said means being so located with respect to the wire shifter that during each reciprocation of the same the wire moves into operative engagement with the severing means; means for anchoring the end of the supply wire to one of the members upon relative approaching movement between both members; and means for feeding the supply wire into position to be anchored by the anchoring means.

65. In a coil winding machine, the combination of a rotatable head member; a rotatable form member, the head member together with the engaged form member defining a winding form; means for causing relative approaching and withdrawing movement between both members; means for driving the engaged members; a reciprocable wire shifter; means operable to sever a wound coil from a supply wire, said means being so located with respect to the wire shifter that during each reciprocation of the same the wire moves into operative engagement with the severing means; means for anchoring the end of the supply wire to one of the members upon relative approaching movement between both members; and means for feeding the supply wire into position to be anchored by the anchoring means and into operative engagement with the severing means.

66. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means for anchoring the end of a supply wire to one of the cooperating members upon relative movement between the turret and head member in a direction to cause cooperation between aligned members; means for feeding the supply wire into position to be anchored by the anchoring means; and means operable to sever a wound coil from the supply wire.

67. In a coil winding machine, the combination of a head member, a rotatable turret; a

plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means for anchoring the end of a supply wire to one of the cooperating members upon relative movement between the turret and head member in a direction to cause cooperation between aligned members; means operable to sever a wound coil from the supply wire; and means for feeding the supply wire into position to be anchored by the anchoring means and into operative engagement with the severing means.

68. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means for driving cooperating members; a reciprocable wire shifter; means operable to sever a wound coil from a supply wire, said means being so located with respect to the wire shifter that during each reciprocation of the same the wire moves into operative engagement with the severing means; means for anchoring the end of the supply wire to one of the cooperating members upon relative movement between the turret and head member in a direction to cause cooperation between aligned members; and means for feeding the supply wire into position to be anchored by the anchoring means.

69. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member so as to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means for driving cooperating members; a reciprocable wire shifter; means operable to sever a wound coil from a supply wire, said means being so located with respect to the wire shifter that during each reciprocation of the same the wire moves into operative engagement with the severing means; means for anchoring the end of the supply wire to one of the cooperating members upon relative movement between the turret and head member in a direction to cause cooperation between aligned members; and means for feeding the supply wire into position to be anchored by the anchoring means and into operative engagement with the severing means.

70. In a coil winding machine, the combination of a head member; a form member movable into and out of engagement with the head member and defining together with the engaging form member a winding groove; means for driving both members when in engagement with each other; means for separating the members means carried by one of the members and operable to retain a wound coil on said one member after the members are separated; and means for releasing the coil retaining means.

71. In a coil winding machine, the combination of a head member defining a side wall of a winding groove; a form member defining the other side wall and the bottom of the winding groove; means for causing relative approaching and withdrawing movement between both members to establish the winding groove and to separate both members for removal of a wound coil from the form member; means carried by the form member for retaining a wound coil thereon after members are separated, and means for releasing the coil retaining means.

72. In a coil winding machine, the combination of a head member defining a side wall of a winding groove, said side wall being provided with a plurality of recesses; a form member defining the other side wall and the bottom of the winding groove; means for causing relative approaching and withdrawing movement between both members to establish the winding groove and to separate both members for removal of a wound coil from the form member; a plurality of coil retaining fingers pivotally mounted on the form member, said fingers being normally yieldingly urged into coil retaining position in which they are received in the recesses of the head member and are flush with the side wall of the winding groove, provided by said head member, when both members are in engagement with each other; and means for simultaneously rotating all fingers against their tendency to rotate into coil retaining position for releasing the coil from the form member.

73. In a coil winding machine, the combination of a head member defining a side wall of a winding groove, said side wall being provided with a plurality of recesses; a form member defining the other side wall and the bottom of the winding groove; means for causing relative movement between both members so as to cause engagement and disengagement between said members to establish the winding groove and to separate both members for removal of a wound coil from the form member; a plurality of coil retaining fingers pivotally mounted on the form member and each being provided with a gear segment, said fingers being normally yieldingly urged into coil retaining position in which they are received in the recesses of the head member and are flush with the side wall of the winding groove, provided by said head member, when both members are in engagement with each other; and a reciprocable rack meshing with the gear segments of all fingers for simultaneously rotating said fingers out of the path of removal of the coil from the form member against the tendency of said fingers to rotate into coil retaining position.

74. In a coil winding machine, the combination of a head member defining a side wall of a winding groove, said side wall being provided with a plurality of recesses; a form member defining the other side wall and the bottom of the winding groove; means for causing relative linear movement between both members so as to cause engagement and disengagement between the members to establish the winding groove and to separate both members for removal of a wound coil from the form member; a plurality of coil retaining fingers pivotally mounted on the form member substantially centrally thereof and in such manner that they are rotatable in planes parallel to the direction of relative linear movement between both members and extending substantially

radially of the center of the winding groove, each of said fingers being provided with a gear segment and normally yieldingly urged into coil retaining position in which they are received in the recesses of the head member and are flush with the side wall of the winding groove, provided by said head member, when both members are in engagement with each other; and a reciprocable rack carried by the form member and meshing with the gear segments of all fingers for simultaneously rotating said fingers against their tendency to rotate into coil retaining position until they are out of the path of removal of a coil from the form member.

75. In a coil winding machine, the combination of a rotatable head member defining a side wall of a winding groove, said side wall being provided with a plurality of recesses; a reciprocable form member rotatable coaxially of the head member and defining the other side wall and the bottom of the winding groove; means for moving the form member into and out of engagement with the head member to establish the winding groove and to separate both members for removal of a wound coil from the form member; means for driving both members when engaging each other; a plurality of coil retaining fingers pivotally mounted on the form member substantially centrally thereof and in such manner that they are rotatable in planes parallel to and passing through the axis of rotation of the form member and extending radially of said axis, each of said fingers being provided with a gear segment; a reciprocable rack carried by the form member and having annular teeth meshing with the gear segments of all fingers for simultaneously rotating said fingers into a position in which they extend substantially parallel to the axis of rotation of the form member in order to release a coil for removal from the form member, said rack being also provided with an annular groove; a pivotally mounted lever projecting with one end into the annular groove of the rack for moving the same, said lever being movable with the form member but not rotatable therewith; and a spring urging the rack into a position in which the fingers assume coil retaining position, in such coil retaining position the fingers being received in the recesses of the head member and being flush with the side wall of the winding groove, provided by said head member, when both members are in engagement with each other.

76. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; and means carried by each form member for normally yieldingly retaining a wound coil therein, said means being operable to release a coil when a form member is in a position in which the coil may descend therefrom by gravity.

77. In a coil winding machine, the combination of a rotatable head member; a rotatable turret; a plurality of form members rotatably mounted on said turret, the head member together with a cooperating form member defining a winding form; means for causing relative bodily movement between the turret and head member to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means for driving cooperating members; and means carried by each form member for normally yieldingly retaining a wound coil thereon, said means being operable to release a coil when a form member is in a position in which the coil may descend therefrom by gravity.

78. In a coil winding machine, the combination of a head member; a rotatable turret; a plurality of form members on said turret, the head member together with a cooperating form member defining a winding groove; means for causing relative bodily movement between the turret and head member to cause separation and cooperation between aligned members; means for indexing the turret so as to align consecutive form members with the head member; means carried by each form member for normally yieldingly retaining a wound coil thereon, said coil retaining means being actuated in response to an intermittent rotation of the turret to release a coil from its form member.

79. In a coil winding machine, the combination of a rotatable winding form; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for severing a wound coil from the supply wire; means for moving the wire shifter out of engagement with the supply wire; and a common manually actuated controller operable to cause operation of the coil severing means and of the wire shifter moving means.

80. In a coil winding machine, the combination of a rotatable winding form; means for preventing a supply wire from backing away from the winding form after a wound coil has been severed from said supply wire; means for severing a wound coil from the supply wire; and a common manually actuated controller operable to cause operation of the coil severing means and of the wire back-away preventing means.

81. In a coil winding machine, the combination of a rotatable winding form; a reciprocable wire shifter for guiding a supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for severing a wound coil from the supply wire; means anchoring the end of the supply wire to the winding form; means for preventing the supply wire from backing away from the winding form after a wound coil has been severed from said supply wire; and a common manually actuated controller operable to cause operation of the coil severing means, the wire shifter moving means and the wire back-away preventing means.

82. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and controllers operable for causing operation of the severing means, the wire shifter moving means,

the wire back-away preventing means and the feeding means.

83. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; and means operated in response to relative separating movement between both members for moving the wire shifter out of engagement with the supply wire.

84. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for severing a wound coil from the supply wire; means for moving the wire shifter out of engagement with the supply wire; and means operated in response to relative separating movement between both members for causing operation of the coil severing means and of the wire shifter moving means.

85. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; and means actuated in response to relative separating movement between both members for preventing a supply wire from backing away from the members after a wound coil has been severed from said supply wire.

86. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for preventing a supply wire from back-away from the members after a wound coil has been severed from said supply wire; means for severing a wound coil from the supply wire; and means operated in response to relative separating movement between both members for causing operation of the coil severing means and of the wire back-away preventing means.

87. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for severing a wound coil from the supply wire; means for moving the wire shifter out of engagement with the supply wire; means for preventing the supply wire from backing-away from the members after a wound coil has been severed from said supply wire; and means operated in response to relative separating movement between both members for causing operation of the coil severing means, the wire shifter moving means and the wire back-away preventing means.

88. In a coil winding machine the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for anchoring a supply wire to one of the cooperating members; and means actuated in response to relative separating movement between both members for feeding the supply wire into position to be anchored by the anchoring means.

89. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for anchoring a supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; a reciprocable wire shifter for properly guiding the supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; and means actuated in response to relative separating movement between both members for causing operation of the feeding means and of the wire shifter moving means.

90. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for anchoring a supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for severing a wound coil from the supply wire; and means actuated in response to relative separating movement between both members for causing operation of the feeding means and of the severing means.

91. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for anchoring a supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a wound coil has been severed from said supply wire; and means actuated in response to relative separating movement between both members for causing operation of the feeding means and of the wire back-away preventing means.

92. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between

the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and means actuated in response to relative separating movement between both members for causing operation of the severing means, the wire shifter moving means, the wire back-away preventing means and the feeding means.

93. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and controllers actuated successively in response to relative separating movement between the members for causing operation of the severing means, the wire shifter moving means, the wire back-away preventing means and the feeding means.

94. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; a controller actuated in response to relative separating movement between the members for causing operation of the severing means, the wire shifter moving means and the wire back away preventing means; and another controller also actuated in response to relative separating movement between both members for causing operation of the feeding means.

95. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; and means for moving the wire shifter out of engagement with the supply wire, said means being also actuated in response to relative cooperating movement between both members for returning the wire shifter into engagement with the supply wire.

96. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; and means actuated in response to relative separating movement between the members for moving the wire shifter out of engagement with the supply wire, and actuated in response to relative cooperating movement between the members for returning the wire shifter into engagement with the supply wire.

97. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for severing a wound coil from the supply wire; means for moving the wire shifter into and out of engagement with the supply wire; and means actuated in response to relative separating movement between both members for causing operation of the coil severing means and for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire, and actuated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire.

98. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for preventing a supply wire from backing away from the members after a wound coil has been severed from said supply wire; and means for rendering the wire back-away preventing means effective, said means being actuated in response to relative cooperating movement between the members for rendering said wire back-away preventing means ineffective.

99. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for preventing a supply wire from backing away from the members after a wound coil has been severed from said supply wire; and means actuated in response to relative separating

movement between the members for rendering the wire back-away preventing means effective, and actuated in response to relative cooperating movement between the members for rendering said wire back-away preventing means ineffective.

100. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for preventing a supply wire from backing away from the members after a wound coil has been severed from said supply wire; means for severing a wound coil from the supply wire; and means actuated in response to relative separating movement between the members for causing operation of the severing means and for causing the wire back-away preventing means to be effective, and actuated in response to relative cooperating movement between the members for causing the wire back-away preventing means to become ineffective.

101. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for severing a wound coil from the supply wire; means for moving the wire shifter out of engagement with the supply wire; means for preventing the supply wire from backing away from the members after a wound coil has been severed from said supply wire; and means operated in response to relative separating movement between both members for causing operation of the coil severing means, for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire and for causing the wire back-away preventing means to be effective, and actuated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire and to cause the wire back-away preventing means to become ineffective.

102. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and a controller operable to cause the wire shifter moving means to move the wire shifter out of engagement with the wire and to cause operation of the wire back-up preventing means, said controller being also operated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the wire and to render the wire back-away preventing means ineffective.

103. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and a controller operated in response to relative separating movement between the members for causing the wire shifter moving means to move the wire shifter out of engagement with the wire and to cause operation of the wire back-away preventing means, said controller being also operated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire and to render the wire back-away preventing means ineffective.

104. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for anchoring a supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; a reciprocable wire shifter for properly guiding the supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means actuated in response to relative separating movement between the members for causing operation of the feeding means; and means also actuated in response to relative separating movement between the members for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire, and actuated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire.

105. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; means for anchoring a supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a wound coil has been severed from said supply wire; means actuated in response to relative separating movement between the members for causing operation of the feeding means; and means actuated in response to relative separating movement between the members for rendering the wire back-away preventing means effective, and actuated in response to relative cooperating movement between the members for rendering the wire back-away preventing means ineffective.

106. In a coil winding machine, the combina-

tion of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; means actuated in response to relative separating movement between the members for causing operation of the feeding means; and means actuated in response to relative separating movement between both members for causing operation of the severing means, for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire and for rendering the wire back-away preventing means effective, and actuated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire and for rendering the wire back-away preventing means ineffective.

107. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and controllers operable for causing operation of the severing means, for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire, for rendering the wire back-away preventing means effective and for causing operation of the feeding means, one of said controllers being operated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire and to render the wire back-away preventing means ineffective.

108. In a coil winding machine, the combination of a rotatable head member; a rotatable form member defining together with the cooperating head member a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; means for driving the cooperating members; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and controllers actuated in response to relative separating movement between the members for causing operation of the coil severing means, for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire, for rendering the wire back-away preventing means effective and for causing operation of the feeding means, one of said controllers being operated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire and to render the wire back-away preventing means ineffective.

109. In a coil winding machine, the combination of a rotatable winding form; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for preventing the supply wire from backing away from the winding form after a coil has been severed from said supply wire; fluid pressure operated means for causing operation of the wire shifter moving means, the severing means and the wire-back-away preventing means; and a valve operable to admit fluid pressure to the fluid pressure operated means.

110. In a coil winding machine, the combination of a rotatable winding form; a reciprocable wire shifter for properly guiding a supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; means for severing a wound coil from the supply wire; means for preventing the supply wire from backing away from the winding form after a coil has been severed from said supply wire; fluid pressure operated means for causing operation of the wire shifter moving means, the severing means and the wire back-away preventing means; and a valve operable to admit fluid pressure to the fluid pressure operated means so as to cause the wire shifter moving means to move the wire shifter out of engagement with the supply wire, to cause operation of the severing means and to render the wire back-away preventing means effective, said valve being also operable to admit fluid pressure to the fluid pressure operated means so as to cause the wire shifter moving means to return the wire shifter into engagement with the supply wire and to render the wire back-away preventing means ineffective.

111. In a coil winding machine, the combination of a rotatable winding form; means for anchoring a supply wire to the winding form; a reciprocable wire shifter for properly guiding the supply wire to the winding form; means for moving the wire shifter out of engagement with the supply wire; means for feeding the supply wire into position to be anchored by the anchoring means; means for severing a wound coil from the supply wire; means for preventing the supply wire from backing away from the winding form after a coil has been severed from said supply wire; fluid pressure operated means for causing operation of the wire shifter moving means, the severing means and the wiring back-away preventing means, a valve operable to admit fluid pressure to said fluid pressure operated means; anchoring the end of the supply wire to one of the cooperating members; means for feeding the supply wire into position to be anchored by the anchoring means; means for preventing the supply wire from backing away from the members after a coil has been severed from said supply wire; and controllers actuated in response to relative separating movement between the members for causing operation of the coil severing means, for causing the wire shifter moving means to move the wire shifter out of engagement with the supply wire, for rendering the wire back-away preventing means effective and for causing operation of the feeding means, one of said controllers being operated in response to relative cooperating movement between the members for causing the wire shifter moving means to return the wire shifter into engagement with the supply wire and to render the wire back-away preventing means ineffective.

another fluid pressure operated means for causing operation of the feeding means; and another valve operable to admit fluid pressure to said other fluid pressure operated means.

112. In a coil winding machine, the combination of a rotatable winding form; means for anchoring a supply wire to the winding form; a reciprocable wire shifter for properly guiding the supply wire to the winding form; means for moving the wire shifter into and out of engagement with the supply wire; reciprocable means for feeding the supply wire into position to be anchored by the anchoring means during a forward stroke of said feeding means; means for severing a wound coil from the supply wire; means for preventing the supply wire from backing away from the winding form after a coil has been severed from said supply wire; fluid pressure operated means for causing operation of the wire shifter moving means, the severing means and the wire back-away preventing means; a valve operable to admit fluid pressure to the fluid pressure operated means so as to cause the wire shifter moving means to move the wire shifter out of engagement with the supply wire, to cause operation of the severing means and to render the wire back-away preventing means effective, said valve being also operable to admit fluid pressure to the fluid pressure operated means so as to cause the wire shifter moving means to return the wire shifter into engagement with the supply wire and to render the wire back-away preventing means ineffective; another fluid pressure operated means for causing operation of the feeding means; and a valve operable to admit fluid pressure to said other fluid pressure operated means for causing a forward stroke of the feeding means, and operable to admit fluid pressure to said other fluid pressure operated means to cause a return stroke of the feeding means.

113. In a coil winding machine, the combination of a rotatable winding form; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; means for actuating the clutch; a reciprocable wire shifter; a controller normally assuming a position in which to cause the clutch actuating means to disengage the clutch, said controller being shiftable into a position in which to cause the clutch actuating means to engage the clutch; and means actuated in timed relation with the reciprocation of the wire shifter for arresting the controller in clutch engaging position during a predetermined number of reciprocations of the wire shifter.

114. In a coil winding machine, the combination of a rotatable winding form; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; means for actuating the clutch; a wire shifter reciprocated in timed relation with the rotation of the winding form; a controller normally assuming a position in which to cause the clutch actuating means to disengage the clutch, said controller being shiftable into a position in which to cause the clutch actuating means to engage the clutch; and means actuated in timed relation with the reciprocation of the wire shifter for arresting the controller in clutch engaging position during a predetermined number of reciprocations of the wire shifter.

115. In a coil winding machine, the combination of a rotatable winding form; reciprocable means for feeding a supply wire toward the winding form during forward movement of said means; a controller operable to cause movement of the feeding means in either direction; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; another controller operable to cause engagement and disengagement of the clutch; and means for simultaneously actuating both controllers to cause backward movement of the feeding means and engagement of the clutch.

116. In a coil winding machine, the combination of a rotatable winding form; reciprocable means for feeding a supply wire toward the winding form during forward movement of said means; a controller operable to cause movement of the feeding means in either direction; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; another controller for actuating the clutch, said controller being normally urged into a position in which to cause disengagement of the clutch; means for simultaneously operating both controllers to cause backward movement of the feeding means and engagement of the clutch; and means arresting said other controller in clutch engaging position, said means being operable to release said other controller.

117. In a coil winding machine, the combination of a rotatable winding form; reciprocable means for feeding a supply wire toward the winding form during forward movement of said means; a controller operable to cause movement of the feeding means in either direction; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; another controller for actuating the clutch, said controller being normally urged into a position in which to cause disengagement of the clutch; means for simultaneously operating both controllers to cause backward movement of the feeding means and engagement of the clutch; and means actuated in timed relation with the rotation of the winding form for arresting said other controller in clutch engaging position during a predetermined cycle of rotation of the winding head.

118. In a coil winding machine, the combination of a rotatable head member; a rotatable form member, the head member together with the cooperating form member defining a winding form; means for causing relative bodily movement between both members so as to cause separation and cooperation between the members; a driving connection between the cooperating members; reciprocable means for feeding a supply wire toward the members to be anchored thereto during forward movement of said means; a controller for causing movement of the feeding means in either direction, said controller being actuated in response to relative separating movement between the members for causing forward movement of the feeding means; mechanical power means; a clutch for drivingly connecting the mechanical power means with the head member; another controller for actuating the clutch, said controller being normally urged into a position in which to cause disengagement of the clutch; means for simultaneously operating both controllers to cause backward movement of the feeding means and engagement of the clutch; and means actuated in timed relation with the rotation of the head member for arresting said other controller in clutch engaging position during a predetermined cycle of rotation of said head member.

119. In a coil winding machine, the combina-

tion of a rotatable winding form; and means for abruptly bending a portion of a supply wire for preventing the latter from backing away from the winding form after a wound coil has been severed from said supply wire.

120. In a coil winding machine, the combination of a rotatable winding form; a stationary U-shaped bar; and a movable finger for bending a portion of supply wire within the U-shaped bar to prevent the supply wire from backing away from the winding form after a wound coil has been severed from said supply wire.

121. In a coil winding machine, the combination of a rotatable winding form; a wire shifter; and means actuated in timed relation with the rotation of the winding form for reciprocating the wire shifter, said means including transversely movable bars, one of which is oscillated by the other by means of a pin and slot connection.

122. In a coil winding machine, the combination of a rotatable winding form; a wire shifter; means actuated in timed relation with the rotation of the winding form for reciprocating the wire shifer, said means including a reciprocable bar on which the wire shifter is rotatably mounted; and means for rotating the wire shifter out of engagement with the wire.

123. In a coil winding machine, the combination of a rotatable winding form; a wire shifter; means actuated in timed relation with the rotation of the winding form for reciprocating the wire shifer, said means including transversely movable bars on one of which the wire shifter is rotatably mounted and one of which is oscillated by the other bar by means of a pin and slot connection; and means for rotating the wire shifter out of engagement with the wire.

124. In a coil winding machine, the combination of a rotatable winding form; a wire feed block movable toward and away from the winding form; and means carried by the feed block and actuated in response to forward movement of the latter toward the winding form for clamping the wire to said feed block, and actuated in response to a completed predetermined cycle of forward movement of the feed block for releasing said wire whereupon the same is in a position to be anchored to the winding form.

125. In a coil winding machine, the combination of a rotatable winding form; means for anchoring the start of a supply wire to the winding form; a wire feed block movable toward and away from the winding form and having a surface adjacent the supply wire; means including a shiftable member for clamping and releasing the wire from said block surface; and means operated in response to forward movement of the block toward the winding form for shifting the member in order successively to clamp and after a predetermined cycle of such forward movement of the feed block to release the wire from the block surface whereupon the start of the supply wire is adjacent the anchoring means.

126. In a coil winding machine, the combination of a rotatable winding form; means for anchoring the start of a supply wire to the winding form; a wire feed block movable toward and away from the winding form and having a surface adjacent the supply wire; means for stopping the feed block in a position most retracted from the winding form; means including a shiftable member for clamping and releasing the wire from said block surface; and means operated in response to forward movement of the block toward the winding form for shifting the member in order to cause the wire clamping and releasing means successively to clamp the wire to the block surface and after a predetermined cycle of such forward movement of the feed block to release the wire from said block surface whereupon the start of the supply wire is adjacent the anchoring means.

127. In a coil winding machine, the combination of a rotatable winding form; means for anchoring the start of a supply wire to the winding form; a wire feed block movable toward and away from the winding form and having a surface adjacent the supply wire; means for stopping the block in a position most retracted from the winding form; means carried by the feed block including a shiftable member for clamping and releasing the wire from the block surface, said member having two wedge shaped notches; a spring urged plunger having a wedge shaped end which is adapted to register with either one of the two wedge shaped notches of the member; stationary means for stopping the shiftable member during movement of the feed block away from the winding form whereby the member is shifted relative to the block into a position in which the wedge shaped end of the plunger engages part of one side wall of one of the wedge shaped notches of the member; means for preventing the plunger from forcing its way into said one notch while the block is in a most retracted position, said means releasing the spring urged plunger in response to movement of the feed block toward the winding form so that the latter registers with said one notch whereby the member is shifted into a position relative to the block in which the wire clamping and releasing means clamps the wire to the block surface; and a stationary stop for stopping the member during movement of the block toward the winding head so that the same is shifted relative to the feed block into a position in which the plunger end registers with the other wedge shaped notch whereupon the wire clamping and releasing means is caused to release the wire.

128. In a coil winding machine, the combination of a rotatable winding form; means for anchoring the start of a supply wire to the winding form; a wire feed block movable toward and away from the winding form and having a surface adjacent the supply wire; means for stopping the feed block in a position most retracted from the winding form; a cam disc rotatably mounted on the feed block; a linearly movable member having two wedge shaped notches; a driving connection between the member and the cam disc; a spring urged plunger having a wedge shaped end which is adapted to register with either one of the two wedge shaped notches of the member; stationary means for stopping the shiftable member during movement of the feed block away from the winding form whereby the member is shifted relative to the block into a position in which the wedge shaped end of the plunger engages part of one side wall of one of the wedge shaped notches of the member; means for preventing the plunger from forcing its way into said one notch while the feed block is in a most retracted position, said means releasing the spring urged plunger in response to movement of the feed block toward the winding form so that said plunger registers with said one notch whereby the member is shifted into a position relative to the feed block in which the cam disc clamps the wire to the block surface; and a stationary stop for stopping the member during movement of the feed block toward the winding form so that

the same is shifted relative to the block into a position in which the plunger registers with the other wedge shaped notch whereupon the cam disc is rotated out of engagement with the wire.

129. In a coil winding machine, the combination of a rotatable winding form; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; means for engaging and disengaging the clutch; and means for gradually stopping rotation of the winding form after the clutch has been disengaged, and for returning the winding form into that angular position in which the gradual stopping begins.

130. In a coil winding machine, the combination of a rotatable winding form; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; means for engaging and disengaging the clutch; and means operable in response to disengagement of the clutch for gradually stopping rotation of the winding form and for returning the same into that angular position in which the gradual stopping begins.

131. In a coil winding machine, the combination of a rotatable winding form; a driving element having clutch teeth; a member having clutch teeth and being rotatable with the winding form and reciprocable into and out of driving engagement with the driving element; and means adapted to be drivingly engaged by the member during movement thereof away from the driving element, said means gradually stopping rotation of the winding form and returning the same into that angular position in which the gradual stopping begins when in driving engagement with the member.

132. In a coil winding machine, the combination of a rotatable winding form; a driving element having clutch teeth; a member having clutch teeth and being rotatable with the winding form and reciprocable into and out of driving engagement with the driving element; a rotatable stop element having a projecting arm and being adapted to be drivingly engaged by the member during movement thereof away from the driving element; a spring yieldingly resisting rotation of said stop element in the direction of rotation of the winding form; and an adjustable stop against which the spring urges the arm of the stop element when the latter has been rotated by the member against the tendency of the spring to maintain the stop element in an angular position in which the arm engages said stop.

133. In a coil winding machine, the combination of a rotatable winding form; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; means for actuating the clutch; a wire shifter reciprocated relative to the winding form in timed relation with the rotation of said winding form; and means operated in response to disengagement of the clutch for gradually stopping rotation of the winding form and for returning the same into an angular position in which the wire shifter assumes a predetermined position relative to the winding form.

134. In a coil winding machine, the combination of a rotatable winding form; mechanical power means; a clutch for drivingly connecting the mechanical power means with the winding form; means for actuating the clutch; means operable to sever a wound coil from a supply wire; a wire shifter reciprocated relative to the winding form in timed relation with the rotation of said winding form, said wire shifter during each reciprocation shifting the supply wire into operative engagement with the coil severing means; and means operated in response to disengagement of the clutch for gradually stopping rotation of the winding form and for returning the same into an angular position in which the wire shifter assumes a position in which the supply wire is in operative engagement with the severing means.

135. In a coil winding machine, the combination of a rotatable winding form; a rotatable wheel having a grooved periphery over the greater part of which the supply wire is guided; a normally ineffective brake for the wheel; and means actuated in response to rotation of the winding form for causing the brake to be effective.

136. In a coil winding machine, the combination of a rotatable winding form; a rotatable wheel having a grooved periphery over the greater part of which the supply wire is guided; a brake band normally held out of engagement with the wheel; and means actuated in response to rotation of the winding form for moving the band into braking engagement with the wheel.

LORA E. POOLE.