July 3, 1928. 1,675,650

M. B. GROUT

WINDING MACHINE

Filed April 26, 1926 6 Sheets-Sheet 1

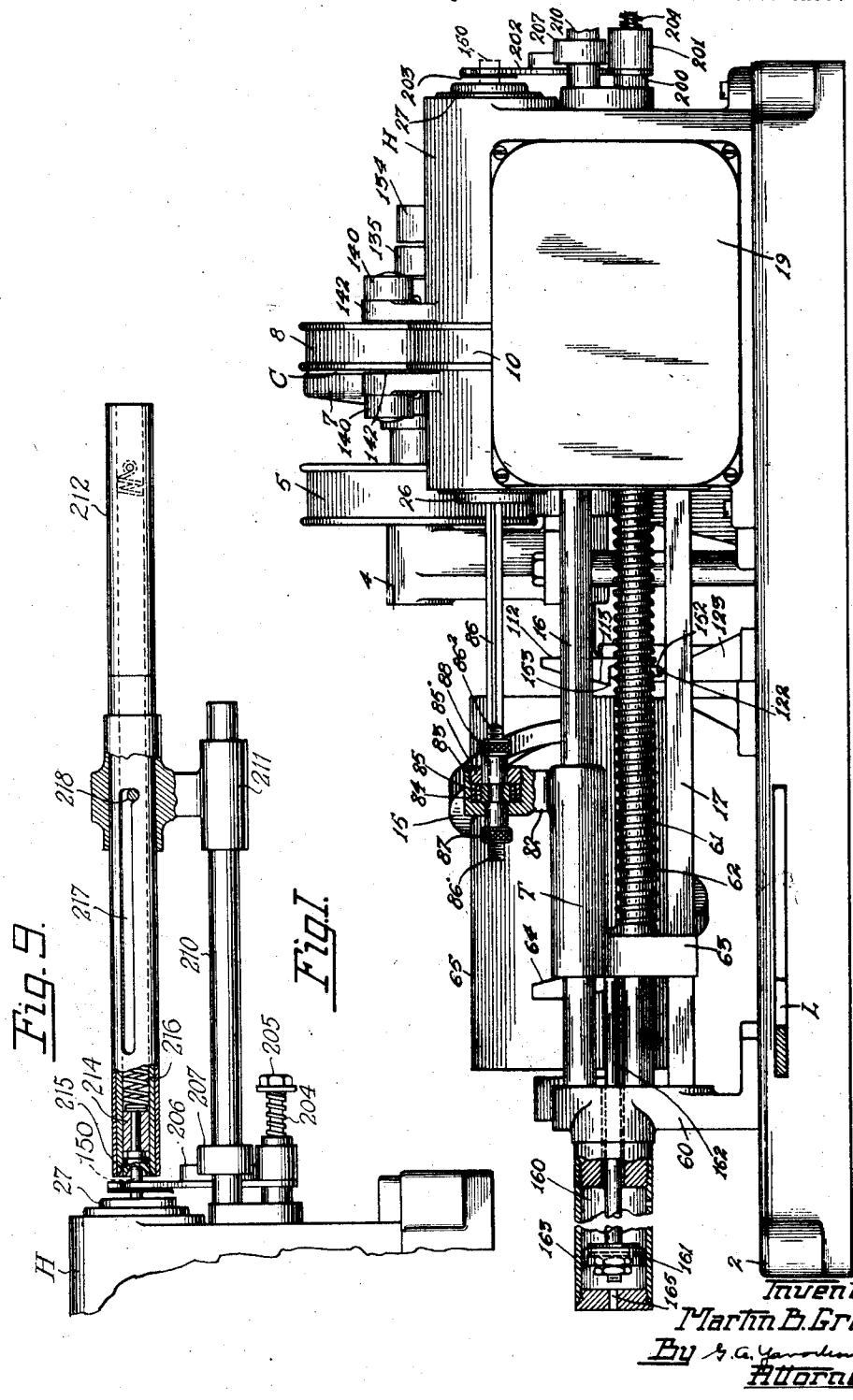

Fig. 1.

Fig. 9.

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WINDING MACHINE

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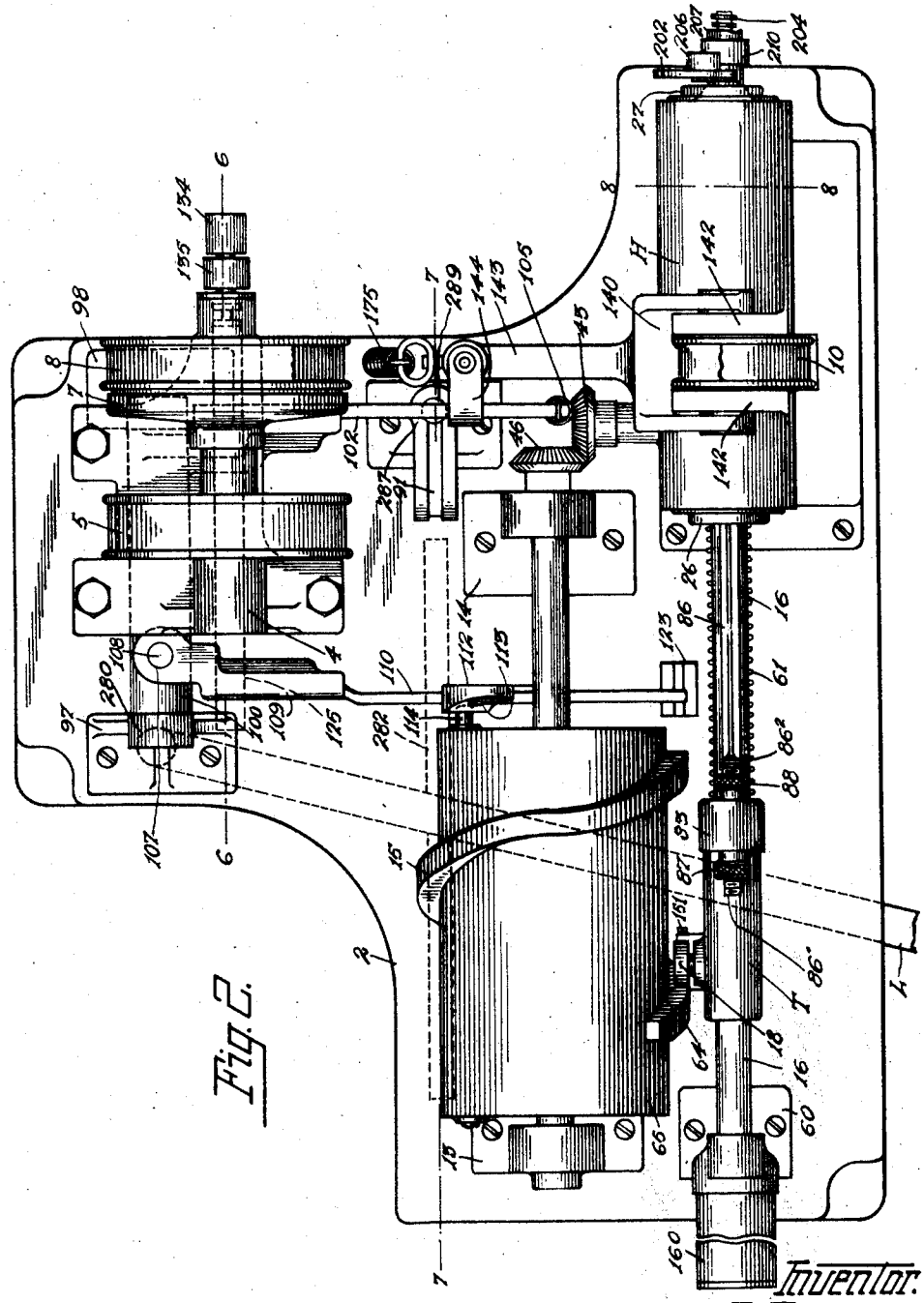

Fig. 2.

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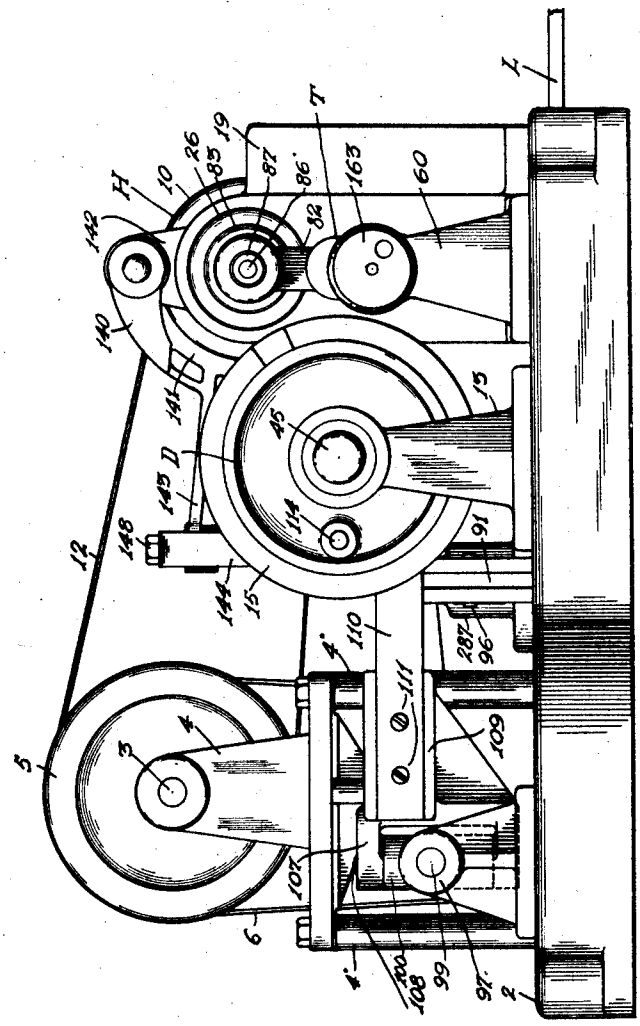

Fig. 3.

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WINDING MACHINE

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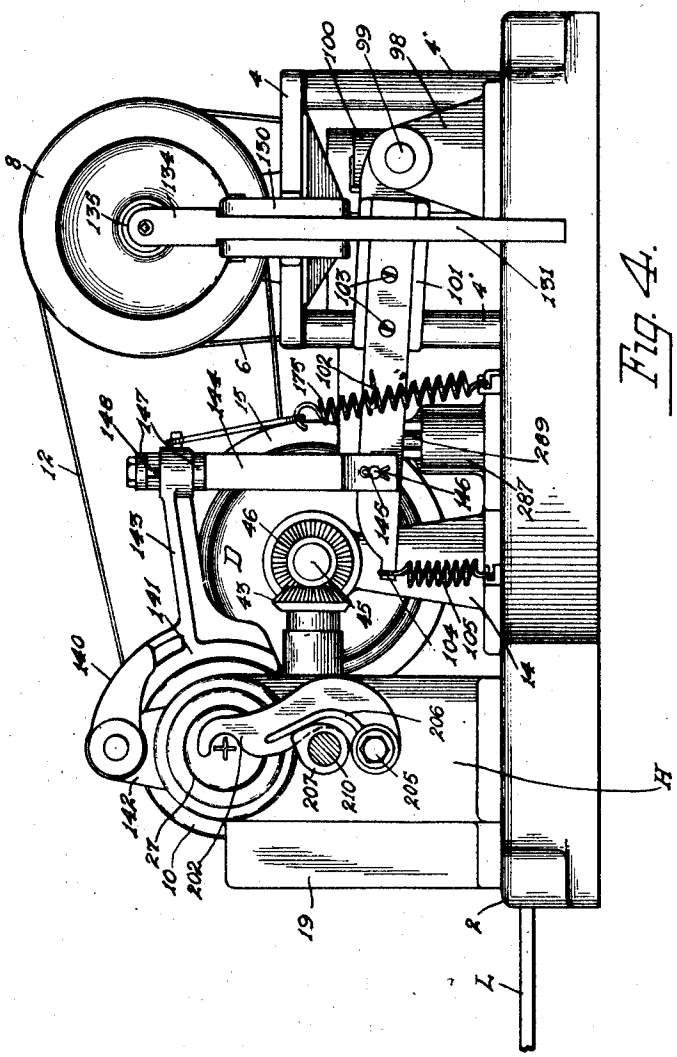

Fig. 4.

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M. B. GROUT

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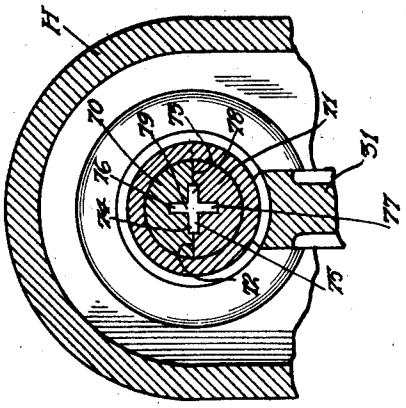

Fig. 8.

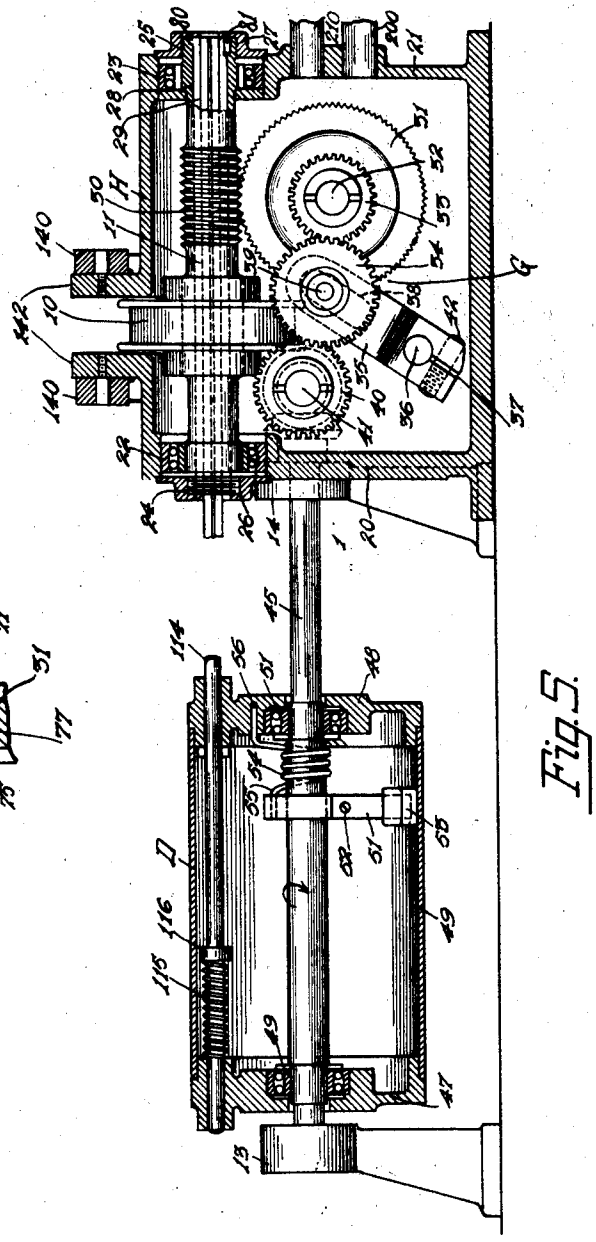

Fig. 5.

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M. B. GROUT

WINDING MACHINE

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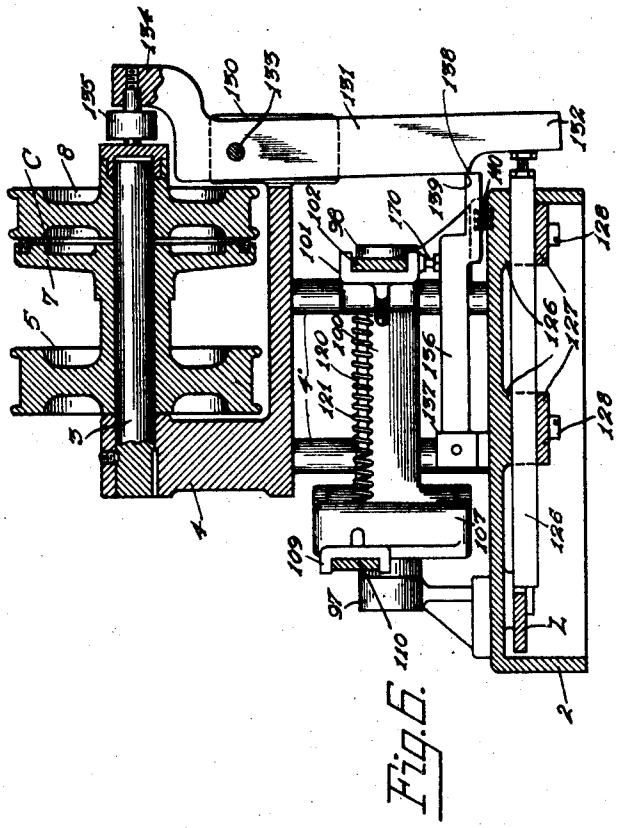

Fig. 6.

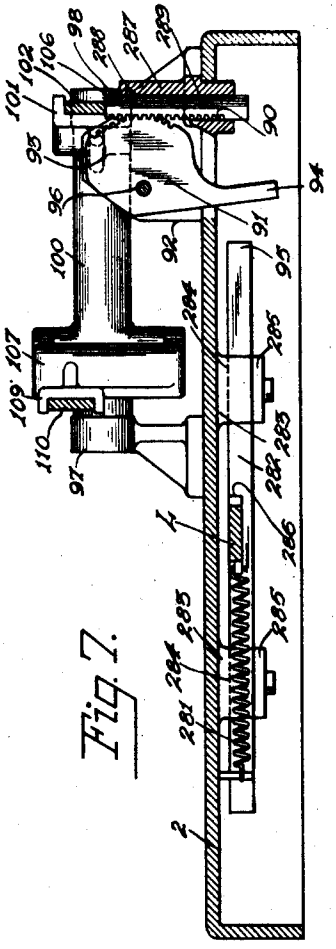

Fig. 7.

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Patented July 3, 1928. 1,675,650

UNITED STATES PATENT OFFICE.

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WINDING MACHINE.

Application filed April 26, 1926. Serial No. 104,606.

My invention relates in general to winding machines which are used for winding a material such as a strand of wire upon a suitable core, and has to do more particularly with that class of winding machines which are used for winding a strand of wire upon a ribbon or flat core to form a resistance unit such as is used in connection with a rheostat for controlling the filament voltage of an audion tube.

An object of my invention is to provide a machine of the above type with which the work can be done in a rapid, efficient and economical manner.

A feature of my invention is the provision of a machine which will automatically wind a coil of wire upon a core and stop at a predetermined point when a predetermined number of convolutions of wire have been placed upon the core.

Resistance units such as are used in connection with rheostats for controlling the filament voltage of an audion tube in a broadcast receiving set are usually wound on a strip of flat ribbon insulation and comprise a predetermined number of convolutions of wire for a given resistance and a feature of my invention is the provision of a rotatable spindle shaft which supports a chuck and which is rotatable therewith for receiving the strip of insulation material or core and through the medium of a suitable feeding bar the core is forced out of the chuck at a predetermined rate while rotating to receive a strand of wire from a supply source to form a resistance unit of a predetermined ohmic resistance.

Another feature of my invention is the provision of a feeding bracket which through the agency of a rotating cam and cam follower on the feeding bracket cause the feeding bracket to be moved longitudinally to move a feeding bar rotatably supported by the feeding bracket through the rotating chuck in the spindle shaft to bring about the movement of the core upon which the wire is wound at a predetermined rate.

Another feature of my invention is the provision of a novel suitable clutch mechanism which is controlled by a starting lever for moving a loose pulley into engagement with a constantly rotating clutch disk so that motion may be transmitted to the spindle shaft to operate the winding machine.

Another feature of my invention is the provision of control means governed by the feeding bracket for releasing the loose pulley from the clutch disk the instant that the cam has made one complete revolution to stop the rotation of the spindle shaft.

Still another feature of my invention is the provision of means controlled by the feeding bracket for freeing the cam from the cam follower after the cam has made one complete revolution to permit the feeding bracket to restore to its starting position and permit the cam follower secured thereto to again engage the cam.

The above named features as well as others not specifically pointed out will be more fully hereinafter described in the ensuing specification, and for a more complete understanding of my invention reference may be had to the accompanying drawings in which like reference characters in the several views denote like parts, and in which

Fig. 1 is a front elevation of the winding machine of my invention.

Fig. 2 is a plan view of Fig. 1.

Fig. 3 is a left end view of Fig. 1.

Fig. 4 is a right end view of Fig. 1.

Fig. 5 is a vertical sectional view through a housing which contains the driving mechanism and the cam carrying drum to illustrate in detail a portion of the operating mechanism of the winding machine.

Fig. 6 is a sectional view along the line 6—6 of Fig. 2.

Fig. 7 is a sectional view along the line 7—7 of Fig. 2.

Fig. 8 is an enlarged fragmentary sectional view along the line 8—8 of Fig. 2 illustrating the chuck for receiving the core upon which the wire is wound, and

Fig. 9 shows mechanism secured to the right side of my device.

Referring now more in detail to my invention as illustrated in the accompanying drawings, and first describing the main parts of the winding machine, it comprises a main frame or mounting plate 2, suitably supported upon a table or bench. A shaft

3 secured to a bracket 4 supported on the plate 2 by posts 4' rotatably supports a pulley 5 which is connected to a suitable motor (not shown) by means of a suitable belt 6. Suitable clutch mechanism C comprising a disk clutch 7 integrally formed with the pulley 5 is associated with a pulley 8 rotatably supported on the shaft 3 and through the medium of suitable mechanism associated with the starting lever L, the pulley 8 is caused to move into engagement with the clutch disk 7 to cause rotation of the pulley 8. A suitable housing H secured to the mounting plate 2, encloses suitable gearing mechanism and through the medium of a pulley 10 secured to a spindle shaft 11 rotatably supported in housing H and connected to the pulley 8 by means of the belt 12 rotary motion is transmitted to the spindle shaft 11, and through the medium of this train of gearing G motion is transmitted to a drum D. The drum D is loosely and rotatably supported on a shaft 45 which is supported in suitable bearings 13 and 14 secured to the plate 2 and is provided with a cam or screw lead 15. A feeder bracket T slidably supported on rods 16 and 17 supports a cam follower 18 which is held in engagement with the face of the cam 15 on the drum, and as the drum D is rotated through the agency of the gear train G the feeder bracket T is moved toward the right with reference to Fig. 1 for purposes as will be more fully described in the ensuing description.

The housing H which encloses the train of gearing G and the spindle shaft 11 which is rotatably supported thereby is rectangular in shape and is provided with a cover 19 secured to the open side of the housing H to permit access to the interior and the mechanism contained therein. The ends 20 and 21 of the housing H are provided with counterbores through which the spindle shaft 11 extends, and ball bearings 22 and 23 are provided which rest in the counterbores in the ends 20 and 21 of the housing H, and rotatably support the spindle shaft 11. The respective ends 24 and 25 of the spindle shaft 11 are threaded and are adapted to receive caps 26 and 27 which have threaded engagement with the threaded ends 24 and 25 of the shaft 11 and prevent longitudinal movement of the same when supported by its bearings 22 and 23. The shaft 11 is provided with a central bore 28 which receives a split chuck 29 for purposes as will presently be described. The spindle shaft 11 is also provided with a pulley 10 which is connected by means of the belt 12 to the pulley 8 on the shaft 3 as before described and through the agency of this belt 12 motion is transmitted to the spindle shaft 11.

The spindle shaft 11 has a worm portion 30 cut thereon intermediate of its ends and meshes with a worm gear 31 secured on a transverse shaft 32 rotatably supported in suitable bearings in the wall of the housing H and the removable cover 19. The transverse shaft 32 also supports a gear 33 which is secured thereto in any suitable manner and this gear 33 meshes with a gear 34 adjustably supported by an arm 35 secured to a stud 36 fastened to the housing H. The arm 35 is provided with a split end 37 and the body portion of the arm 35 is provided with a slot 38 which receives a suitable stud 39 for supporting the gear 34.

A gear 40 secured to a transverse shaft 41 rotatably supported in bearings in the wall of the housing H and the removable cover 19 cooperates with the gear wheel 34 supported by the arm 35. The stud 39 which rotatably supports the gear wheel 34 may be adjusted in the slot 38 in the arm 35 until the gear 34 rotatably supported thereby meshes properly the gears 33 and 40 on the transverse shafts 32 and 41 and when this adjustment is obtained locking means are provided for locking this stud 39 and its rotatably supported gear 34 in its adjusted position in the slot 38 of the arm 35. The arm 35 may also be turned about its supporting stud 36, to facilitate the adjustment of the gear 34 with relation to the gears 33 and 40 and when this arm 35 is properly positioned a screw 42 passing through a suitable orifice in one of the split portions has screw threaded engagement with a tapped orifice in the other end to clamp the arm 35 on the supporting stud 36.

The transverse shaft 41 upon which the gear 40 is secured extends through the wall of the housing H and its protruding end has secured to it a bevel gear 43. When the pulley 10 on the spindle shaft 11 is rotated through the agency of the belt 12 the spindle shaft 11 is also rotated. The worm 30 on the shaft 11 being in mesh with the worm gear 31 on the transverse shaft 32 causes the same to rotate and the gear 33 secured thereto transmits motion to the transverse shaft 41 through the agency of the gear 34 on the arm 35 and the gear 40 on the transverse shaft 41.

The shaft 45 which is rotatably supported in bearings 13 and 14 secured to the plate 2 has secured to its one end a bevel gear 46 which meshes with the bevel gear 43 on the transverse shaft 41 to transmit motion to the shaft 45. The drum D on the shaft 45 comprises a pair of end plates 47 and 48 and a cylindrical member 49 secured to the end plates 47 and 48 and as a whole is loosely supported on the shaft 45. The end plates 47 and 48 are provided with suitable counterbores which receive ball bearings 49 and 50 for the usual purposes. An arm 51 suit-

ably secured to the shaft 45 by means of the screw 52 cooperates with a lug 53 secured to the inner face of the drum D. A helical spring 54 is supported on the shaft 45 between the arm 51 secured on the shaft 45 and the end plate 48 of the drum D and has its one end 55 secured to the arm 51 and its other end 56 secured to the end plate 48 of the drum D. The drum D being loosely supported on the shaft 45 the spring 54 as just described maintains the lug 53 secured to the inner face of the drum D in engagement with the arm 51 secured to the shaft 45 so that as the shaft 45 rotates in the direction of the arrow indicated thereon motion is transmitted to the drum D.

The feeder bracket T is slidably supported on the pair of guide rods 16 and 17 which are supported at their respective ends by a bracket 60 and the housing H. The cam follower 18 is secured to the feeder bracket T, and a coil spring 61 on a rod 62 also supported by the bracket 60 and housing H, rests between a depending portion 63 of the feeder bracket T and the housing H and maintains the feeder bracket T and cam follower 18 secured thereto in engagement with the face 64 of the cam 15 on the circumferential face 65 of the drum D.

The spindle shaft 11 as before described is rotatably supported in bearings in the respective ends 20 and 21 of the housing and is provided with a longitudinal bore 28 which receives the chuck 29. The chuck comprises a pair of semicircular members 70 and 71; the plane faces 72 and 73 of which are each provided with shallow grooves 74 and 75 and slots 76 and 77 at right angles to the shallow grooves 74 and 75. When the plane faces 72 and 73 of the members 70 and 71 are placed in matched relation to form the cylindrical chuck 29 the respective grooves 74 and 75 and the slots 76 and 77 in the respective members 70 and 71, form slots 78 and 79 which intersect each other at right angles to form an X or cross-shaped orifice which extends through the chuck 29. One end of each of the members 70 and 71 is provided with enlarged portions 80 to form a collar which rests in a counterbore in the end 25 of the spindle shaft 11 and a pin or key 81 keys the chuck 29 to the spindle shaft 11 so that it rotates with the shaft 11.

Returning now to the feeder bracket T, it is provided with an upwardly extended integrally formed member 82 provided with a cylindrical portion 83 whose axis is in alignment with the axis of the winding spindle 11. This cylindrical portion 83 is provided with an orifice 84 of a size to receive ball bearing 85 which is locked in position by means of a threaded collar 85' which has threaded engagement with a threaded portion of the orifice 84. An X or cross-shaped feeding member 86 is rotatably supported in the bearing 85 and is provided with means for adjusting the same longitudinally by means of a thumb nut 87 which has threaded engagement with the protruding end 86' of the member 86 and a thumb nut 88 is provided which has threaded engagement with the threaded portion 86^2 of the member 86 to lock the same in its adjusted position. The body of the member 86 is X or cross-shaped and is adapted to fit in the slots 78 and 79 of the chuck 29 secured in the bore 28 of the spindle shaft 11 and it is readily apparent that as the feeder bracket T is moved to the right with reference to Fig. 1 through the agency of the rotating drum D which is provided with the cam 15 that the feeding member 86 is also moved to the right through the rotating chuck 29 in the spindle shaft 11 and also rotates with the chuck 29 due to its bearing support in the feeder bracket T.

Having described the operating mechanism of my invention, I will now describe the apparatus which controls the starting and stopping of the machine. A starting lever L is pivotally secured to the bottom face of the plate 2 at the point 280 and is held in its normal position as indicated in Fig. 2 by means of a suitable spring 281 whose respective ends are secured to the lever L and suitable fastening means on the plate 2. A transverse bar 282 is provided and is slidably supported in slots 284 in a pair of lugs 283 depending from the bottom face of the plate 2. The bar 282 is maintained in the slots 284 in the lugs 283 by means of retaining plates 285 secured to the lugs 283 and this bar 282 is provided with a slot 286 in which the lever L rests. A suitable bracket 287 secured to the face of the plate 2 is provided with an orifice 288 which receives a rack member 289 provided with teeth 90. A member 91 pivotally secured to the bracket 287 in a slot 92 in the bracket 287 is provided with an arcuate portion provided with teeth 93 which mesh with the teeth 90 on the rack member. The member 91 is provided with an integrally formed depending portion 94 which is adapted to be engaged by the end 95 of the transverse sliding bar 282 when the lever L is moved to the right with reference to Fig. 7 to cause its end 95 to engage the depending portion 94 of the pivoted member 91. Continued movement of the bar 282 causes the member 91 to rotate about its pivot 96 and as the teeth 93 of the member 91 are in mesh with the teeth 90 on the rack 89, the rack 289 is of course moved up for purposes as will presently be described.

A pair of brackets 97 and 98 are secured to the plate 2 and support a shaft 99 which in turn supports a brake arm member 100. The brake arm member 100 is provided with an integrally formed forwardly extending portion 101 provided with a channel which

is adapted to receive an arm 102 which is secured thereto by means of screws 103. This arm 102 extends forward with reference to Fig. 4 and has secured to its free end 104 a spring 105, the other end of the same being secured to suitable means on the plate 2. The arm 102 is in alignment with the rack 289 and as the same is moved up as before described, the protruding end 106 of rack 289 engages the arm 102 and moves it up against the normal tension of the spring 105.

A bracket 107 is pivotally supported on the brake arm member 100 by means of the pivot pins 108 and is provided with an integrally formed forwardly extending portion 109 provided with a channel which is adapted to receive an arm 110, which is secured to the bracket 107 by screws 111.

A member 112 provided with a cam face 113 is secured to the arm 110 and cooperates with a plunger 114 which is slidably supported in the ends 47 and 48 of the drum D. A spring 115 which rests between the end 47 of the drum D and a collar 116 on the plunger 114 normally holds the plunger in the position illustrated in Fig. 5 with relation to the member 112 provided with the cam face 113.

Attached to the housing is a stud 200 which supports a collar 201, to which is attached an arm 202. The arm 202, has secured to it a piece of fibre 203. The said arm 202 is rotatably secured on the stud 200 and held in position by means of a coiled spring 204. The spring is held on the stud 200 by means of a nut 205. The arm 202 is provided with a rib 206 which cooperates with a cam 207, which cam is adjustably secured to the housing to limit the extent of movement of the arm 202. This arm 202 is rotatably secured to the housing so that it may be moved back out of the way when a strip of fibre is inserted into or taken out of the chuck which receives the same.

The resistance wire that is wound upon the elongated strip of fibre is fed between the face of the strip of fibre 203, attached to the arm 202, and the face of the member 27, thus the wire is held in position when being wound upon the strip of fibre.

Having described the apparatus of the winding machine in detail I will now describe in detail its operation. The drawings show the mechanism in position ready to start winding. To start the machine in operation the operator grasps the lever L and moves the same to the right with reference to Fig. 2, causing the transverse bar 282 to move to the right bringing the end 95 of the bar 282 in engagement with the depending member 94 of the pivoted member 91 and causes it to rotate about its pivot 96. This movement of the member 91 causes the rack 289 to move up due to the teeth 93 of the member 91 meshing with the teeth 90 of the rack 289. As the rack moves up its protruding end 106 of the rack engages the arm 102 and raises it against the tension of the spring 105 secured to its free end 104. The arm 102 being secured to the brake arm bracket 100 causes the same to turn about the shaft 99 upon which it is loosely supported, and as the arm 110 is also secured to the bracket 107 which is in turn pivotally secured to the bracket 100 it is also raised up with reference to Fig. 3. A rod 120 is provided which is secured to the extended portion 101 of the member 100 and supports a coil spring 121 which bears against the arm 110 which is pivoted to the member 101. Now as the arm 110 is raised it is also moved to the left with reference to Fig. 1 under the influence of the spring 121 to cause its free end to engage the notch 122 and a plate member 123 secured to the mounting plate 2. The spring 121 maintains the arm 110 in engagement with the notch 122 in the member 123 to hold it in its raised position and as the arm 102 is also linked to the member 100 by the integrally formed member 101 it is also held in its raised position against the tension of the spring 105 secured to its free end 104.

A transverse bar 125 is slidably supported in lugs 126 on the bottom face of the plate 2 by retaining plates 127 secured to the lugs 126 by screws 128. The end of the bar 125 is engaged by the lever L and as the bar 125 is associated with lever L near its pivotal point 280 the bar 125 only travels a short distance to the right. The bracket 4 which supports the pulleys 5 and 8 is provided with an integrally formed slotted portion 130 which pivotally supports a trigger arm 131. The end 132 of the arm 131 is adapted to be engaged by the bar 125 as it is moved to the right causing the arm to move about its pivot 133 to force the upper end 134 of the arm 131 which has secured to it a hardened wear piece 135 to the left with reference to Fig. 6 causing the pulley 8 which is loose on the shaft 3 to be forced into engagement with the disk clutch 7.

A catch lever 136 is provided which is pivotally secured to a bracket 137 secured to the mounting plate 2. The forward end of the lever 136 normally rests below the shoulder 138 formed by the reduced portion of the lever 131 but as the end 132 of the lever 131 moves to the right the instant that the shoulder 138 clears the nose 139 of the lever 136 it is moved up under the influence of a spring 140 which rests between the bottom face of the lever 136 and the face of the plate 2 to hold the arm 131 in its position illustrated in Fig. 6. The movement of the lever 136 at this time is permitted by the arm 102 which is now held in its raised position as previously described. The pulley 6 and its integrally formed disk clutch 7 are constantly rotating as previously described and as

the pulley 8 is forced into engagement with the rotating clutch 7 by arm 131, rotation is now transmitted to the pulley 8 and this rotation is transmitted to the pulley 10 on the spindle shaft 11 by means of the belt 12.

I provide a brake 140 for the pulley 10 on the spindle shaft 11 which comprises an arcuate shaped portion 141 pivotally secured to lugs 142 integrally formed with the housing H.

The arcuate shaped portion 141 is provided with an integrally formed arm 143 which is connected to a link 144 secured to the arm 102. The link 144 is provided with a bifurcated end 145 which straddles the arm 102 and is pivoted thereto by a pivot pin 146. The other end of the link 144 is provided with a pair of integrally formed lugs 147 between which the arm 143 of the brake 140 rests and is held against displacement by means of a threaded member 148 secured to the upper lug of the link 144. As the arm 102 is raised as previously described the link 144 which is connected to the arm 102 with the arm extension 143 of the brake 140 is also raised causing the arcuate face 141 of the brake 140 which is suitably lined with a brake lining to disengage the face of the pulley 10 and as motion is now transmitted to the pulley 10 on the spindle shaft 11 the same may now rotate freely. The spindle shaft 11 also rotates and through the agency of the worm 30 on the shaft 11 and the worm gear 31 and gears 33, 34 and 40 motion is transmitted to the transverse shaft 41. The transverse shaft 41 through the agency of its bevel gear 43 and bevel gear 46 now transmits motion to the shaft 45 loosely supporting the drum D. The arm 51 which is secured to the shaft 45 rotates with the same and being in engagement with the lug 53 secured to the inner circumferential face of drum D motion is transmitted to the drum D. The drum D starts to rotate and as the cam follower 18 on the feeder bracket T is in engagement with the face 64 of the cam 15 on the drum D the feeder bracket T is forced to the right with reference to Fig. 2 against the tension of the spring 61 on the rod 62.

The resistance units of rheostats in general use comprise a narrow strip of insulation material upon which the resistance wire is wound. The strip of insulation material is of a predetermined width, length and thickness around which the resistance wire is wound to form a unit of a predetermined resistance and I have therefore designed the winding machine of my invention to wind resistance units of this type.

The cap 27 secured to the threaded portion 25 of the spindle shaft 11 is provided with a cross shaped opening which registers with the slots 78 and 79 in the chuck 29 in the spindle shaft 11. These slots 78 and 79 are of a size to receive a strip of this insulating material and it is inserted until its one end abuts against the end of the cross shaped feeding member 86 rotatably secured to the feeder bracket T and which enters the chuck 29 as previously described. The other end of the insulating strip 150 as shown in dotted lines in Fig. 9 extends slightly beyond the cap 27 to permit the resistance wire to be secured thereto.

In Fig. 9 I show the mechanism that is adapted to receive the strip of fibre with the resistance unit wound thereon as it is forced out of the slots 78 or 79 of the winding spindle. The rod 210 which is attached to the housing has attached thereto a bracket 211. The bracket 211 is provided with an orifice in which is a rod 212. The rod 212 has an orifice therethrough somewhat larger than the diameter of the fibre strip that receives the resistance winding. In this orifice is a plunger 214 which has attached thereto a rotatable cup shaped member 215. Back of the plunger 214 is a compression spring 216. The rod 212 has a slot 217 therein which cooperates with a pin 218 in the bracket 211.

To insert a strip of fibre in my device the rod 212 is rotated slightly and moved to the right in Fig. 9. The strip 150 is then inserted in one of the cross slots in the rotating spindle, the arm 202 being out of its normal position. The wire is then connected to the protruding end of the fibre strip and the arm 202 moved back into position with the wire held taut between the fibre face 203 of arm 202 and the face of member 27. The rod 212 is then moved back into position with the protruding end of strip 150 resting in the cup shaped member 215. As the strip 150 is gradually fed out of the rotating spindle it presses against cup 215 moving the plunger 214 to the right against the tension of spring 216. When the machine automatically stops the rod 212 is rotated slightly and moved to the right so that the projecting wound strip of fibre 150 may be removed from the machine and another one placed therein.

Returning to the operation of the machine the drum D is rotated as before described and as the cam follower 18 on the feeder bracket T is in engagement with the cam face 64 of the cam 15 on the drum D, this rotation of the drum D causes the feeder bracket T to be moved to the right with reference to Fig. 2. The spindle shaft 11 and the chuck 29 keyed thereto and the feeding member 86 rotate as a whole and the movement of the feeder bracket T to the right causes the feeding member 86 to be moved to the right in addition to its rotary motion. This movement to the right of the feeding member 86 forces the insulation strip 150 to the right at a predetermined rate to place the required number of turns

of resistance wire on the insulating strip 150 for a predetermined ohmic resistance.

As the drum D continues its rotation the plunger 114 slidably supported in the ends 47 and 48 of the drum D engages the cam face 113 on the member 112 secured to the arm 110 causing the plunger 114 to be forced to the left with reference to Fig. 5 against the tension of the spring 115. The instant that the drum D has made a revolution the stop 151 on the feeder bracket T engages the arm 110 pivotally secured to the bracket 100 and moves the same to the right against the tension of the spring 121 until the edge 152 of the arm 110 disengages the notch 122 in the member 123 in which it rested. The instant that the drum D has made a revolution the plunger 114 in the drum D has also passed below the edge 153 of the cam face 113 permitting the spring 115 to again move the plunger 114 to its normal position as illustrated in Fig. 5. The movements of the plunger 114 and the arm 110 take place simultaneously and as the arm 110 has been moved to disengage the notch 122 in the member 123 the arms 110 and 102 are free to be restored to normal through the agency of the spring 105 secured to the free end 104 of the arm 102. The arm 102 is moved down under the influence of the spring 105 and as the arm 110 is pivotally secured to the bracket 100 this arm 110 is also moved down under the influence of the spring 105. As the arm 110 moves down under the influence of the spring 105 the member 112 secured to the arm 110 strikes the end of the plunger 114 which is now beneath this member 112 a sharp blow causing the drum to rotate a slight degree and independent of the shaft 45 upon which it is loosely supported. This additional movement of the drum D caused by the arm 110 striking the plunger 114 causes the cam face 64 of the cam 15 on the drum D to be moved beyond the cam follower 18 and with the cam follower 18 on the feeder bracket T free of the cam face 64, the feeder bracket T is in a position to again move to the left under the influence of the spring 61, on the rod 62 which spring 61 was placed under tension when the feeder bracket T moved to the right.

The return movement of the feeder bracket T is controlled by a suitable check 160 which comprises a piston 161 secured to one end of a rod 162, which fits in a suitable cylinder 163 secured to the bracket 60. The other end of the rod 162 is secured to the feeder bracket T and as the same returns to its starting position under the influence of the spring 61 the piston 161 in the cylinder 163 permits the feeder bracket T to restore to normal gradually, the speed of return being governed by the size of the the opening 165 in the end of the cylinder 163 for the escape of air as it is compressed by the returning piston 161.

The movement of the drum D caused by the arm 110 engaging the end of the plunger 114 to release the feeder bracket T causes the lug 53 secured to the drum D to disengage the arm 51 secured to the shaft 45 upon which the drum D is loosely supported. This movement of the drum D places the spring 54 under additional tension and immediately returns the drum D to normal position with the lug 53 again engaging the arm 51 on the shaft 45. The feeder bracket T having restored to its normal position permits the cam follower 18 on the feeder bracket T to again engage the face 64 of the cam 15 and the feeder bracket T and drum D are now in position to complete another cycle of operation.

The arm 102 in its downward movement causes the adjustable stop 170 on the bottom of the arm 102 to engage the lever 136 and force it down against the tension of the spring 140 and when the nose 139 of the lever 136 passes the shoulder 138 on the arm 131 the arm 131 is free to move about its pivot 133, to release the pressure that forced the pulley 8 into engagement with the clutch disk 7. The pulley 6 and its integrally formed clutch disk 7 continue to rotate but as the pulley 8 has disengaged the clutch disk 7 it discontinues its rotation.

The link 144 which connects the arm 102 with the arm 143 of the brake 140 is also moved down when the arm 102 starts its downward movement, causing the upper lug 147 of the link 144 to engage the arm 143 of the brake 140 and move it downward. The arcuate face 141 of the brake 140 is now moved into engagement with the face of the pulley 10 on the shaft 11 and pressure is applied to the brake face by a spring 175 having one end secured to the arm 143 of the brake 140 and its other end secured to suitable fastening means which checks the rotation of the spindle shaft 11. The downward movement of the arm 102 also engages the rack 289 which was moved up when the starting lever L was actuated and restores the same, and this movement of the rack 289 also returns the pivoted member 91 which is in mesh with the rack 289.

The drum D is now restored to its normal position under the influence of the spring 54 and the feeder bracket T is also restored to its starting position with the cam follower 18 in engagement with the face 64 of the cam 15 on the drum D. The feed member 86 has also been carried to its starting position by the feeder bracket T and with the other mechanism restored as described above the machine is ready to start another cycle of operation. The strip of insulation 150 upon which the wire has been wound having been forced out at a predetermined rate

by the feed member 86 is now removed by the operator after the end of the wire is suitably secured to the strip 150 and another strip 150 is now inserted in the slots 78 or 79 of the chuck 29 and the end of the wire secured to the strip and the starting lever L again moved to the right to cause the mechanism to function in the same manner as just described.

The source of wire supply is suitably supported by a tension device as illustrated and described in a copending application filed February 2, 1925, and bearing Serial No. 6,959.

It is also readily apparent that resistance units of varying resistances may be wound by changing the gearing ratio of the train of gearing in the housing H thus providing a machine which is very flexible.

From the foregoing it is apparent that all that is necessary for the operator of my machine to do is to insert the strip of material in the chuck of the machine, to fasten the wire thereto and to pull the lever to the right to start the machine in operation. The machine automatically stops itself after automatically placing the predetermined number of turns of wire upon the strip.

While I have illustrated and described a preferred form of my invention it is readily apparent that changes and modifications will suggest themselves to those skilled in the art and I therefore do not wish to be limited to the exact structure as shown but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent is:

1. A winding machine including a rotating spindle, a coil receiving member supported by said spindle, a strand of material adapted to be wound upon said coil receiving member, and automatic means including a rotatable cam adapted to engage a feeding bracket associated with a feeding bar adapted to enter said spindle to engage the said coil receiving member for moving said coil receiving member relative to said strand of material to space the strand of material upon said coil receiving member.

2. A winding machine including a winding spindle, a coil receiving member supported by said spindle, a strand of material adapted to be wound upon said coil receiving member, automatic means including a rotatable cam adapted to engage a feeding bracket associated with a feeding bar adapted to enter said spindle to engage one end of the said coil receiving member for moving said coil receiving member to space the strand of material upon said coil receiving member, and means for automatically stopping the rotation of said winding spindle when a predetermined number of turns of said material has been placed upon said coil receiving member.

3. A winding machine including a winding spindle adapted to be rotated, a coil receiving member supported by said winding spindle, a strand of material adapted to be wound upon said coil receiving member, means including a rotatable cam adapted to engage a feeding bracket associated with a feeding bar adapted to enter said spindle to engage one end of the said coil receiving member for longitudinally advancing said coil receiving member relative to said winding spindle and said strand of material to space said strand of material upon said coil receiving member.

4. A winding machine including a windnig spindle adapted to be rotated, a coil receiving member supported by said winding spindle, a strand of material adapted to be wound upon said coil receiving member, means including a rotatable cam adapted to engage a feeding bracket associated with a feeding bar adapted to enter said spindle to engage one end of the said coil receiving member for longitudinally advancing said coil receiving member relative to said winding spindle and said strand of material to space said strand of material upon said coil receiving member, and automatic means for stopping the rotation of said winding spindle.

5. A winding machine including a winding spindle adapted to be rotated, a coil receiving member supported by said winding spindle, a strand of material adapted to be wound upon said coil receiving member, means for longitudinally advancing said coil receiving member relative to said winding spindle and said strand of material to space said strand of material upon said coil receiving member, an automatic means for stopping the rotation of said rotating spindle, and means including a train of gears, an adjustable support for one of said gears whereby different sized gears may be inserted for varying the spacing of the windings of said strand material on the said coil receiving member.

6. A winding machine including a rotating spindle, a coil receiving member adapted to be inserted into said spindle, a strand of material adapted to be wound upon said coil receiving member, and automatic means including a rotatable cam adapted to engage a feeding bracket associated with a feeding bar adapted to enter said winding spindle to engage one end of said coil receiving member for feeding said coil receiving member out of said spindle as said strand of winding material is placed upon said coil receiving member.

7. A winding machine including a rotating spindle, a coil receiving member adapted to be inserted into said spindle, a strand of

material adapted to be wound upon said coil receiving member, automatic means including a rotatable shaft, a cam supported by said shaft, an arm rotatably secured to said shaft and adapted to engage means affixed to said cam whereby the said cam may be rotated to operate a feeding bar for feeding said coil receiving member out of said spindle as said strand of winding material is placed upon said coil receiving member, and means for automatically stopping the rotation of said winding spindle and the advancement of said means which advances the coil receiving member.

8. A winding machine including a rotating spindle, a coil receiving member adapted to be inserted into said spindle, a strand of material adapted to be wound upon said coil receiving member, automatic means for feeding said coil receiving member out of said spindle as said strand of winding material is placed upon said coil receiving member, and means including a chuck for receiving the protruding end of said coil receiving member and a slidable support for said chuck for confining the rotation of the protruding end of said coil receiving member to a single horizontal plane.

9. A winding machine including a rotating spindle, a coil receiving member adapted to be inserted into said spindle, a strand of material adapted to be wound upon said coil receiving member, automatic means for feeding said coil receiving member out of said spindle as said strand of winding material is placed upon said coil receiving member, a chuck for receiving the protruding end of said coil receiving member, a slidable support for said chuck, said chuck and support adapted to confine the rotation of the protruding end of said coil receiving member to a single horizontal plane and means for resetting the machine ready for reoperation by a single movement.

10. A machine of the character described including a spindle shaft and power means for driving the same, a cam shaft supporting a cam, gearing mechanism associated with said spindle shaft for rotating said cam shaft, a chuck in said spindle shaft, and a feeding bracket rotatably supporting a feeding bar extending into said chuck, said cam acting upon said feeding bracket to longitudinally move said feeding bar a predetermined distance through said chuck.

11. A machine of the character described including a spindle shaft and power means for driving the same, a cam shaft loosely supporting a cam, gearing mechanism associated with said spindle shaft for rotating said cam shaft, means associated with said cam and said shaft for rotating said cam, a chuck secured in said spindle shaft, and a feeding bracket rotatably supporting a feeding bar extending into said chuck, said cam acting upon said feeding bracket to longitudinally move said feeding bar a predetermined distance through said chuck.

12. A machine of the character described including a spindle shaft and power means for driving the same, a chuck secured in said spindle shaft, a cam shaft and a cam loosely supported thereon, a train of gearing associated with said spindle shaft for rotating said cam shaft, means associated with said cam and said shaft for rotating said cam, a feeding bracket rotatably supporting a feeding bar extending into said chuck, said cam acting upon said feeding bracket to move said feeding bar longitudinally through said chuck, and means on said feeding bracket to control the amount of longitudinal movement of said feeding member in said chuck.

13. A machine of the character described including a spindle shaft and power means for driving the same, a chuck secured in said spindle shaft, a cam shaft and a cam loosely supported on said cam shaft, a train of gearing associated with said spindle shaft for rotating said cam shaft, means on said cam shaft for rotating said cam, a feeding bracket and a feeding bar rotatably supported thereon and extending in said chuck, said cam acting upon said feeding bracket to move the same longitudinally to move the feeding bar through said chuck at a predetermined rate, and tripping means actuated by said feeding bracket to arrest the rotation of said spindle shaft and said cam after said bar has moved into said chuck a predetermined distance.

14. A machine of the class described including a spindle shaft and a chuck secured in said spindle shaft, power means for driving said spindle shaft, a cam shaft and a cam supported thereon, a train of gearing associated with said spindle shaft for rotating said cam shaft, a feed bracket and a feed bar rotatably supported thereon and extending into said chuck, a strand of wire and a core in said chuck adapted to receive said wire, said cam acting upon said feed bracket to move the same longitudinally to move said feed bar through said chuck at a predetermined rate to force said core from said chuck to receive a predetermined number of convolutions of said strand of wire.

15. A machine of the class described including a spindle shaft and a chuck secured in said spindle shaft, power means for driving said spindle shaft, a cam shaft and a cam supported thereon, a train of gearing associated with said spindle shaft for rotating said cam shaft, a feed bracket, a feed bar rotatably supported by said feed bracket extending into said chuck, said cam acting upon said feed bracket to move the same longitudinally to move said feed bar through

said chuck, and trip means controlled by said feed bracket actuated upon the completion of a revolution of said cam to arrest the rotation of said spindle shaft and said cam.

16. A machine of the class described including a spindle shaft and a chuck secured in said spindle shaft, power means for driving said spindle shaft, a cam shaft and a cam loosely supported thereon, a train of gearing associated with said spindle shaft for rotating said cam shaft, means on said cam shaft for rotating said cam, a feed bracket, and a feed bar rotatably supported by said feed bracket extending in said chuck, said cam acting upon said feed bracket to move the same longitudinally to move said feed bar through said chuck, trip means controlled by said feed bracket actuated upon the completion of a revolution of said cam to arrest rotation of said spindle shaft and said cam, said trip means releasing said feed bracket from said cam to permit the same to restore and again engage said cam.

17. A machine of the class described including a spindle shaft and a chuck secured in said spindle shaft, power means for driving said spindle shaft, a cam shaft and a cam loosely supported thereon, a train of gearing associated with said spindle shaft for rotating said cam shaft, means on said cam shaft for rotating said cam, a source of supply material and a core adapted to be received in said chuck upon which said material is wound, a feed bracket, a feed bar rotatably supported by said freed bracket extending into said chuck, said cam acting upon said feed bracket to move the same longitudinally to cause said feed bar to engage said core and force the same out of said chuck at a predetermined rate to receive a predetermined number of convolutions of wire during the completion of one revolution of said cam, and trip means controlled by the feed bracket and actuated upon the completion of the revolution of said cam to arrest the rotation of said spindle shaft and said cam and longitudinal movement of said feed bar.

18. A winding machine including a rotating spindle, a coil receiving member adapted to be inserted into said spindle, a strand of material adapted to be wound upon said coil receiving member, automatic means for feeding said coil receiving member out of said spindle as said strand of winding material is tightly placed upon said coil receiving member, means for confining the rotation of the free end of said coil receiving member, means for automatically stopping the rotation of said winding spindle, and automatic means for preparing the machine for subsequent operation.

19. A winding machine of the character described including a rotating spindle, a coil receiving member carried by said spindle, a spool of winding material, means for rotating and longitudinally moving said coil receiving member to receive a coil of winding material from said spool, automatic means for stopping rotation of said spindle, and means for preparing said machine for a subsequent operation.

In testimony whereof I have signed this specification.

MARTIN B. GROUT.