

May 26, 1931.

R. DEAR

1,807,199

WINDING DEVICE

Filed Nov. 14, 1928

3 Sheets-Sheet 1

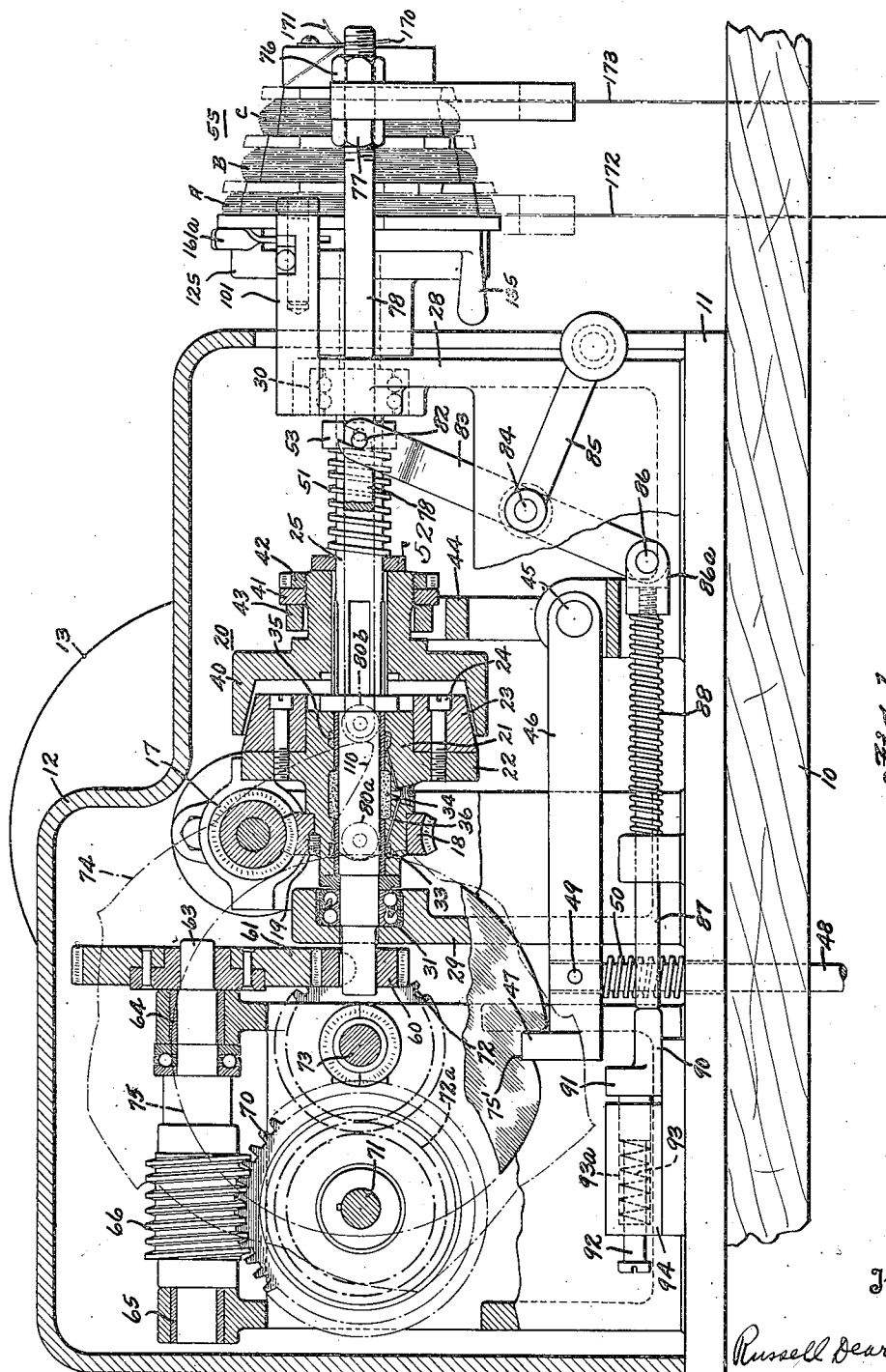


Fig. 1

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3 Sheets-Sheet 2

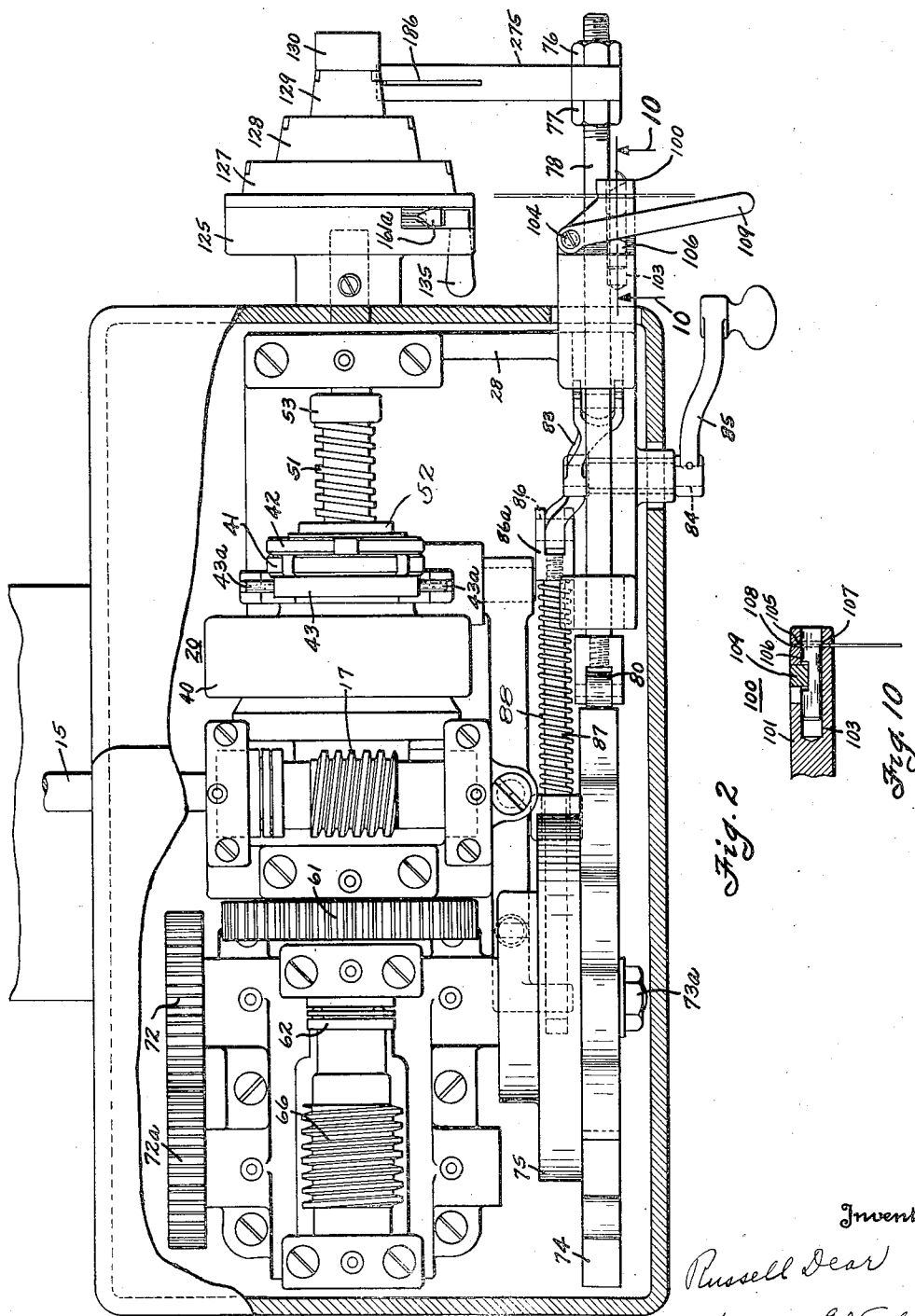


Fig. 2

Fig. 10

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3 Sheets-Sheet 3

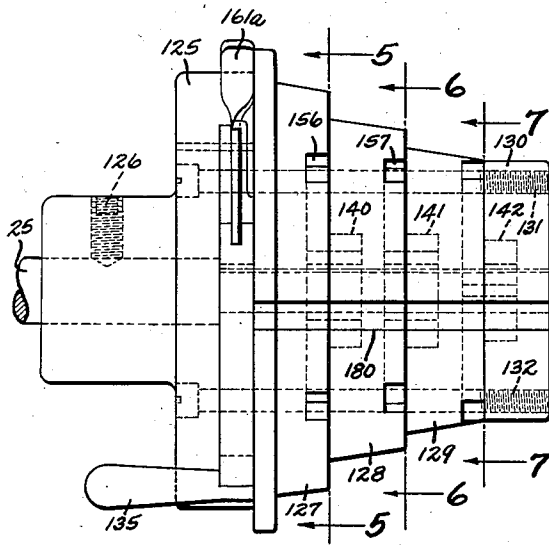


Fig. 3

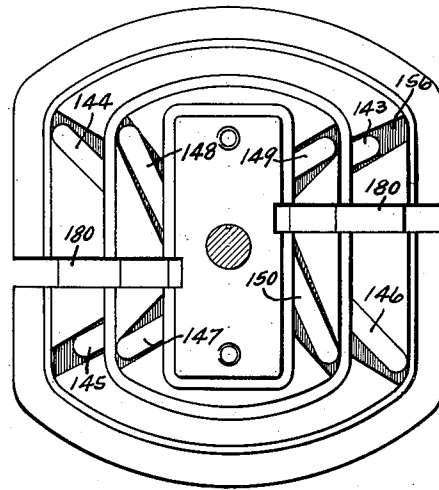


Fig. 4

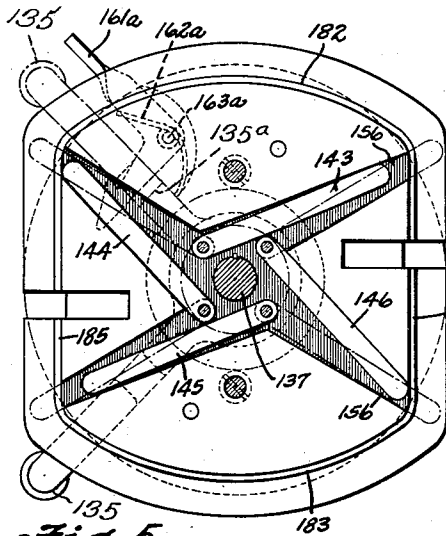


Fig. 5

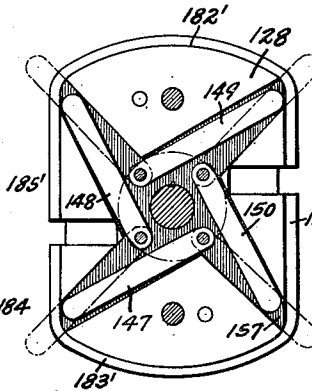


Fig. 6

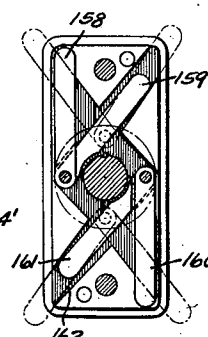


Fig. 7

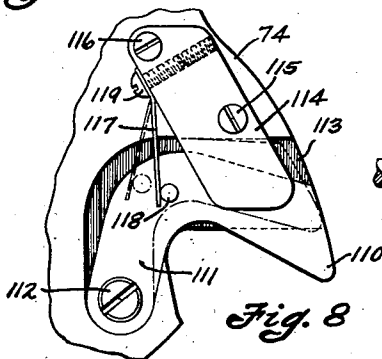


Fig. 8

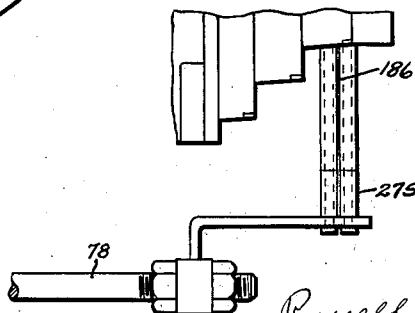


Fig. 9

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UNITED STATES PATENT OFFICE

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WINDING DEVICE

Application filed November 14, 1928. Serial No. 319,367.

This invention relates to improvements in a device for winding a plurality of coils consecutively.

An object of this invention is to provide a machine which will reduce the cost of manufacturing stator coils and at the same time produce a better coil by eliminating manual labor to a minimum and increasing the rate of production. This is accomplished by providing a reel assembly for forming the coils which has stepped bases with collapsible arms or fingers adjacent each base which permit the removal of the wound coils when the arms are collapsed without disassembling the reel assembly, by providing an improved wire guiding or feeding means which feeds the wire to each base in sequence, by providing an improved driving mechanism for the coils, and by providing an improved wire cutting and holding device.

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 side elevation, certain parts being shown in section, more clearly to illustrate interior mechanisms.

Fig. 2 is a plan view of the device with parts of the cover cut away to show certain parts of the device.

Fig. 3 is a side view of the reel assembly or form.

Fig. 4 is an end view of the reel assembly or form.

Figs. 5, 6 and 7 are cross sectional views taken on the sectional lines 5-5, 6-6 and 7-7 respectively of Fig. 3.

Fig. 8 is a detail view of part of a cam for controlling the wire guiding or feeding device.

Fig. 9 is another modification of the feed-

ing device. Fig. 10 is a sectional view of the wire cutting and holding device.

The reference numeral 10 indicates a table or any other suitable support for the device. The removable casing or cover 12 is mounted upon a suitable base 11. An electric motor 13 is mounted on an upright support integral with the base, of which 15 is the armature shaft prolonged, which extends into the casing or cover 12 and is properly supported therein. Keyed to shaft 15 is a worm 17 meshing with a worm gear 18 which is keyed by key 19 to a sleeve 21 which forms part of a clutch 20 and is freely rotatable with the shaft 25.

Integral with the sleeve 21 is a flange 22 which has attached thereto by bolts 24 a conical shaped member 23 which forms the internal cone shaped member of the cone clutch 20. The shaft 25 is supported on uprights 28 and 29 integral with the base 11 in suitable bearings 30 and 31, which are mounted upon the uprights 28 and 29 respectively. Oil is supplied to the sleeve 21 and the shaft 25 by means of felt rings 33, 34 and 35, which receive oil from the ducts 36. Member 40, which forms the external and the movable part of the clutch, is splined on the shaft 25. A couple of collars or lock nuts 41 and 42 are secured on the one end of the sleeve portion of member 40. A freely movable collar 43 on the sleeve engages the yoke member 44 by a couple of studs 43a (see Fig. 1). As this does not form part of the invention, a detailed showing is not deemed necessary, it being all conventional. A stub shaft or pintle 45 is fixedly attached to the yoke 44 and to the arm 46, having an upright 47 mounted thereon. The purpose of upright stop 47 will appear later. Member 48 is a vertical connecting rod which connects a lever or a treadle (not shown) to arm 46 by means of pin 49. Between members 46 and the base 11 a spring 50 is seated about the connecting rod 48 to maintain the clutch in the dis-

engaged position as disclosed in Fig. 1. Spring 51 is mounted on the shaft 25 abutting against the collar 53 which is keyed to the shaft 25 thereby urging the movable clutch member to the left as viewed in Fig. 1. A slidable collar 52 is mounted between the spring 51 and the clutch member 40. On one end of the shaft 25 there is mounted a winding reel assembly 55. This will be described in detail later.

Keyed to the other end of shaft 25 is a gear 60 meshing with gear 61 which is keyed to a shaft 63 mounted in bearings 64 and 65. The shaft 63 has a worm 66 keyed thereto meshing with the worm gear 70 keyed to the shaft 71. On the end of shaft 71 is keyed a gear 72a which meshes with a similar gear 72 keyed to the shaft 73. On the shaft 73 there are two cams 74 and 75 as best seen in Fig. 2. Cams 74 and 75 are held on the shaft 73 by a suitable nut 73a, best seen in Fig. 2. The cam 74 has an irregular cam surface designed to operate the wire guiding member 275 which is attached to the square rod 78 by means of nuts 76 and 77 engaging threads on a turned end of this rod. On the other end of rod 78 there is mounted a roller 80 which cooperates with the cam 74 to urge the feeding mechanism to the right as viewed in Figs. 1 and 2. Lever 83 slidably engages a pin 82 which is inserted through an aperture in the rod 78. This lever 83 is keyed to a stub shaft 84 which is pivoted in a suitable support integral with the base. Also keyed to the stub shaft 84 is a lever 85 to be operated by the operator, the purpose of which will appear later. An aperture is provided near the other end of lever 83, into which a stub shaft 86 is mounted. On one end of rod 87 is mounted the yoke 86a which engages the stub shaft 86. A spring 88 or a suitable weight (not shown) is provided to urge member 86a to the right, thereby biasing lever 83 in a counter-clockwise direction as viewed in Fig. 1 so as to urge roller 80 against the cam 74. The other end of 87 abuts against member 90 which is slidably mounted in support 94 integral with the base 11 by means of bolt 92. Mounted on the bolt 92 in a recess 93a in the support 94 is a spring 93 urging member 90 against member 87.

In Fig. 1 it is seen that when roll 80 is in the broken line position as indicated by 80a, it cannot be moved to the position 80b because of the projection 110 of cam 74, unless suitable means is provided to facilitate the movement of the projection 110. This is overcome by the structure disclosed in Fig. 8, which is a portion of the cam 74. Member 111 is a movable cam sector pivoted at 112 and urged in a clockwise direction by spring 117 engaging the stud 118 provided on member 111. Spring 117 is attached by a suitable screw 119 to the retainer 114 which is rigidly mounted on cam 74 by means of screws

115 and 116. The cam segment is moved counter-clockwise when roll 80 is moved toward the right by the operator turning lever 85 in a clockwise direction as viewed in Fig. 1. The cam segment 111 moves into the dotted position shown in Fig. 8 in the recess 113. Now as the roll 80 clears the extreme point 110 of the cam sector 111, the cam sector immediately snaps back into the position shown in full lines, thereby preventing roll 80 from moving into the position indicated by 80a.

The stop 91 prevents the operator actuating the clutch engaging rod 48 by the lever or treadle (not shown) before the cam following roll 80 has been moved from the position 80a to 80b. That is when the roll 80 is in the position 80a, the upright stop 91 will abut against arm 46, thereby preventing the operator engaging the clutch members until roll 80 is in the position 80b. This upright stop 91 therefore is a safety device preventing the operator from actuating levers 85 and the treadle in the inverse order.

Supported on the upright 28 is a wire cutter and holder 100, comprising a frame 101 having an aperture 103 supporting a reciprocating knife 106 which cooperates with the stationary blade 105 integral with frame 101 to sever the wire and which cooperates with the edge 107 to hold a wire after it has been cut and until it is attached to the reel assembly. The reciprocating knife 106 is actuated by a lever 109 pivotally mounted at 104 to the support 101.

The form or reel assembly 55 comprises a collar 125 keyed by means of a set screw 126 to the shaft 25. On one side of the collar 125 there are mounted the form segments 127, 128 and 129 which are held together by means of bolts 131 and 132 screw-threaded into the end pieces 130.

Two of these segments have each a pair of surfaces 182 and 183, and 182' and 183' which have the shape of a frustro-conical sector and a pair of flat inclined surfaces 184 and 185, and 184' and 185'. As these segments have been designed as the forms for stator windings, it is desirable to have two sides of the coils straight and the two ends curved. The two reasons why the flat surfaces are inclined and why the curved surfaces taper, are that this arrangement permits the removal of the coil when the arms 143 et seq. are retracted and that this is the ideal shape for each of the coils which are to be used as a stator winding. Handle 135 is keyed to the reduced end of shaft 25 which is designated by the numeral 137 which has keyed thereto a plurality of disc or collar members 140, 141 and 142. Handle 135 has an opening 135a therein provided for purposes to be described. Disc 140 has pivotally attached thereto the movable or collapsible arms 143, 144, 145 and 146 which operate in the grooves

156 so as to lie substantially in radial relation when extended and substantially in a tangential relation when retracted as lever 135 is rotated. On the disc 141 there are mounted the arms 147, 148, 149 and 150 which operate in the slots or grooves 157 in member 128. On disc 142 are mounted the arms 158, 159, 160 and 161 which operate in the grooves 162. By rotating lever 135 in a clockwise direction as seen in Fig. 5, each of the collapsible arms are moved outwardly into the position disclosed by the dotted lines in each of Figs. 5, 6 and 7. When the lever 135 is moved in a clockwise direction to the position indicated by dotted lines in Fig. 5, it is locked in this position by means of a latch or lever 161a mounted on the pin 163a and spring urged by spring 162a, said latch entering the opening 135a in the handle 135 and engaging the edge thereof to hold said handle in this dotted line position in which it will maintain all the arms in the extended position.

The operation of the device is as follows:

Assuming the coils A, B and C as disclosed in Fig. 1, have been removed from their respective forms and that the device is in position ready to start winding a new set of coils, the wire 172 which is held by the wire holding device 100 is released and moved into the position 173 up over the reel for coil C over one of the arms extended and down and under the wire holding clip 170 into the position 171. Before the winding of the coils is started, the wire must be inserted between the feeding slot 186 in member 275. As soon as the wire has been placed in position, the operator actuates the lever or the treadle which operates rod 148 to engage the clutch 20. As soon as the clutch is engaged, a rotary movement will be imparted to the reel assembly from the motor 13 and to the two cams 74 and 75. Cam 74 actuates the feeding device 275 to first feed wire to coil C, then after coil C has been completed, to coil B, and when coil B has been completed, to coil A until it is completed. All of these coils are wound during the rotation of cams 74 and 75 through one revolution. As soon as cam 75 has made one revolution, member 47 is moved into the recess 75' in the cam 75 by spring 50, thus disengaging the clutch. Member 47 not only permits the clutch to disengage, but acts as a positive stop for the entire moving mechanism, thus insuring the device stopping after a predetermined number of revolutions.

The wire is now in the position 172 and is ready to be cut. To do this it is placed into the slot 108 where it is severed and where it is held until again needed. Before the arms are retracted, a wire or any other suitable fastening in wrapped around each of the coils. In order to facilitate the wrapping of the wire about each of the coils, a groove 180 is provided in each of the sectors. This permits

the wire used in wrapping to be inserted under the coil through this groove 180. After the coils have been wrapped or tied together, lever 135 is rotated in a counter-clockwise direction as shown in Fig. 5 after the latch 161a has been released. This rotation of lever 135 retracts or collapses the arms, thereby permitting removal of the coils by the operator. Before another set of coils can be wound, it is necessary to actuate lever 85 in a clockwise direction as seen in Fig. 1 so as to move roll 80 from the position 80a to the position 80b.

This places the feeding device back in position ready to rewind another set of coils, as already set forth.

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. A form for winding a plurality of coils, comprising, in combination, a plurality of form sectors, each adapted to have a coil wound thereon, a plurality of arms extending radially from each of said form sectors, and means for simultaneously moving the arms of all of said sectors to permit the removal of the wound coils.

2. A reel assembly for forming a plurality of coils wound from wire, comprising, in combination, means upon which the coils are formed consisting of a plurality of stepped base portions, one base for each coil, retaining means at each end of each of said base portions, certain of said retaining means being adapted to be retracted thereby permitting the removal of the wound coils from the base portions, and, means adapted simultaneously to operate all of said retractable retaining means.

3. A reel assembly for forming a plurality of coils, comprising, in combination, a plurality of base portions concentrically mounted and arranged in stepped relation, a retaining wall at one end of each of said base portions and grooves in the other end of each of said base portions, an arm in each groove, operable to extend from the respective base portions for retaining the coils in position on the respective base portions while being wound, rotary means for retracting all of said arms thereby permitting the removal of the coils when wound without dismantling the reel assembly, and means for locking said rotary means.

4. A reel assembly for receiving convolutions of wire to form a plurality of coils comprising, in combination, a plurality of winding sections each having a pair of inclined flat surfaces diametrically arranged, all of said flat surfaces converging toward the axis of the reel substantially equi-angularly, holding means movably supported in each winding section and arranged to retain the wire

convolutions on the respective winding sections when extended and to provide for the removal of the said convolutions when retracted, rotary means for retracting said holding means, and means for locking said rotary means when in position to maintain the holding means extended.

5. A device for forming a plurality of coils in sequence from a wire comprising, in combination, an assembly of a plurality of reels each consisting of a base portion and means on each side of the base portion for retaining the coil, the means on one side being collapsible to permit the removal of the coil when completed, driving means for said assembly including a clutch, cam means for stopping the clutch after a predetermined number of revolutions of said reel assembly, means for feeding the wire in sequence to each of said reels, cam means for actuating said feeding means, and a safety device for preventing premature engagement of the clutch.

6. A device for winding a stator coil from wire, comprising, in combination, a plurality of collapsible forms, driving means including a clutch for rotating said forms, guiding means for feeding the wire on to the forms, a single cam means so constructed and arranged as to actuate the guiding means to feed the wire to each form in sequence, cam means for disengaging the clutch when a coil has been completely wound on each of the forms and means for preventing the premature engagement of said clutch.

7. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a reel having a plurality of wire receiving sections; means for rotating said reel; means for guiding the wire from one reel section to the other; manually operable means for shifting the wire guiding means into the proper position preliminary to its wire guiding operation; and resiliently urged means for moving said means through its wire guiding cycle.

8. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a reel having a plurality of wire receiving sections; means for rotating said reel; means for guiding the wire from one reel section to the other, and means driven by said reel rotating means for controlling the wire guiding means.

9. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a reel having a plurality of wire receiving sections; means for rotating said reel; means for guiding the wire from one reel section to the other; a manually operable lever adapted to shift the wire guiding means into the proper position preliminary to its wire guiding movement; resilient means engaging said lever and urging it in one direction to move the wire guiding

means; and means operated by the reel rotating means for controlling the operation of the wire guiding means.

10. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a reel having a plurality of wire receiving sections; means for rotating said reel; wire guiding means adapted to be set initially in a proper position preliminary to the winding operation; a spring adapted to move the wire guiding means to shift the wire from one reel section to the other; and means for controlling the operation of said wire guiding means by the spring whereby said wire guiding means will be detained adjacent each reel section properly to supply the respective sections with the required convolutions of wire.

11. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a reel having a plurality of wire receiving sections; means for rotating said reel; means for guiding the wire from one reel section to the other; a lever connected with the wire guiding means, said lever being manually operable to shift said means adjacent one end section of the reel; a spring engaging said lever and urging it to move the said means toward the opposite end section of the reel; and timing means engaging the wire guiding means to control its operation.

12. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a reel having a plurality of wire receiving sections; means for rotating said reel; means for guiding the wire from one reel section to the other; manually operable means for shifting the wire guiding means into the proper position preliminary to its wire guiding operation; resilient means for moving said wire guiding means; and means adapted to render the device operative only after the wire guiding means has been shifted into the said preliminary position.

13. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a drive shaft; a driven shaft; a normally disconnected clutch between said shafts; means manually operable to control the clutch; a winding reel on said driven shaft; a wire guiding member; means for shifting said member into the proper position preliminary to the wire guiding operation; and means adapted to render the clutch controlling means operable only after said wire guiding member has been moved into said preliminary position.

14. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a drive shaft; a driven shaft, a normally disconnected clutch between said shafts; a winding reel upon the driven shaft; a wire guiding member; means under the control of the wire guiding member for con-

trolling the clutch; and means on the drive shaft for operating said clutch controlling means to disconnect the clutch.

15. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a rotatable reel having a plurality of wire receiving sections; a wire guiding means; a cam for controlling the wire guiding means; manually operable means adapted to shift the wire guiding means into a position preliminary to the wire guiding operation; means on the cam adapted to hold said wire guiding means in said position until the machine is started; and a spring engaging the manually operable means to urge the wire guiding means into engagement with the cam.

16. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a rotatable reel having a plurality of wire receiving sections; a wire guiding means; a cam for controlling the wire guiding means; manually operable means adapted to shift the wire guiding means into a position preliminary to the wire guiding operation; a spring loaded latch carried by the cam and adapted to engage the wire guiding means, when it is moved to the position preliminary to the wire guiding operation, and to hold said means in said position until the winding operation is started; and a spring urging the wire guiding means into engagement with said cam.

17. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a rotatable reel having a plurality of wire receiving sections; a wire guiding means; a cam for controlling the wire guiding means, said cam normally holding said wire guiding means in proper alignment with the section of the reel last to be wound; means for shifting the wire guiding means into alignment with the reel section first to be wound; and means carried by the cam for retaining the wire guiding means in alignment with said reel section first to be wound until the main position of the cam is engaged by the wire guiding means.

18. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a rotatable reel having a plurality of wire receiving sections; a wire guiding means; a cam for controlling the wire guiding means, said cam normally holding said wire guiding means in proper alignment with the section of the reel last to be wound; means for shifting the wire guiding means into alignment with the reel section first to be wound; and a spring loaded latch on the cam, automatically responsive to the shifting of the wire guiding means into alignment with the reel section first to be wound, for holding said means in said position until it is engaged by the main body of the rotating cam.

19. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a drive shaft; a driven shaft; a clutch between said shafts, normally disengaged; a winding reel on the driven shaft; a wire guiding means; a clutch operating member; and means adapted to render said clutch operating member ineffective to engage the clutch while the wire guiding means is in one extreme position.

20. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a drive shaft; a driven shaft; a clutch between said shafts, normally disengaged; a winding reel on the driven shaft, having a plurality of wire receiving sections; a wire guiding means normally in alignment with the reel section last to receive wire; a lever engaging the wire guiding means for shifting said means into alignment with the reel section first to receive wire, preliminary to the winding operation; a clutch operating member; and means under control of the aforementioned lever for rendering the clutch operating member ineffective to engage the clutch until said lever is moved to shift the wire guiding means into alignment with the reel section first to receive wire.

21. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a drive shaft; a driven shaft; a clutch between said shafts, normally disengaged; a winding reel on the driven shaft; having a plurality of wire receiving sections; a wire guiding means normally in alignment with the reel section last to receive wire; a lever engaging the wire guiding means for shifting said means into alignment with the reel section first to receive wire, preliminary to the winding operation; a clutch operating member; a block under control of the said lever, for engaging the clutch operating member to prevent its operation into clutch engaging position until the said lever has been moved to shift the wire guiding means into alignment with the reel section first to receive wire; and a cam automatically adapted to operate said clutch operating member into the clutch disengaging position.

22. A device for winding wire to form a plurality of coils in tandem, comprising in combination, a drive shaft; a driven shaft; a clutch between said shafts, normally disengaged; a winding reel on said driven shaft, having a plurality of sections adapted to receive wire; a wire guiding member; a cam controlling the operation of said member, said cam normally maintaining said member in alignment with the reel section last to receive wire; a clutch operating member normally maintaining said clutch in disengaged position; an abutment block normally engaging said clutch operating member to render it inoperative to engage the clutch; a lever, manually operable to shift the wire guiding

means into alignment with the reel section
first to receive wire and to move the abut-
ment block out of engagement with the clutch
operating member to render the same oper-
5 able for clutch engagement; a spring loaded
latch on the said cam automatically oper-
able to maintain the wire guiding means in
alignment with said reel section first to re-
ceive wire until said guiding means is en-
10 gaged by the cam proper; and a second cam
adapted to operate the clutch operating mem-
ber to disengage the clutch at a proper time
in the operation of the device.

In testimony whereof I hereto affix my sig-
15 nature.

RUSSELL DEAR.

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