June 21, 1960 W. W. CLARKE 2,941,734

CONTROL FOR TOROIDAL COIL WINDING MACHINES

Filed April 15, 1957 3 Sheets-Sheet 1

FIG. 1

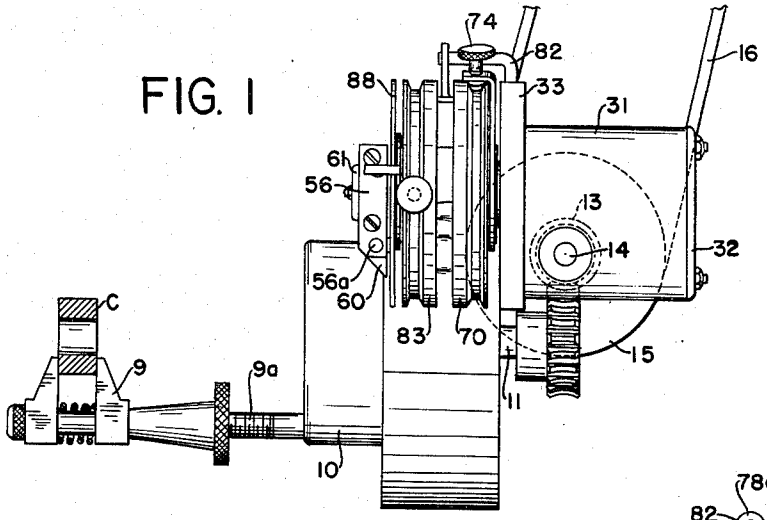


FIG. 2

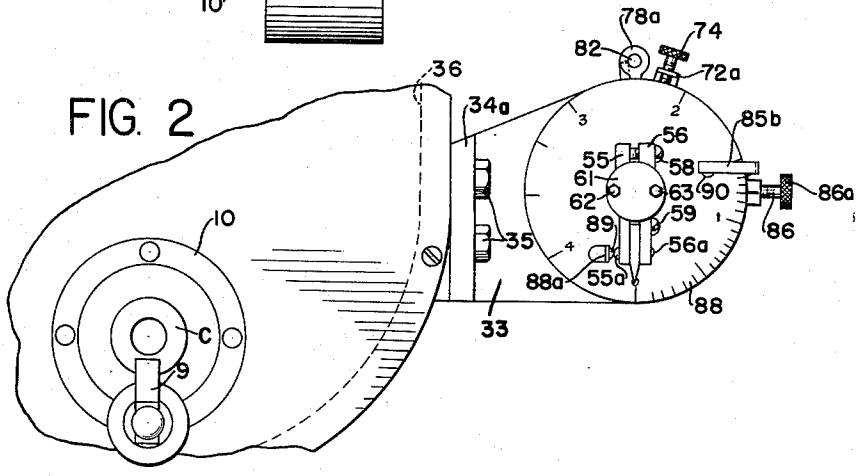
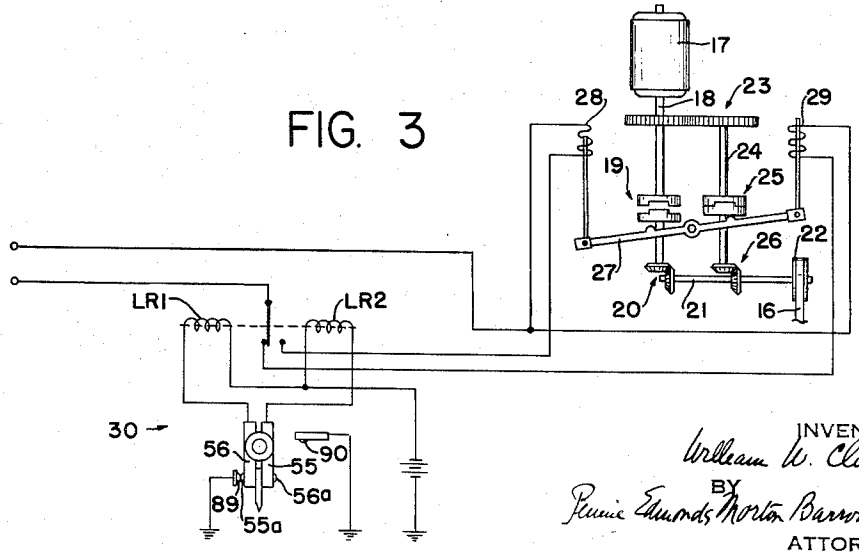


FIG. 3

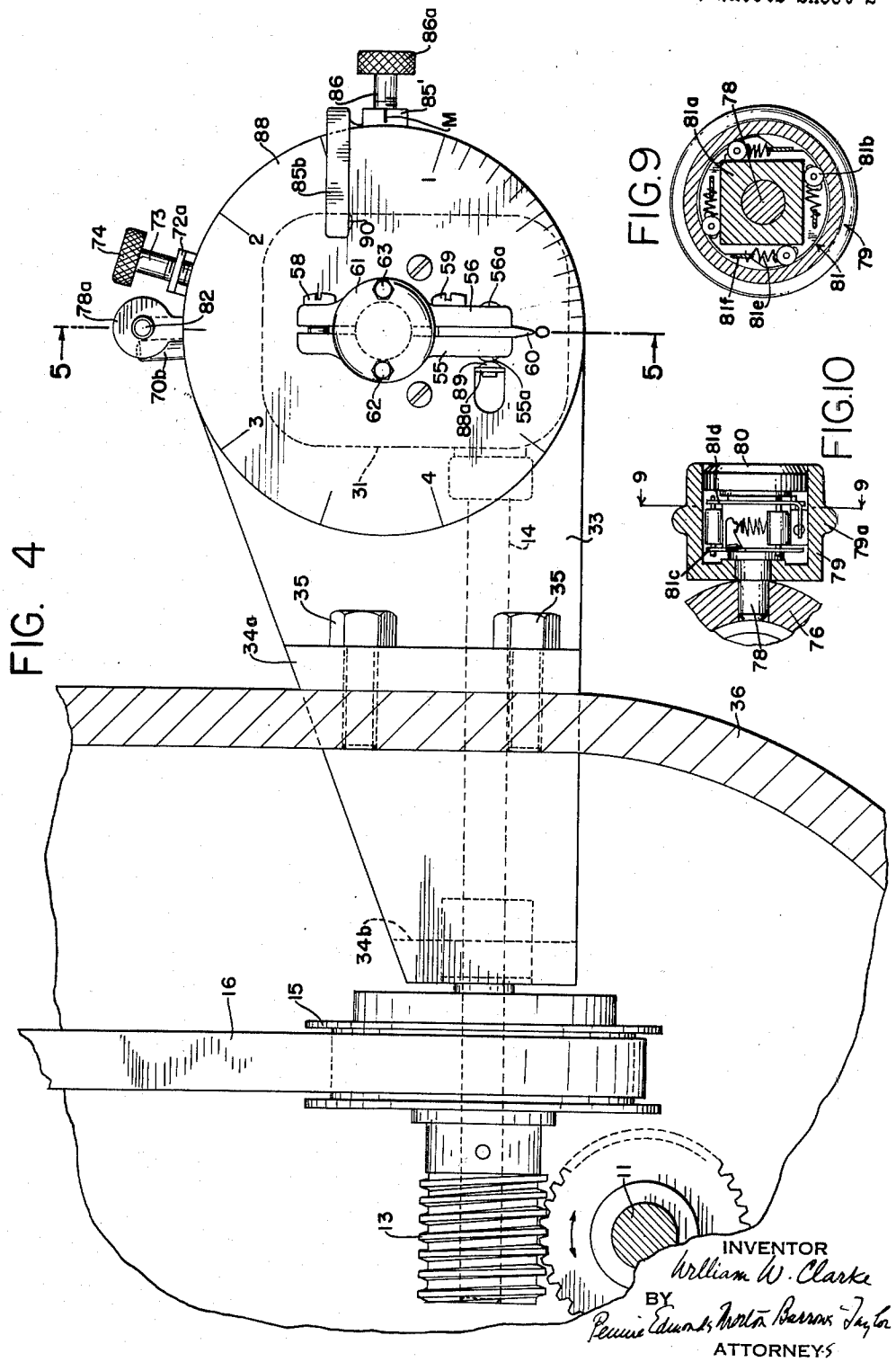


INVENTOR
William W. Clarke
BY
Pennie Edmonds Morton Barrows Taylor
ATTORNEYS

June 21, 1960 W. W. CLARKE 2,941,734

CONTROL FOR TOROIDAL COIL WINDING MACHINES

Filed April 15, 1957 3 Sheets-Sheet 2



June 21, 1960 W. W. CLARKE 2,941,734

CONTROL FOR TOROIDAL COIL WINDING MACHINES

Filed April 15, 1957 3 Sheets-Sheet 3

FIG. 5

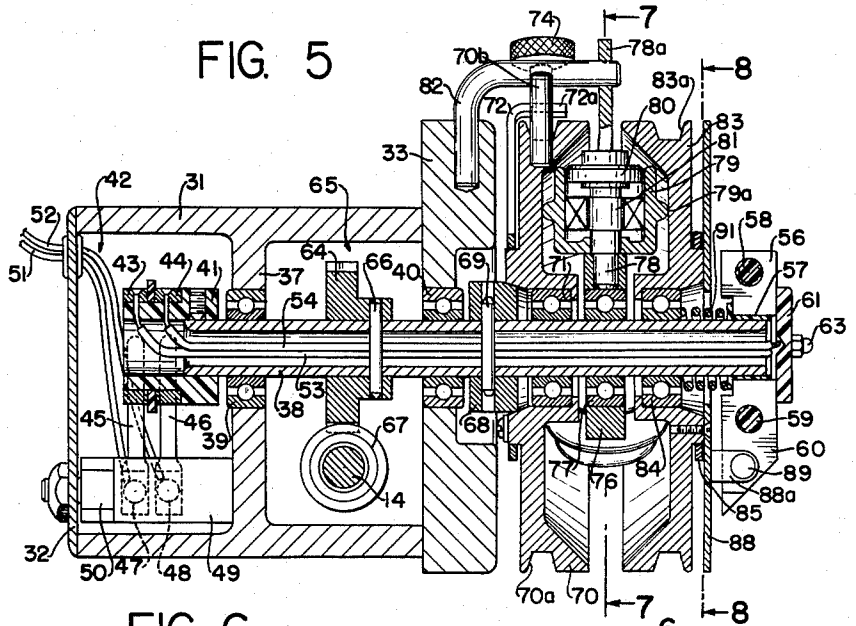


FIG. 6

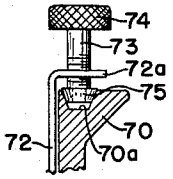


FIG. 7

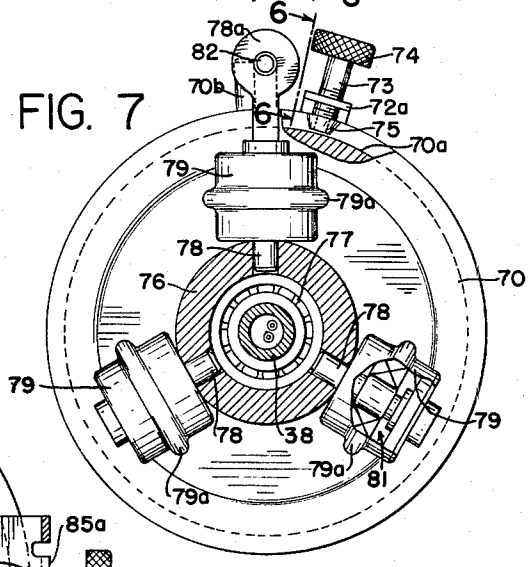
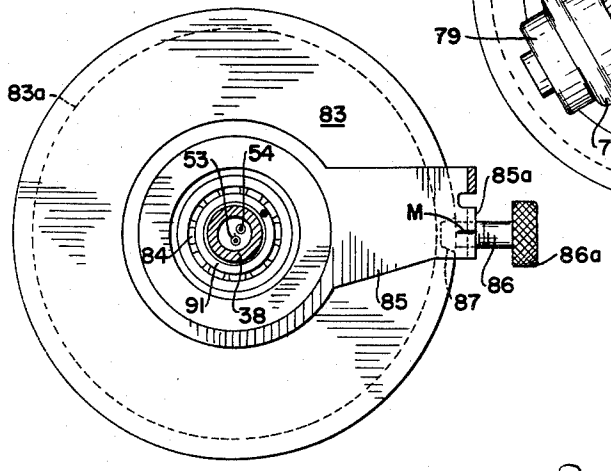


FIG. 8



INVENTOR
William W. Clarke
BY
Bennie Edwards, Morton, Barrows & Taylor
ATTORNEYS

United States Patent Office 2,941,734 Patented June 21, 1960

2,941,734

CONTROL FOR TOROIDAL COIL WINDING MACHINES

William W. Clarke, Brookfield, Conn., assignor to Boesch Manufacturing Co., Inc., Danbury, Conn., a corporation of Connecticut

Filed Apr. 15, 1957, Ser. No. 652,859

11 Claims. (Cl. 242—4)

This invention relates to the winding of toroidal coils and is concerned more particularly with a novel control mechanism for toroidal winding machines of various conventional types. The new mechanism controls the driving means, which turns the device for holding the core during the winding of the strand thereon, and operates periodically to reverse the direction of angular movement of the holding means, so that the strand is wound upon the core in layers. The mechanism is so constructed that each layer of the winding laid upon the core may extend slightly beyond the layer beneath it and the control is adjustable, so that both the length of a layer and the extent of its advance beyond the preceding layer may be varied, as desired.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is an end elevational view of the control;

Fig. 2 is a front elevational view of the control mounted on a winding machine;

Fig. 3 is a simplified wiring diagram;

Fig. 4 is a view similar to Fig. 2 but on a larger scale and with parts of the winding machine removed;

Fig. 5 is a sectional view on the line 5—5 of Fig. 4;

Fig. 6 is a sectional view on the line 6—6 of Fig. 7;

Figs. 7 and 8 are sectional views on the lines 7—7 and 8—8, respectively, of Fig. 5;

Fig. 9 is a sectional view on an enlarged scale on the line 9—9 of Fig. 10, showing a one-way clutch; and

Fig. 10 is a longitudinal sectional view showing the clutch.

The control of the invention is shown in the drawings applied to a typical core winding machine, in which the core C to be wound is held in the jaws of a clamp 9 mounted on a stem 9*a* receivable in one of a series of openings in a ring 10 on a shaft 11, the clamp holding the core in coaxial relation to the shaft. Shaft 11 is driven by a worm 13 on a drive shaft 14 of the winding machine, which carries a pulley 15 driven through a belt or chain 16 and a variable speed transmission by a motor 17. The control functions to cause the direction of rotation of shafts 11 and 14 to be reversed periodically and the reversal may be effected in various ways. A typical arrangement is illustrated in the wiring diagram, in which shaft 18 of motor 17 is shown as connected through a clutch 19 and gearing 20 to a shaft 21 carrying a pulley 22, about which belt 16 is trained. Shaft 18 is also connected through gearing 23, a shaft 24, a clutch 25, and gearing 26 to shaft 21. The clutches are biased toward open position and they are alternately closed by a lever 27 actuated by the solenoids 28 and 29 energized by the control generally indicated at 30. The circuits for energizing the solenoids include conventional latch relays, indicated at LR1 and LR2, each of which functions to maintain its associated solenoid energized until the circuit through the other relay is closed.

The control comprises a housing 31 closed at one end by a cover 32 and, at the other, by a portion of a plate-

like bracket 33 having a lateral flange 34*a*, by which the bracket can be attached, for example, by screws 35, to a part of the casing 36 of the winding machine. Another flange 34*b* on the bracket provides a support for a bearing for the shaft 14. The housing contains a partition 37 parallel to bracket 33 and a hollow shaft 38 is mounted in ball bearings 39, 40 in openings in the partition and bracket, respectively. Shaft 38 carries a collar 41 of insulating material on its end in the chamber 42 between cover 32 and partition 37 and the collar is encircled by spaced slip rings 43, 44 engaged by respective conductive spring fingers 45, 46 attached to terminals 47, 48 on a block 49 of insulating material held in place in chamber 42 by a stud 50 mounted in an opening through cover 32. Insulated wires 51, 52 lead from terminals 47, 48 through a bushing in an opening through cover 32 and insulated wires 53, 54 lead from slip rings 43, 44 through the interior of shaft 38 to the exposed end thereof lying beyond bracket 33. A clamp formed of jaws 55, 56 is mounted on a sleeve 57 of insulating material encircling one end of shaft 38 and the jaws are secured together by screws 58, 59 of insulating material with a pointer 60 of insulating material projecting radially beyond the clamp. The end of shaft 38 is closed by a plate 61 of insulating material held in place by screws 62, 63 threaded into the jaws 55, 56 and serving as terminals by which the ends of wires 53, 54 are connected to respective jaws. The jaws, which are insulated from each other, as described, carry contacts 55*a*, 56*a* on opposite sides of the pointer 60 and the contacts are electrically connected to the wires 53, 54 through the jaws.

A worm gear 64 is mounted on shaft 38 within the chamber 65 in housing 31 between partition 37 and plate 33 and is held in place by a pin 66 passing through the hub of the gear and the shaft. The gear meshes with a worm 67 on shaft 14. Just beyond bracket 33, a clutch element 68 having an outwardly coned end is secured on shaft 38 by a pin 69 passing through the element and shaft.

A winding advance control plate 70 is mounted on a ball bearing 71 encircling shaft 38 and the plate has a hub centrally recessed to receive the coned end of element 68. The plate has a circumferential channel 70*a* with inwardly convergent sides and a fixed pin 70*b* is mounted in the bottom of the channel to project radially. An advance adjustment arm 72 having an end 72*a* overlying the channel 70*a* lies between bracket 33 and plate 70 and has an annular inner end loosely encircling the hub on plate 70. A screw 73 with a knurled head 74 is threaded in an opening through the end 72*a* of arm 72 and engages a shoe 75 in the channel 70*a*. By backing off screw 73, the shoe 75 may be freed, so that the arm 72 may be moved to any desired angular position relative to plate 70 and the arm may then be secured in this position by tightening the screw to cause the shoe to bear firmly against the sides of channel 70*a*.

A roller cage 76 is mounted beyond plate 70 on a ball bearing 77 encircling shaft 38 and the cage carries a plurality of fixed radial studs 78, on each of which is mounted a cup-like roller 79 for free rotation and a disc 80 fast on the shaft and lying within and engaging the inner surface of the roller. A conventional one-way clutch 81 is disposed between each stud and its roller 79 and the clutch includes a block 81*a* square in cross-section and fast on the stud and four rollers 81*b* lying against the faces of the block parallel to the axis of the stud and having necks in slots in plates 81*c*, 81*d* at opposite ends of the block. Each roller is acted on by one end of a spring 81*e*, the other end of which is seated on an arm 81*f*, the arms being integral alternately with the plates 81*c*, 81*d*. One of the studs 78 projects outwardly through its disc 80

and terminates in a loop 78*a* encircling the end of a fixed rod 82 mounted in the edge of plate 33 and bent to overlie the cage. Each roller 79 has a circumferential bead 79*a* engageable with the adjacent face of plate 70.

A layer length control plate 83 is mounted on a ball bearing 84 encircling shaft 38 and the plate has a flat radial face engageable by the beads 79*a* on the rollers 79 and a circumferential channel 83*a* with inwardly convergent sides. A layer length adjustment arm 85 lies beyond plate 83 and has an annular inner end loosely encircling a hub on plate 83. The outer end of the arm is bifurcated to form two tongues and one tongue 85*a* is bent to overlie channel 83*a* in plate 83 and a screw 86 with a knurled head 86*a* is threaded through tongue 85*a* and bears against a shoe 87 in channel 83*a*. The screw and shoe provide means by which arm 85 can be held in any desired angular position relative to plate 83.

A plate 88 carrying a dial is secured to the outer face of the hub of plate 83 and the plate has an ear 88*a* struck from it and extending outwardly and carrying a contact 89 engageable by contact 55*a* on jaw 55 of the clamp. The second tongue 85*b* of the outer end of arm 85 is bent to overlie the face of the dial and carries a contact 90 engageable by the contact 56*a* on clamp jaw 56.

A spring 91 encircles shaft 38 and bears at one end against the inner race of bearing 84, which is of the radial and thrust type. At its outer end, the spring bears against a flange on the insulating sleeve 57, the flange lying in contact with the inner sides of the clamp jaws 55, 56. The spring acts to hold plate 83 against the beads 79*a* on rollers 79, the beads against plate 70, and plate 70 against the clutch element 68.

A winding machine equipped with the new control operates to wind a strand upon a core in a holder, which is rotated through an arc to cause convolutions of the strand to be laid on the core to form a layer of the length of the arc. When the holder has moved forward to the end of its arcuate movement, the control reverses the direction of angular movement of the core, so that a second layer is laid upon the first in the return movement of the core. The control is so constructed that the forward movements of the core are all of the same length throughout a winding operation but the return movements may be shorter. As a result, each layer of convolutions of the strand wound during a forward movement of the core extends beyond the layer wound during the next preceding forward movement of the core. When a winding of the desired number of layers has been wound as described upon an arcuate section of the core, a second clamp 9 is applied to the core, the first clamp is released, and the second clamp is properly mounted in ring 10 to position the core for the application of additional convolutions of the winding.

In the new control, the length of a layer of convolutions of the winding applied in the forward movement of the core and referred to as the "traverse length" is determined by the angular spacing between the mark M on arm 85 and the zero position on dial 88 and the graduations on the dial thus indicate the length of a traverse produced by a setting of arm 85. The length of the traverse advance, that is, the extent to which each layer wound on the core in a forward movement of the core projects beyond the layer wound in the next preceding forward movement of the core, is determined by the angular spacing between the pin 70*b* in plate 70 and screw 73, which clamps arm 72 to plate 70.

In the adjustment of the control for a particular winding operation, the screw 86 is first loosened to free arm 85 from the traverse control plate 83 and plate 83 and dial plate 88 are moved counter-clockwise to place contact 89 on the ear 88*a* on plate 88 against contact 55*a* on pointer 60. Arm 85 is then moved along dial 88 until the mark M on the arm registers with the graduation on the dial representing the desired traverse and screw 86 is tightened to secure the arm to plate 83. The traverse advance is next adjusted and, for this purpose, the plate 70 is moved, if necessary, to cause pin 70*b* to bear against the left side of fixed rod 82, as the control is viewed in Fig. 4, and the screw 73 is loosened. The winding machine motor is now started and shaft 38 begins to move counter-clockwise carrying the pointer with it away from the zero point on dial 88. When the pointer is in register with the graduation on the dial representing the desired traverse advance, for example, ⅛", the machine is stopped, the arm 72 is moved counterclockwise to cause screw 73 to engage the right side of pin 82, and the screw is tightened to secure the arm to the traverse advance control plate 70. The plate 70 is next moved clockwise to bring pin 70*b* on the plate against fixed pin 82, the plate slipping relatively to the clutch element 68 in such movement. As plate 70 moves clockwise, it turns rollers 79 and the rollers cause a counter-clockwise movement of plate 83 and dial 88 to bring contact 89 on ear 88*a* on the dial against contact 55*a* on pointer 60. The control is now in condition for a winding operation.

When the motor of a winding machine equipped with a control adjusted as described is started, the shaft 38 begins to turn counter-clockwise and the traverse advance control plate 70 is caused to move with it by the engagement of clutch element 68 with the plate. When plate 70 moves counter-clockwise, it cannot turn rollers 79 on studs 78 because the discs 80 are held against the corresponding movement by the one-way clutches 81. As the roller cage 76 is held stationary by engagement of loop 78*a* with fixed pin 82 and the counter-clockwise movement of plate 70 cannot rotate rollers 79, the plate slips relatively to the rollers and the movement of the plate is without effect on plate 83, so that that plate and dial 88 remain at rest. The counter-clockwise movement of plate 70 with shaft 38 continues, until screw 73 securing arm 72 to plate 70 strikes fixed pin 82. The plate and arm are then prevented from further movement and the plate slips relatively to clutch element 68. When the counter-clockwise movement of shaft 38 has continued through an arc corresponding to the traverse, for which arm 85 was set, contact 56*a* on arm 56 strikes contact 90 on tongue 85*a* and latch relay LR2 is actuated to release relay LR1, so that solenoid 29 is de-energized, solenoid 28 is energized, and the direction of rotation of shaft 38 is reversed and becomes clockwise.

As soon as shaft 38 starts to turn clockwise, plate 70 begins to move with it and rotates the rollers 79, the one-way clutches 81 permitting. Such rotation of the rollers causes plate 83 and dial 88 to be moved counter-clockwise, so that the contact 89 on ear 88*a* on the dial is moved toward arms 55, 56 and pointer 60, which are moving clockwise with the shaft. The clockwise movement of plate 70 with the shaft continues until pin 70*b* strikes fixed pin 82 and the length of such movement of the plate thus corresponds to the angular spacing between screw 73 and pin 70*b*, that is, to the traverse advance. The counter-clockwise movement of the dial 88 through an arc corresponding to the traverse advance, as described, moves the contact 55*a* in such direction that the arc of return movement of arms 55, 56 and pointer 60 before contact 55*a* engages contact 89 is less than the arc between the zero on dial 88 and the mark M on arm 85 by the arc of traverse advance. Accordingly, the layer of convolutions of the strand wound on the core in the return movement of the core with shaft 38 is shorter than the layer wound in the forward movement of the core and, when contact 55*a* engages contact 89 and the second forward movement of the core and shaft starts, the first convolution of the second forward movement layer is displaced by the first convolution of the first forward movement layer by an arc equal to the traverse advance.

As the winding operation proceeds, plate 83 and dial 88 are moved counter-clockwise through an arc equal to the traverse advance during each return or clockwise

movement of shaft 38, so that the core receives a winding in which the layers applied during the forward movements of the core are all of the same length and the layers applied during the return movements of the core are also of the same length but shorter than the forward movement layers. The length of each layer applied to the core during the forward movement of the core can be varied by angularly adjusting arm 85 to alter the arc between the mark M on the arm and the zero on dial 88. The length of the traverse advance can be varied by adjusting arm 72 to alter the arc between the pin 70*b* on plate 70 and the screw 73 clamping the arm 72 to the plate. If the screw 73 is adjusted to engage one side of the fixed pin 82, while the pin 70*b* lies in contact with the other side of pin 82, the machine has no traverse advance. In that event, the layers applied to the core in both the forward and return movements of shaft 38 are of the same length and a non-progressive winding is produced.

I claim:

1. A device for controlling the operation of a core winding machine having a rotatable core holder and means, including a drive shaft, for rotating the core holder, which comprises a control shaft operatively connected to the drive shaft for rotation with the core holder, means for reversing the action of the rotating means, means for actuating the reversing means, and means for periodically operating the actuating means, including a pair of contacts mounted on the control shaft for angular movement therewith, a second pair of contacts disposed in spaced relation with the first pair of contacts between them, the contacts of the second pair being individually engageable by respective contacts of the first pair as the control shaft moves angularly in opposite directions, an electrical circuit containing a source of energy, the contacts, and the actuating means, the closing of the circuit by engagement of a contact of one pair with a contact of the other pair energizing the actuating means and causing such means to actuate the reversing means to cause a reversal of the direction of operation of the rotating means, and means operable by the control shaft rotating in one direction only to shift the second pair of contacts in the opposite direction.

2. The device of claim 1, in which the contacts of the first pair are mounted back-to-back on an arm assembly attached to the control shaft.

3. The device of claim 2, in which the arm assembly includes a pair of arms insulated from each other and from the control shaft and extending outwardly from the shaft, the contacts of the first pair being mounted on the outer faces of the arms.

4. The device of claim 1, in which the first contact of the second pair is rigidly secured to a support mounted movably on the control shaft and the second contact of said pair is mounted on said support for angular adjustment relative to the first contact.

5. The device of claim 4, in which the support includes a plate and a dial secured rigidly together, the first contact of the second pair is fixedly mounted on the dial, and the second contact of the second pair is adjustably mounted on the plate and overhangs the dial to lie in opposition to said first contact.

6. The device of claim 5, in which the contacts of the first pair are mounted on opposite sides of an arm assembly attached to the control shaft and including a pointer movable over the dial.

7. The device of claim 1, in which the contacts of the second pair are mounted on a support carried by the control shaft for rotation relative thereto, a member is mounted on the control shaft for rotation therewtih through a part of the rotation of the shaft in both directions, and transmission means transmit the movement of the member with the control shaft in one direction only.

8. The device of claim 7, which includes slipping clutch means connecting the member to the control shaft, a fixed stop, and spaced projections on the member alternately engaging the stop as the member is moved in opposite directions with the control shaft.

9. The device of claim 8, in which one of the projections is fixedly mounted on the member and the other projection is mounted on the member for angular movement relative to the first projection.

10. The device of claim 7, in which the member is a plate mounted on the control shaft for free rotation relative thereto and formed in part as a clutch element, a clutch element fast on the control shaft is adapted to cooperate with the clutch element part of the plate, a spring acts on the plate to hold the clutch elements in contact, the support includes a plate mounted on the control shaft for free rotation relative thereto, and the transmission means includes a mount carried by the control shaft between the plates, means holding the mount against rotational movement with the control shaft, and rollers on the mount and in engagement with the two plates, the rollers being free to rotate in one direction only.

11. The device of claim 10, in which the mount includes a plurality of fixed radial studs, the rollers are mounted on respective studs, and a one-way clutch restricts each roller to rotation in one direction only relative to its stud.

References Cited in the file of this patent

UNITED STATES PATENTS

1,053,962	Alexander	Feb. 25, 1913
2,656,124	Stevens	Oct. 20, 1953
2,657,865	Bennert et al.	Nov. 3, 1953
2,726,817	Barrows	Dec. 13, 1955