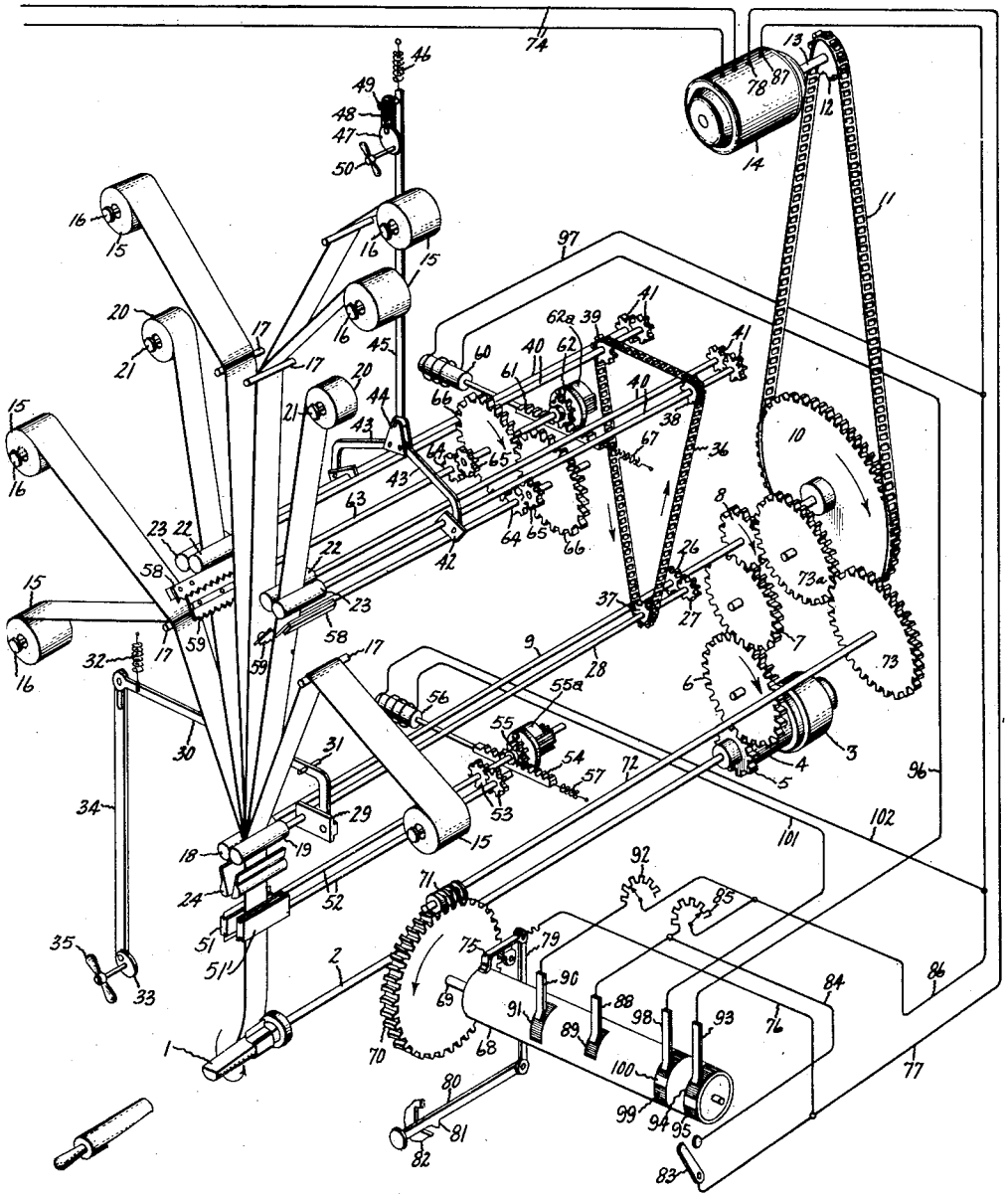
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CONDENSER WINDING MACHINE

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CONDENSER WINDING MACHINE

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4 Claims. (Cl. 242—56)

The present invention relates to machines for winding coil condensers.

The object of my invention is to provide an improved construction and arrangement in machines of this type permitting automatic high speed winding of condensers, and for a consideration of what I believe novel and my invention, attention is directed to the following description and the claims appended thereto.

In the accompanying drawing the single figure is a diagrammatic view of a condenser winding machine embodying my invention.

Referring to the drawing, the condenser is wound on a split mandrel 1 fixed to a shaft 2 which is driven by a slip clutch comprising a part 3 fixed to the shaft and a part 4 loose on the shaft and frictionally connected to the part 3. Integral with the clutch part 4 is a gear 5 which is driven by a gear train comprising gears 6, 7, 8, and 10. Gears 8 and 10 are fixed to a shaft 9, the gear 10 being driven by a chain 11 running over a gear 12 fixed to the shaft 13 of an electric motor 14.

The condenser comprises alternate strips of foil and of a dielectric, such as paper. The paper is fed to the mandrel from rolls 15 rotatably carried on spindles 16 and passes from the rolls over guides 17 and between paper feeding rolls 18 and 19 to the mandrel. The foil is supplied from rolls 20 rotatably carried on spindles 21 and passes between foil feeding rolls 22 and 23 and between the paper feeding rolls 18 and 19 to the mandrel. Guides 24 for the foil and paper are arranged below the paper feeding rolls 18 and 19. As hereinafter described, the paper and foil are positively fed to the mandrel by the respective feeding rolls which normally rotate at a fixed speed.

It is therefore necessary that the mandrel be rotated to wind the foil and paper thereon at a speed sufficient to take up the slack and that the proper mandrel speed will vary with the diameter of the foil and paper wound thereon. The proper mandrel speed is obtained by the slip clutch 3, 4 which is set to maintain a safe constant tension on the strips.

The paper feeding roll 18 is fixed to the shaft 9 and accordingly is driven by gear 10. The roll 19 is positively driven from the shaft 9 by a gear 26 fixed to the shaft 9 meshing with a gear 27 fixed to the shaft 28 of the roll 19. The roll 18 rotates on a fixed axis. The roll 19 is pressed against the roll 18 by a slide 29 carried in suitable guides (not shown) and journaled on the shaft 28. The slide 29 is pivotally connected to one end of a lever 30 pivoted intermediate its ends at 31. A spring 32 connected to the other end of the lever 30 biases the lever in a clockwise direction about the pivot 31 and moves the roll 19 toward the roll 18. The roll 19 is moved away from the roll 18 to render the paper feeding rolls ineffective by an eccentric 33 connected by a link 34 to the left-hand end of the lever 30. A handle 35 is provided for rotating the eccentric. Upon rotation of the eccentric through a half revolution from the position shown, the link 34 is pulled downward, pivoting the lever 30 in a counterclockwise direction and moving the roll 19 away from the roll 18. This releases the pressure between the rolls so that the paper is not fed even though the rolls are continuously rotated.

The foil feeding rolls 22 and 23 are driven at the same speed as the paper feeding rolls 18 and 19 by a chain 36 driven by a gear 37 fixed to the shaft 28 and running over gears 38 and 39 respectively fixed to one of the shafts 40 of each pair of foil feeding rolls. The foil feeding rolls are positively rotated by gears 41 fixed to the shafts 40. Each of the foil feeding rolls 22 rotates on a fixed axis. The foil feeding rolls 23 are moved toward and away from the rolls 22 by slides 42 suitably carried in guides (not shown) and connected to the lower ends of links 43. The upper ends of the links 43 are connected to a block 44 which is connected to the lower end of a link 45 urged upward by a coil spring 46. Upward movement of the link 45 moves the slides 42 inward, yieldingly moving the rolls 23 into engagement with the rolls 22. The rolls 23 are moved away from the rolls 22 by an eccentric 47 connected by a link 48 to a pin 49 on the link 44. A handle 50 is provided for rotating the eccentric. When the eccentric is rotated through a half revolution from the position shown, the link 44 is moved downward, moving the slides 42 outward and thereby moving the rolls 23 out of engagement with the rolls 22. When out of engagement the rolls 22 and 23 are ineffective to feed foil even though continuously rotated.

Below the guides 24 are paper cutters comprising rotatable cutters 51, 51' fixed to shafts 52. The cutters 51, 51' are rotated in opposite directions by gears 53 fixed to the shafts 52, one of the shafts being rotated by a rack 54 meshing with a pinion 55 connected to the shaft by a ratchet 55a. One end of the rack is connected to a solenoid 56, and the other end of the rack is connected to a tension spring 57 biasing the rack to the position illustrated. When the solenoid 56 is energized the rack 54 is moved to the left, causing the cutters 51, 51' to be rotated in opposite directions a half revolution to sever the paper.

When the solenoid 56 is deenergized the parts are returned by the tension spring 57 to the position illustrated. During the return movement the ratchet 55a is ineffective and the knives remain stationary.

Below each of the foil feeding rolls 22 and 23 are foil cutters each comprising a stationary cutter blade 58 and a rotatable cutter blade 59. The cutter blades 59 are rotated by a solenoid 60 having a rack 61 meshing with a pinion 62 connected to a ratchet 62a which is effective during one direction of rotation of the pinion to rotate the cutter blade shafts 63 through gear trains comprising gears 64 fixed to the shafts 63 and gears 65 and 66. The solenoid 60 is biased to the position illustrated by a tension spring 67 connected to the free end of the rack 61. When the solenoid 60 is energized the rack 61 is moved to the left, causing the cutters 59 to be rotated through the ratchet and gear trains described above. The cutter blades 59 are rotated through the complete revolution so that both edges of the cutter blades cooperate with the stationary cutter. This cuts a section out of the strip of foil being fed downward by the rolls 22 and 23, providing a gap between the severed ends of the foil. The sections which are cut out by the blades 59 fall to one side of the strips of foil and paper. Since both the paper feeding rolls and the foil feeding rolls rotate at the same speed, the downward movement of the foil and paper continues after the operation of the foil cutters, and the gap between the severed ends of the foil is maintained. When the solenoid 60 is deenergized the rack 61 is moved to the right by the spring 67, returning the parts to the position illustrated. The cutter blades 59 remain stationary during the return movement.

The operation of the machine is controlled by a drum 68 fixed to a shaft 69 keyed to a worm wheel 70. The worm wheel is driven by a worm 71 fixed to a shaft 72 and rotated by gears 73 and 73a meshing with the gear 8. The speed at which the drum is rotated, therefore, is directly proportional to the speed at which the foil and paper are fed to the mandrel. In other words, the rotation of the drum 68 is proportional to the length of paper and dielectric wound on the mandrel. The drum 68 is made of metal and is connected to supply conductors 74 by a brush 75 connected by conductors 76 and 77 to a terminal 78 on the motor which in turn is connected to one of the supply conductors 74. The brush is mounted on one arm of a bell crank lever 79, the other arm of which is connected to a link 80. By pulling the link 80 forward the brush 75 may be lifted clear of the drum, opening the circuit thereto. The brush is held in the elevated or open circuit position by a projection 81 on the link 80 which cooperates with a stop 82. Upon moving the projection 81 clear of the stop 82 the brush may be returned to the position contacting the drum.

The motor 14 is started by closing a switch 83 connected in series with the conductor 77 and a conductor 84. The closing of the switch 83 closes a circuit extending from the motor terminal 78 through conductor 77 to the switch 83, and from the switch 83 through conductor 84, variable resistance 85, and conductor 86 to the other motor terminal 87. This starts the operation of the motor. The motor starts at low speed since the resistance 85 is connected in series with the motor. As soon as the motor rotates the drum 68 to move a brush 88 connected to the junction of conductor 84 and resistance 85 clear of an insulating segment 89 on the drum, a circuit across the switch 83 is completed through conductor 76, brush 75, drum 68, and brush 88. The switch 83 may now be opened. At the same time that the brush 88 moves off the insulating segment 89, a brush 90 moves off an insulating segment 91. This connects a variable resistance 92 in parallel with the resistance 85, thereby decreasing the effective resistance in series with the motor and increasing the motor speed.

The foil cutting solenoid 60 is controlled by a brush 93 which normally is kept out of contact with the drum by an insulating section 94. When the drum 68 turns to a position in which the brush 93 rests on the conducting segment 95, a circuit to the solenoid 60 is completed extending from motor terminal 78, conductor 77, conductor 76, and brush 75 to the conducting segment 95, and from the conducting segment 95 through brush 93, conductor 96, solenoid 60, conductor 97, and conductor 86 to the motor terminal 87. This energizes the solenoid 60, causing the operation of the foil cutters 59. When the conducting segment 95 moves clear of the brush 93 the solenoid 60 is deenergized and the foil cutter rack 61 is returned to the position illustrated.

The paper cutters are controlled by a brush 98 which normally rides on an insulating section 99 on the drum. When the conducting section 100 on the drum moves under the brush, a circuit to the solenoid 56 is completed, extending from the motor terminal 78, through conductor 77, conductor 76, and brush 75 to the conducting segment 100, and from the conducting segment 100 through the brush 98, conductor 101, solenoid 56, conductor 102, and conductor 86 to the motor terminal 87. This energizes the solenoid 56, causing the operation of the paper cutters. When the conducting segment 100 moves from under the brush 98 the solenoid 56 is deenergized and the paper cutter rack 54 is returned to the position illustrated.

In the use of the winding machine the ends of the foil and paper are attached to the mandrel, and the rotation of the motor is started at its slow speed by closing the switch 83. The paper feeding rolls 18 and 19 and the foil feeding rolls 22 and 23 which are directly driven from the motor are rotated at a speed proportional to the motor speed, feeding the foil and paper toward the mandrel. The mandrel, which is driven from the slip clutch 3 and 4, rotates at a speed sufficient to take up the slack and maintain a constant tension on the foil and paper. The control drum 68 rotates at a speed proportional to the rate at which paper and foil are fed to the mandrel. In other words, the angular rotation of the drum 68 is proportional to the length of the foil and paper wrapped on the mandrel. The motor continues at its slow speed until the drum 68 rotates to a position in which the insulating segment 91 is clear of the brush 90. This connects the resistance 92 parallel with the resistance 85, thereby decreasing the resistance in series with the motor. At this time the brush 88 is clear of the insulating segment 89 and the switch 83 may be released. When the desired length of foil and paper have been wrapped on the mandrel, the conducting segment 95 makes contact with the brush 93, establishing a circuit to the foil cutting solenoid 60. The solenoid through the rack 61 rotates the foil cutting knives 59 through a complete revolution, cutting a section out of the foil and leaving a gap be-

tween the severed ends. The movement of the foil and paper toward the mandrel does not stop during the foil cutting operation. After cutting, the foil and paper below the cutters **59** are fed to the mandrel by the paper feeding rolls **18** and **19**, and the foil above the cutters **59** is fed toward the mandrel by the foil feeding rolls **22** and **23**, both feeding operations being at the same speed so the gap is maintained. Shortly before the foil cutting operation the motor is returned to its slow speed by the engagement of the brush **90** and the insulating segment **91** which opens the circuit to the resistance **92**. When the gap between the severed ends of the foil comes opposite the paper cutters **51**, the paper cutting solenoid **56** is energized by the brush **98** engaging the conducting segment **100**.

The paper cutters are synchronized with the foil cutters by the interconnecting gearing so that the paper cutters accurately sever the paper in the gap between the severed ends of the foil. After the operation of the paper cutters **51**, the feeding of the paper and foil continues until the lower ends project slightly below the mandrel. At this time the rotation of the motor is stopped by the movement of the insulating segment **89** under the brush **88**, thereby opening the motor circuit.

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

1. In a machine for winding coil condensers, means for supplying alternate strips of foil and dielectric, a mandrel, means for feeding the foil to the mandrel, means for feeding the dielectric to the mandrel, said dielectric feeding means being arranged between the mandrel and the foil feeding means, dielectric cutting means arranged between the dielectric feeding means and the mandrel, foil cutting means arranged between the foil feeding and dielectric feeding means, means for rotating the mandrel to wind the strips thereon at a speed sufficient to take up the slack in the strips fed thereto, means for operating the foil cutting means to cut a section out of the foil providing a gap between the severed ends, and means synchronized with said foil cutters for operating the dielectric cutting means to cut the dielectric in said gap.

2. In a machine for winding coil condensers, means for supplying alternate strips of foil and dielectric, a mandrel, means for feeding the strips to the mandrel, means operating proportionally to the size of the condenser wound on the mandrel for cutting a section out of the foil leaving a gap between the severed ends, and means for thereafter cutting the dielectric in said gap.

3. In a machine for winding coil condensers, means for supplying alternate strips of foil and dielectric, a mandrel, means for feeding the strips to the mandrel, means for cutting a section out of the foil to provide a gap between the severed ends, and means operated in timed relation to the feeding means and the foil cutting means for cutting the dielectric in said gap.

4. In a machine for winding coil condensers, means for supplying alternate strips of foil and dielectric, a mandrel, means for feeding the foil to the mandrel, means for feeding the dielectric to the mandrel, said dielectric feeding means being arranged between the mandrel and the foil feeding means, dielectric cutting means arranged between the dielectric feeding means and the mandrel, foil cutting means arranged between the foil feeding and dielectric feeding means, means for rotating the mandrel to wind the strips thereon at a speed sufficient to take up the slack in the strips fed thereto, means operating proportionally to the size of the condenser wound on the mandrel for operating the foil cutting means to cut a section out of the foil providing a gap between the severed ends, and means operated in timed relation to the feeding of the strips and the operation of the foil cutting means for operating the dielectric cutting means to cut the dielectric in said gap.

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