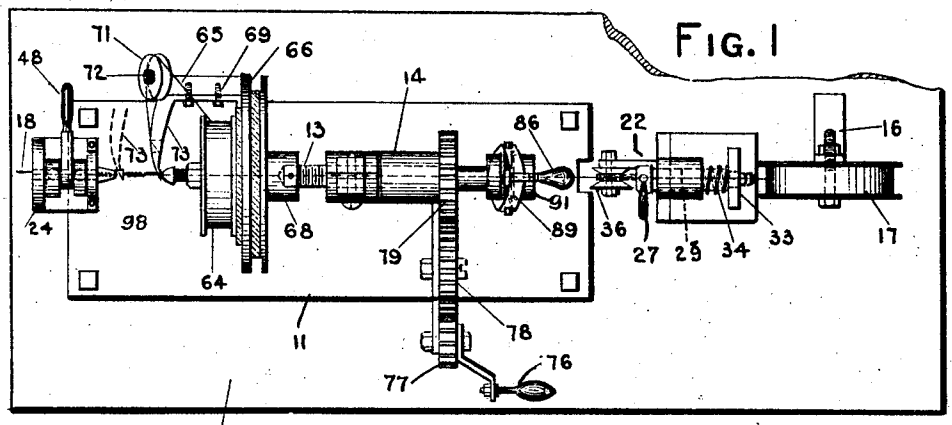
Aug. 17, 1926. 1,596,734

J. J. HIGGINS

COIL WINDER FOR RECTIFIERS

Filed July 25, 1924

FIG. 1



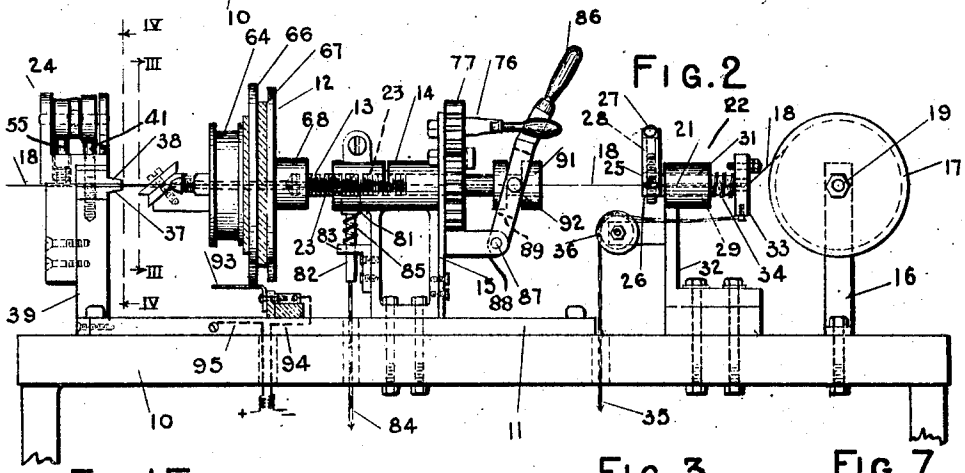


FIG. 2

FIG. 5

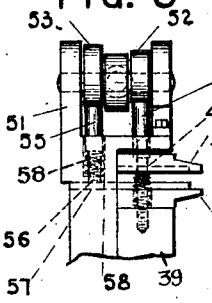


FIG. 4

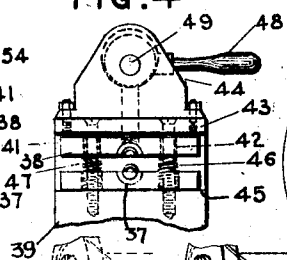


FIG. 3

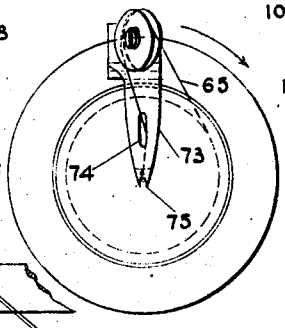


FIG. 7

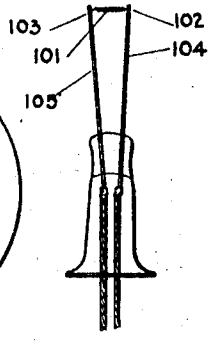
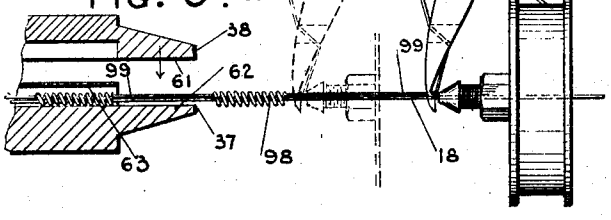


FIG. 6.



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UNITED STATES PATENT OFFICE.

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COIL WINDER FOR RECTIFIERS.

Application filed July 25, 1924. Serial No. 728,091.

This invention relates to a machine for winding coils for electrical devices and more particularly to a device for forming a series of coils spaced apart in a predetermined manner and which are adapted for use in electrical rectifiers.

An object of the invention is to provide means for expeditiously manufacturing a series of coils which are spaced apart by straight connecting sections.

A further object of the invention is to provide for the formation of a coil having straight terminal portions.

A further object of the invention is to provide mechanism for feeding a wire and intermittently forming thereon a plurality of coiled sections separated by straight portions.

A further object of the invention is the provision of mechanism for providing a plurality of spaced helical coils connected by sections disposed parallel to the axial line about which the coils are wound.

A still further object of the invention is the provision of coordinating machine elements adapted to feed a mandrel and to form a plurality of helical spaced coil sections having straight portions therebetween and to discharge the coils and mandrel from the machine.

Other objects and advantages will become apparent from a reading of the following description.

In the manufacture of certain types of electrical devices, it is necessary to provide a coiled section of suitable material and to secure the ends of the coil to conductors. As for example, in bulbs used in connection with certain types of rectifiers, the cathode is welded or otherwise secured to leading-in wires. Ordinarily, when a plurality of spaced coils are wound and subsequently cut into sections, it is necessary to bend the ends or terminals of the coils to provide straight portions for engagement with the leads or conductors to be welded thereto. Heretofore, when a plurality of spaced coils were wound upon a mandrel, the intermediate sections of wire took a gradual sinuous form about the mandrel and when the coiled sections were separated, the ends thereof required bending to make them suitable for convenient attachment to conductors of the electrical device to which they were applied.

The present invention, therefore, aims to provide mechanism in which, instead of the substantially coarsely wound sections between the helical coils heretofore produced a relatively straight portion is provided; which, when the coils are severed to constitute electrodes, provide terminals therefor in condition to be welded or otherwise secured to the conductors of an electrical device.

In practicing my invention I may employ mechanism for feeding a mandrel through a given path and a winding head having a guide finger to lead the wire about the mandrel. The winding head may be rotatable to effect the disposition of the wire about the mandrel in a helix having a given number of turns, after which mechanism is provided whereby the guide finger is moved longitudinally of the mandrel, causing a portion of wire to become disposed adjacent a given portion of the mandrel and in substantial parallel relation thereto.

Another coil may then be wound of a given number of turns after which the operation of providing the straight portion may be effected. These operations may be repeated until the desired number of spaced coils are provided. In this manner a length of a plurality of helical sections of wire may be wound on a mandrel and continuously fed from a machine, the length of wire wound mandrel being limited only by the length of the mandrel employed. When a plurality of coils have been wound upon a mandrel and removed from the machine, the mandrel may be removed therefrom in any desirable manner, either before the coils are divided into the desired lengths or when they are finally cut to provide the short sections for use, as for example a filament or cathode electrode.

The invention will be more fully understood by reference to the accompanying drawings, in which

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

Fig. 2 shows a view in elevation of the machine shown in Fig. 1;

Fig. 3 shows an end view of the winding head of the machine taken on line III—III in Fig. 2 and showing the guide finger in a vertical position;

Fig. 4 shows a portion of the machine taken on line IV—IV in Fig. 2;

Fig. 5 is a side view of the portion of the machine shown in Fig. 4;

Fig. 6 is a fragmentary detailed view showing the relative positions of certain of the movable members of the machine, and

Fig. 7 shows a mount having a coiled filament secured to the support wires thereof.

The invention may include a suitable supporting table 10 having a bed plate 11 bolted thereto to support a winding head 12 secured to a lead screw 13, rotatable in a split-bearing 14 integral with a bracket 15; the bracket in turn being bolted to bed-plate 11. A bearing bracket 16 secured to the table may provide a support for a spool 17 of mandrel wire 18. The spool may be rotatable upon a pin 19 secured to the bracket 16. The mandrel wire 18 is threaded through a suitable passage 21 in a tail-stock 22 and thence through the bearing 14 and a passageway 23 in the lead screw 13, through the winding head 12 and into a head-stock 24.

During the formation of a coil about the mandrel, it is desirable to maintain the mandrel taut and for this purpose, the tail-stock is provided with a movable jaw 25 adapted to be moved against a stationary jaw 26 to grip the wire. The movable jaw 25 may have a threaded rod 25′ movable in a threaded vertical aperture in the jaw, an end of the rod being rotatably attached to the lower jaw 26 and at one side of the path of movement of the mandrel wire 18. At the upper exposed end of the rod 25′ is provided an arm 27 to permit a manual rotation of the rod. A slight rotary movement of the rod will raise the jaw 27 sufficient to permit the passage of the mandrel wire thereunder and an opposite movement will clamp the wire between the jaws. The jaws 25 and 26 are mounted on a slide-rod 29 movable in a bearing 31 integral with an upper end of a bracket 32 bolted to the table 10 and constituting part of the tail-stock 22.

The slide-rod 29 may extend from an end of the bearing 31 and have a collar or cross-piece 33 secured thereto. A spring 34 may be disposed upon the slide-rod between the bearing 31 and the collar to normally carry the jaws 25 and 26 toward the bearing 31. The jaws may, however, be moved away from the bearing by a downward pull upon a chain 35 by means of a treadle (not shown). The chain may have one end attached to the treadle and the other end secured to the collar 33 and may be led over a sheave 36 mounted on the bracket 32.

The head-stock 24 is provided with jaws 37 and 38, the jaw 37 being stationary and mounted on a bracket 39 secured to the bed-plate 11. The jaw 38 is movable vertically upon guide pins 41 and 42 (see Fig. 4), secured in a ledge 43 of a bearing 44 and in the bracket 39, the jaw 38 being provided with suitable openings in the jaw for the pins 41 and 42. Helical springs 46 and 47 are disposed upon the guide pins and between the jaw 38 and surface 45 of the bracket to normally maintain the jaws open. The movable jaw may be actuated by means of a lever 48 secured to a shaft 49 mounted in the bearing 44 and in another bearing 51 secured to the bracket 39. The shaft 49 is rotatable with the lever arm and is provided with cam members 52 and 53. The cam 52 is disposed in engagement with one end of a push-rod 54, the opposite end of the rod being secured to the movable jaw 38. The cam 53 is disposed in engagement with one end of a push-rod 55, the opposite end 56 of which is adapted to be projected into a passage-way 57 through which the wire wound mandrel is led.

A helical spring 58 is disposed about a reduced portion of the push-rod 55 and is adapted to normally urge the same upwardly against the cam member 53. The jaws 37 and 38 are provided with gripping surfaces 61 and 62 (see Fig. 6) to engage with the mandrel and straight portions of the wire wound thereon. A tubular housing 63 is provided to enclose and protect the helical section of the wire when the jaws are closed.

The winding head 12 may comprise a drum 64 for carrying the wire, such for example, as filament wire 65 to be wound on the mandrel 18. The drum may be secured to and insulated from a face-plate 66 secured to a rotatable disk 67 having a hub 68 in which the lead-screw 13 is secured. An extension arm 69 (see Fig. 1) secured to the face-plate 66 is provided to carry a guide sheave 71 rotatable on a pin 72. The arm 69 also serves as a support for a guide-finger 73 (see Figs. 1 and 3). This finger is provided with a slot 74 and a notched end to provide a groove 75. The filament wire 65 is led from the drum over the sheave through the slot 74 and into the groove 75 from which it is given a right-angle bend and carried parallel to the mandrel wire and disposed between the surfaces 61 and 62 of the jaws 37 and 38.

The cams 52 and 53 on the head-stock may be so proportioned that when the lever arm 48 is moved, the push-rod 55 will be initially actuated to engage the mandrel wire 18 and a continued movement of the lever 48 will cause the jaw 38 to close, gripping the mandrel and the end of the filament wire. The treadle may be operated to pull the

chain 35 in opposition to the spring 34 of the tail-stock, thus moving the jaws thereof toward the head-stock and along the mandrel wire 18. The jaws 25 and 26 of the tail-stock may then be closed and the treadle released to permit the spring 34 to recover and pull the mandrel wire taut for the winding of filament thereabout.

When the filament is to be wound, the head-stock may be in position with the finger 73 as shown in dotted lines in Fig. 1, and the winding head 12 rotated by means of a hand lever 76 or other suitable mechanism. The lever 76 may be attached to a gear-wheel 77 to rotate an intermediate gear-wheel 78 in mesh with a gear 79 slidably attached to the lead-screw 13 by a feather or spline in a suitable manner to permit the lead-screw to be moved endwise. The lead-screw may be slidably fitted in the guide-bearing 14 and may be movable longitudinally thereof when rotated, by reason of an adjustable nut 81 which may threadedly engage the threaded portion of the lead-screw, thus when the same is rotated to revolve the head, the head will be advanced to wind wire on the mandrel a given number of turns per inch, depending upon the pitch of the lead-screw. The nut 81 may be provided with a guide rod 82 movable in a bearing 83 and connected to a chain 84 which may be attached to a foot-treadle (not shown).

A helical spring 85 positioned about the guide-rod between the bearing 83 and a shoulder of the nut 81, normally urges the nut into engagement with the lead-screw. A downward movement of the chain, however, will effect a disengagement and permit a longitudinal translation of the lead-screw in the bearing 14. This endwise non-rotatable movement of the lead-screw and consequently the winding head, may be effected by a manipulation of a lever arm 86 pivoted on a pin 87 in a projection 88 integral with the bracket 15. The lever 86 may be provided with a slot 89 to receive a grooved collar 91 secured to an end of the lead-screw 13. The lever arm 86 may be provided with transversely inwardly projecting pins 92 having ends disposed in the slot of the collar 91. Thus the lead-screw may move endwise and at the same time be free to permit a rotary movement.

During the winding of the filament wire upon the mandrel, it is desirable to heat the wire at approximately the point of application to the mandrel. For this purpose, any suitable means may be employed, such for example as an electrical contact member 93 connected by a conductor 94 to a suitable source of electrical energy, another conductor 95 being secured to the bed-plate or other portion of the machine to complete the circuit. Inasmuch as the winding head is movable longitudinally of the machine, the contact 93 may be carried on a block and disposed in slidable engagement with the face plate 66 to effect a flow of electrical current to the finger 93 and thence to the portion of wire being wound on the mandrel.

In operation, the head-stock and tail-stock jaws are first opened and the mandrel wire is passed through the tail-stock, winding-head and into the head-stock. The lever arm 48 may then be actuated to cause the pin 55 of the head-stock to engage the mandrel wire and secure it. The mandrel wire may then be stretched taut by operating the treadle chain 35 as above described and closing the jaws of the tail-stock. The jaws 37 and 38 of the head-stock will, however, still remain open for the insertion of an end of the filament wire which is led around the finger 73 and between the last mentioned jaws. These jaws may then be closed, the winding head at this time being positioned with the finger 73 as indicated in dotted lines in Fig. 1. The crank 76 may then be rotated to wind a given number of turns of filament to provide a section 98 (see Fig. 6) of helical filament upon the mandrel, at which time the finger will take the position, as indicated in dotted lines in Fig. 6. A downward pull may then be exerted upon the chain 84 to bring the nut out of engagement with the lead screw 13. The lever arm 86 may then be moved to carry the winding head a given distance away from the wound coil or to position, as shown in full lines in Fig. 6. Thus a straight portion 99 of filament will be disposed parallel to the mandrel wire 18. The jaws of the head-stock and tail-stock may then be opened and the winding head with the wound wire and mandrel may be moved toward the head-stock until the helical winding on the mandrel is positioned within the tubular housing 63. The jaws of the head-stock may then be closed to grip the mandrel and any stack in the mandrel may be taken up by moving the jaws of the tail-stock toward the head-stock by downward movement of the chain 35 and then securing the mandrel and releasing the chain, leaving the mandrel wire under tension due to the action of the spring 34.

The foregoing operations may be repeated to provide a plurality of coils separated by straight portions. The mandrel with the coils wound thereon may be discharged from the machine in a continuous length and the coils cut into sections to provide electrodes 101 as shown in Fig. 7, having straight end terminals 102 and 103 for welding to lead-in wires 104 and 105 of a lamp stem which may be considered as a practical example of one of the uses to which the coils may be put.

It will be understood that the semi-automatic formation of the straight portions be-

tween the coils saves considerable amount of time on the part of the operator who had heretofore been obliged to straighten the ends before the coil could be properly applied to an electrical device. The mechanism shown herein, although operable manually is readily applicable for automatic operation.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth by the appended claims.

What is claimed is:

1. A machine for making coiled filaments comprising a mandrel, means for winding a wire about said mandrel to provide a helical section of a predetermined pitch, means for extending an end of said section substantially parallel to the axial line of said mandrel, means for gripping said parallel portion of the wire and adjacent portion of the mandrel to prevent relative movement of wire and mandrel during the winding of another helical section upon said mandrel.

2. A machine for making coiled filaments comprising a mandrel, means for winding a wire into a helix about said mandrel, means for extending an end of said helix substantially parallel to the axial line of the mandrel and gripping members arranged to secure the mandrel and straight portion of the wire between helical portions thereof to prevent slippage of the wire during the subsequent formation of a helical portion.

3. A machine for making coiled filaments comprising a mandrel, means for winding a plurality of helical filaments spaced at intervals upon said mandrel, means comprising a pair of jaws for securing the filament to the mandrel between the coiled sections to prevent slippage of said sections during the formation of a coiled section and means for positioning a straight portion of filament in the spaces between the coiled sections.

4. A machine for making coiled filaments comprising a mandrel, means for winding a wire into helical form of a predetermined pitch upon said mandrel, means for moving a portion of the wire longitudinally of the mandrel and substantially parallel thereto and means for gripping the wire and mandrel during the formation of a helical section, said gripping means comprising jaws having a recessed portion to receive a section of coiled filament and contact surfaces to grip the parallel portion of filament and the mandrel adjacent thereto.

5. A machine for making coiled filaments comprising a mandrel, means for winding a wire into a helix of a predetermined pitch upon said mandrel, means for moving the wire longitudinally of the mandrel and substantially parallel thereto to provide a straight section of wire, gripping jaws having contact surfaces to engage the straight portion of wire and the mandrel adjacent thereto, a housing to receive a section of wound filament, one of said jaws having a recess to permit the same to close over said housing and grip the filament and mandrel.

6. A filament winding machine for producing helical sections of a predetermined number of turns connected by straight portions of wire, said means including a guide finger for directing wire to said mandrel, jaws for gripping the wire and mandrel between said sections and means for moving said guide finger longitudinally of the mandrel after the winding of each section.

7. A filament winding machine for producing helical sections of a predetermined number of turns connected by straight portions of wire, said means including a guide finger for directing wire to said mandrel, jaws for gripping the wire and mandrel between said sections, means for moving said guide finger longitudinally of the mandrel after the winding of each section and means for connecting said wire to a source of electrical energy to heat a portion of the wire at the point of winding on the mandrel.

8. A machine for making coiled filaments comprising a mandrel, means for winding a wire into a helix of a predetermined pitch upon said mandrel, means for moving the wire longitudinally of the mandrel and substantially parallel thereto to provide a straight section of wire, gripping jaws having contact surfaces to engage the straight portion of the wire and the mandrel adjacent thereto, a housing to receive a section of wound filament, one of said jaws having a recess to permit the same to close over said housing and grip the filament and mandrel and means for connecting said wire to a source of electrical energy to heat a portion of the wire at the point of winding on the mandrel.

9. A filament winding machine comprising a mandrel, means for supporting said mandrel, means for moving a wire through a given path, a guide member for diverting the movement of said wire for engagement with said mandrel, means for winding a wire about said mandrel to produce a helical section, means for changing the relative positions of said member and said mandrel to produce a straight portion of wire in parallel relation to the mandrel, and means for gripping said straight portion and the mandrel adjacent thereto during the winding of said helical section.

10. A machine for making coiled filaments comprising a head-stock and a tail-stock, means for clamping one portion of a man-

drel wire in said head-stock, means in said tail-stock for gripping another portion of said mandrel wire, a spool of filament mounted to rotate about the longitudinal axis of said mandrel, means for guiding filament wire from said spool to said mandrel, means for winding the filament about the mandrel wire to produce a helical section and means for moving said filament wire unidirectionally to produce a straight section thereof.

In testimony whereof, I have hereunto subscribed my name this 24th day of July, 1924.

JOHN JOSEPH HIGGINS.