No. 807,133. PATENTED DEC. 12, 1905.

A. D. SCOTT.

WINDING MACHINE.

APPLICATION FILED JAN. 25, 1902.

5 SHEETS—SHEET 1.

Fig. 1.

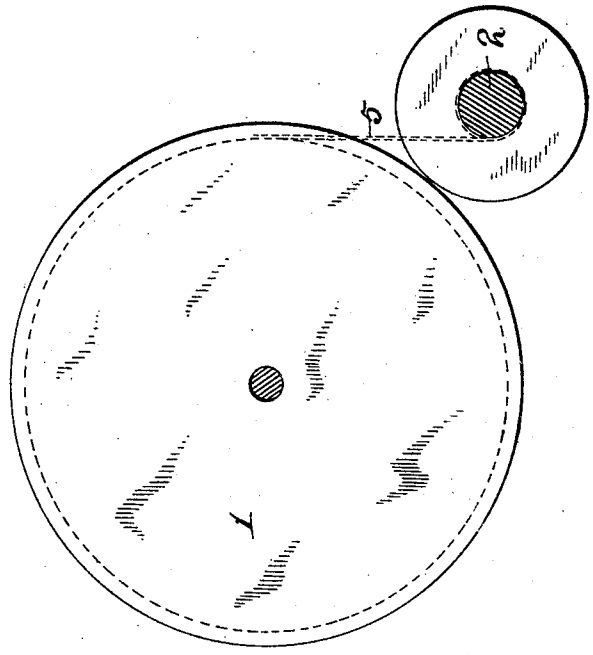
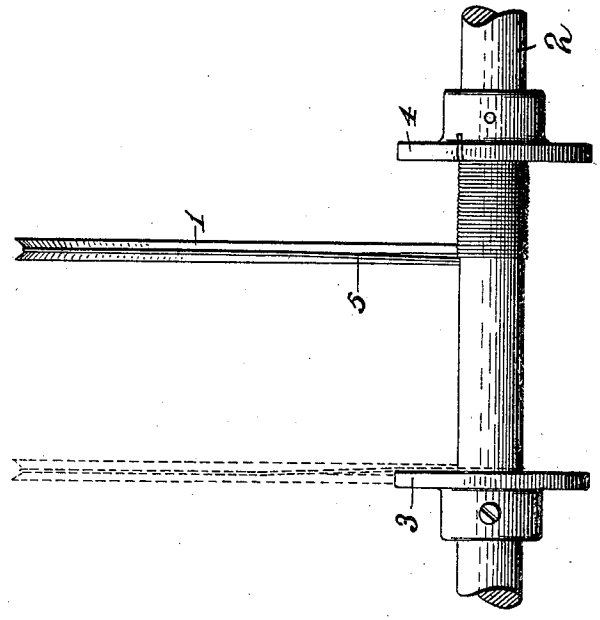


Fig. 2.



Witnesses:
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Walter A. Pauling

Inventor:
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his attorneys.

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5 SHEETS—SHEET 2.

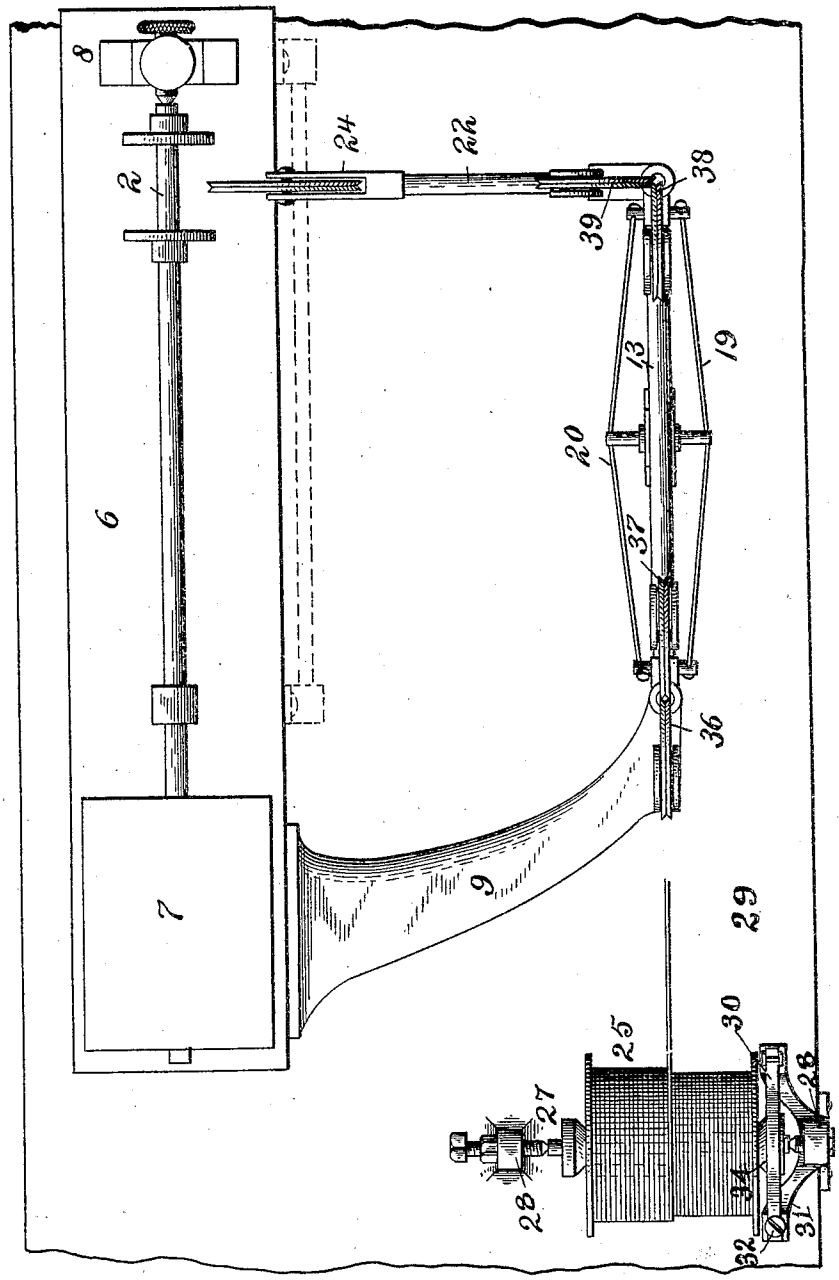

Fig. 3.

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5 SHEETS—SHEET 3.

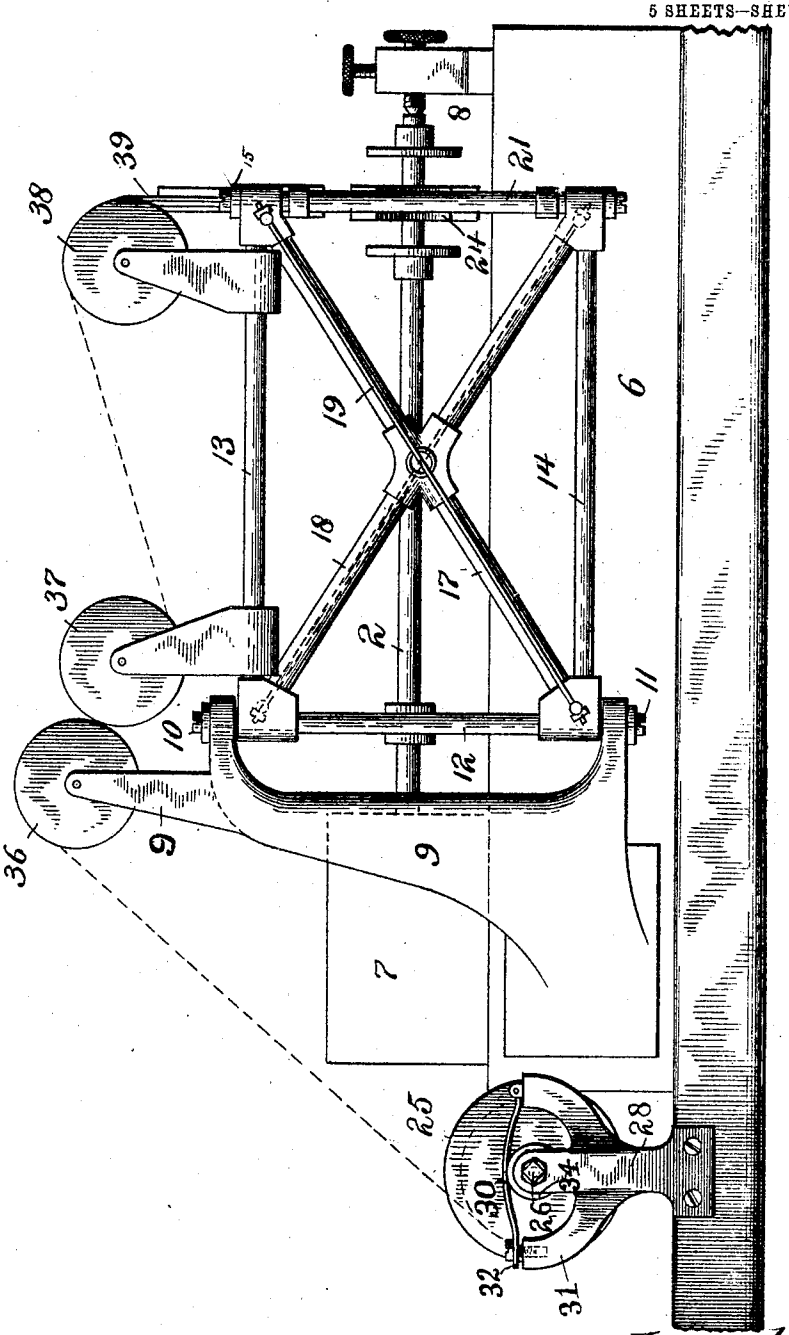

Fig. 4.

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5 SHEETS—SHEET 4.

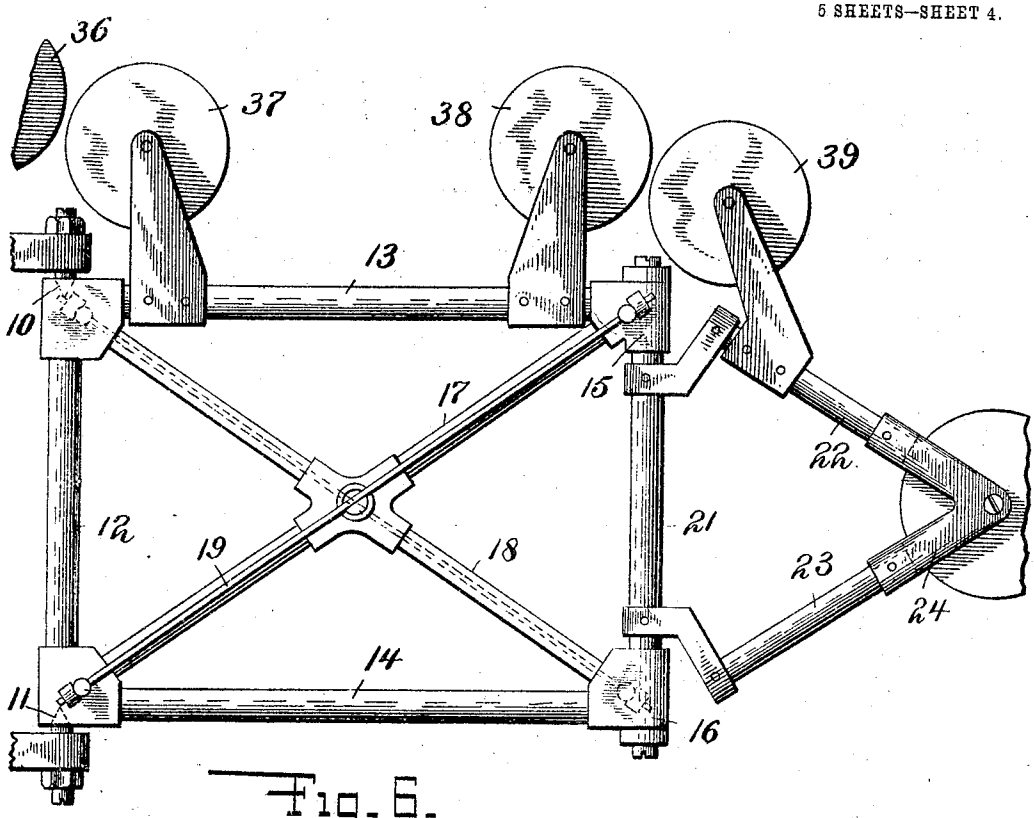

Fig. 6.

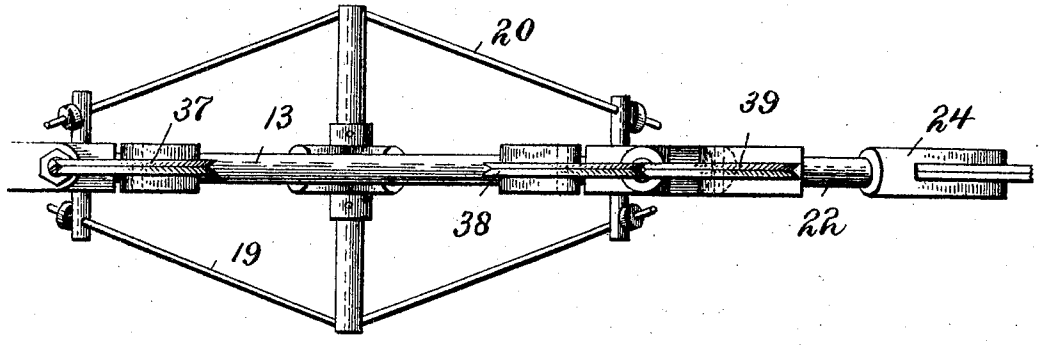

Fig. 5.

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APPLICATION FILED JAN. 25, 1902.

5 SHEETS—SHEET 5.

Fig. 7.

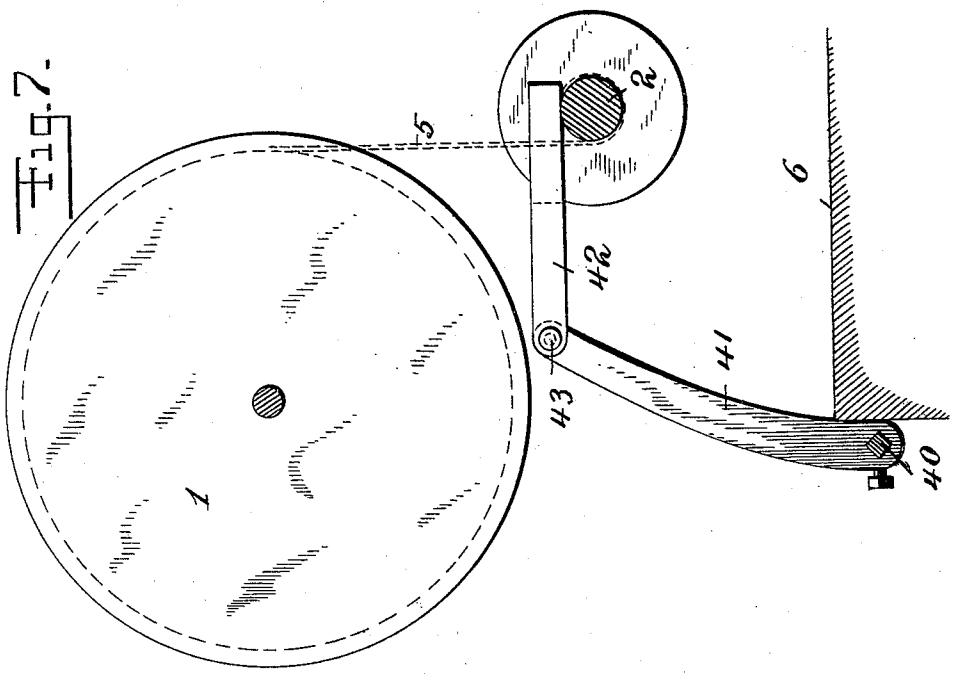
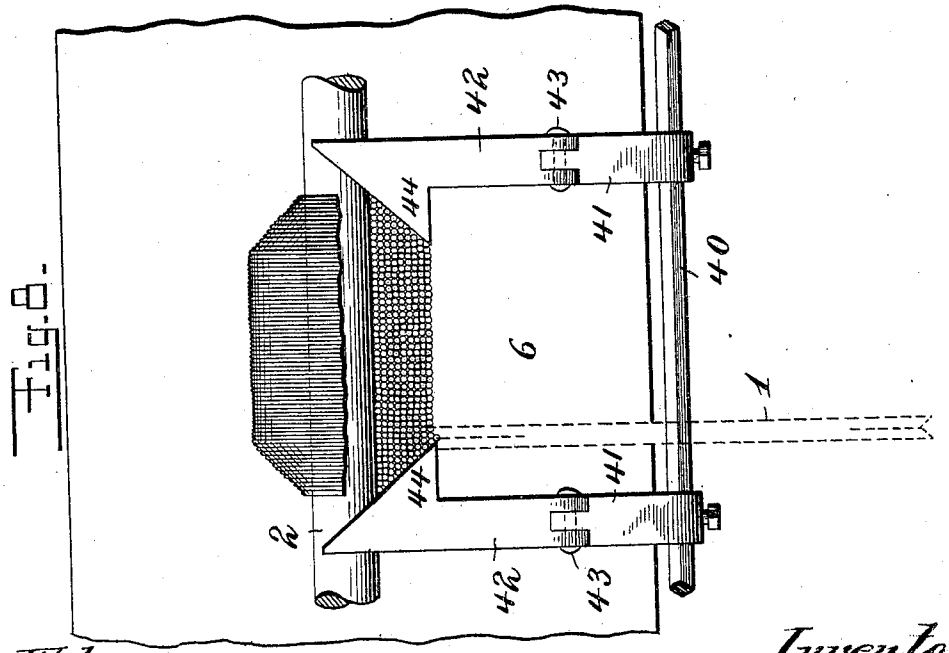


Fig. 8.



Witnesses:

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UNITED STATES PATENT OFFICE.

ARCHIBALD D. SCOTT, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO VARLEY DUPLEX MAGNET COMPANY, A CORPORATION OF NEW JERSEY.

WINDING-MACHINE.

No. 807,133. Specification of Letters Patent. Patented Dec. 12, 1905.

Application filed January 25, 1902. Serial No. 91,222.

To all whom it may concern:

Be it known that I, ARCHIBALD D. SCOTT, a citizen of the United States, and a resident of Providence, in the county of Providence and State of Rhode Island, have invented a new and useful Improvement in Winding-Machines, of which the following is a specification.

This invention is primarily intended and adapted for the winding of insulated wire into coils for electrical apparatus; but principles involved may more or less be applied to the winding of other things.

Heretofore in machines in use for winding in general the movements of the guide for the production of the traverses and the change from one traverse to the next have in general been accomplished by mechanism positively moving the guide independently of the run of strand between the guide and the coil being wound. Such winding-machines are inapplicable to the winding of insulated wire in layers directly upon each other for the purposes of electrical apparatus, because of the knots or lumps in the insulating material or kinks in the wire itself. For this reason, to the best of my knowledge, the winding of insulated wire for electrical apparatus has heretofore been done by hand.

My invention consists of an improved machine in which the traversing of the guide is controlled by the strand being wound.

One feature of my invention consists in so disposing the supports for the wire that the uniformity of self-control exerted by the strand being wound upon the traverses is unimpaired by any substantial variation in tension due to substantial variation in length of wire between the tension device and the coil being wound during a given traverse.

A second feature of my invention consists in so disposing the supports for the wire that the uniformity of self-control exerted by the strand being wound upon the traverses is unimpaired by any substantial variation in the lateral pressure of the guide upon the wire in the direction of traverse during a given traverse.

A third feature of my invention consists in the form of mechanism in which I embody the above first and second features and which consists in a crane supported to swing in a substantially horizontal plane, which being self-supporting relieves the wire from any variations of pressure which might result from participation in the support of the guides, the wire being guided in alinement with the pivotal connections of the crane to also avoid imposing substantial variation in the length of the wire from the movement of the crane.

Other features of my invention will be apparent from the following description and claims.

In the accompanying drawings, Figures 1 and 2 represent in end and front views the mode of operation of the guide and the run of wire between the guide and the mandrel during the process of winding, the deviations of the run of wire from the vertical being exaggerated for clearness of illustration. These views, Figs. 1 and 2, as filed herewith are substantially full size. Figs. 3 and 4 are respectively a plan and rear elevation of the entire apparatus. Figs. 5 and 6 are respectively a plan and elevation of the crane. Figs. 7 and 8 are details of a modification.

The self-control which during the traverse the pull of the wire strand itself exercises upon the operation will first be described.

In Figs. 1 and 2 the guide is represented as the grooved wheel 1 and the coil-receiver as the mandrel 2. 3 and 4 are members which stop or limit the traverses or locate the point of change from one traverse to another. In the preferable form shown they constitute heads consisting of flanges at right angles to the axis of the mandrel and detachably secured to the mandrel, so as to be removable therefrom to permit of the removal of the mandrel from the completed coil. The axis of the wheel-guide 1 is free to move in a horizontal plane, which plane is so located with respect to the mandrel and the mandrel-heads that when the wheel is advanced toward the mandrel till the line tangent to both their peripheries is vertical the wheel will clear the heads 3 and 4 when moved laterally past them. By locating the wheel-guide in the preferable position described and giving it freedom of movement in a horizontal plane it will operate as follows: The end of the wire 5, which passes over the wheel 1 under suitable tension, is fixed to the mandrel by being inserted in a retaining-hole in one of the heads close to the mandrel. The mandrel is run at a speed of, say, two thousand revolutions. As the first layer of wire strand is being wound the wire will pull the wheel-guide 1 so as to keep the

run of wire between the wheel and the mandrel nearly vertical. The wheel, however, because of the friction of its supports or other very gentle and substantially invariable force, will lag slightly behind, and thus give the run of wire between the wheel and mandrel a very slight backward inclination from the vertical, as illustrated with exaggeration in Fig. 2, and cause each succeeding turn of the wire to be laid close up to without mounting upon the preceding turn. This backward inclination of the run of wire also insures the completion of the layer all the way up to the head or strand-stop in advance of any stoppage of the forward traverse of the wheel-guide. The change of traverse is preferably accomplished as follows: When a layer has been completed, the momentum of the wheel-guide will still carry it forward until the run of wire between it and the mandrel becomes perpendicular to the axis of the mandrel and collides with the strand-stop or head 3 or 4, as indicated in dotted lines in Fig. 2, which will arrest the forward movement of the guide-wheel and compel the first turn of a second layer to be superposed upon the first layer. Then the advance of the second layer will impel the wheel-guide in a backward direction and may be depended upon for the change to a backward traverse. As the second layer of the coil proceeds the wire will pull the wheel-guide along with it with a slight lag, as before, until the second layer and backward traverse is complete.

Although in the above specific description reliance is placed upon the heads and upon the force of momentum to complete the layers and to change from one layer to the next, I do not wish to be understood as so limiting myself, because I am aware that a substitute member may perform substantially the function of the head and a substitute force may take the place of the momentum.

Throughout the making of each layer the tendency of the pull of the wire itself when the guide-wheel is in the preferred position is to maintain the movement of the wheel-guide in a straight line parallel with the axis of the mandrel, and as the winding changes from one layer to the next the pull of the wire tends to move the wheel-guide backward the thickness of one layer. Thus the successive traverses of the wheel-guide are made in a succession of straight lines which are separated from each other by the thickness of a layer. In the making of any layer if any variations occur in the size of the strand being wound the freedom of movement of the guide-wheel in the line of traverse permits the wire itself to modify the movement of the guide-wheel, so as to compensate for such variation, and thus the guide-wheel as it traverses is compelled to respond by irregularity of movement to every irregularity in size of the strand being wound. Moreover, it is preferable that, as described, the guide-wheel should also in the change from one traverse or layer to the next be free to be moved backward by the pull of the strand being wound, and when this is the case the extent of backward movement of the guide-wheel accommodates itself to any variation in the thickness of the preceding layer or layers. Thus the line of traverse of the guide-wheel is located by the pull of the wire and deviates from a mathematically straight line to the extent that the surface of the preceding layer deviates.

I will next describe the mechanical structure by which I enable the strand to exercise the self-control upon the winding above described.

6 is a bed-plate, upon which are mounted the stationary head-stock 7 and the movable tail-stock 8, by which the mandrel 2 is held and rotated between centers. To one side of the bed-plate 6 is secured a bracket 9, which rises to a proper height to carry one pair 10 and 11 of the centers of the crane. The inner arm of the crane is composed of the upright 12, which is held by the centers 10 and 11; also, the horizontal members 13 and 14, carrying at their extremities the centers 15 and 16, between which the outer arm of the crane is pivoted; also, the cross-pieces 17 and 18, which are respectively trussed by the rods 19 and 20. The outer arm of the crane is composed of the upright 21, which is held by the centers 15 and 16 and the converging members 22 and 23, at the apex of which is mounted the piece 24, carrying the axle of the guide-wheel 1. The double pivotal connections of this structure firmly support the axis of the guide-wheel in a horizontal plane, but permit of its free movement in such plane responsive to the pull of the wire strand being wound.

25 is the supply bobbin or spool of wire which is mounted between the centers 26 and 27 of the supports or arms 28, carried by the table 29. Tension is applied, preferably, to the supply spool or bobbin by means of the spring 30, one end of which is pivoted to one end of the yoke 31 and the other end of which is adjsuted by a set-screw 32, binding the spring to the other end of the yoke. By adjusting the position of the screw 32 the operator may cause the spring 30 to produce any desired tension by its pressure upon the cone 34. The wire strand leaving the supply spool or bobbin 25 passes over the freely-turning grooved wheel-guide 36, mounted on the bracket 9, and under the freely-turning grooved wheel-guide 37, mounted on the inner arm of the crane. These wheel-guides 36 and 37 are so located that the run of wire between them is for all positions of the crane substantially in alinement with the centers 10 and 11. The wire next proceeds over the freely-running grooved wheel-guide 38, mounted on the forward end of the inner arm

of the crane, and under the freely-running grooved wheel-guide 39, mounted on the outer arm of the crane, the position of these two wheel-guides being such that the run of wire between them is for all positions of the crane held in substantial alinement with the centers 15 and 16. Thus the primary leader to the delivery-guide 1 consists of the two guiding members 38 39, pivotally connected together on the pivotal line 15 16, in substantial alinement with which they lead the strand, while the secondary leader consists of the two guiding members 36 37, pivotally connected together on the pivotal line 10 11, in substantial alinement with which they lead the strand, the leaders and delivery-guide being so distanced from each other by the arms of the crane as to maintain the length of the run of wire substantially invariable. The wire next proceeds over the freely-running grooved wheel-guide 1 to the mandrel, as before described. By having runs of the wire strand held in substantial alinement with both of the pivotal connections of the crane I preserve the freedom of movement of the wheel-guide and substantially prevent any variations in the pull of the wire due to variations of the insulating material or other causes from disturbing the position or regular movement of the guide-wheel 1.

In the modification shown in Figs. 7 and 8 the wheel 1 and mandrel 2 are mounted as before and have the same mode of operation as before during each traverse. In lieu of the heads 3 and 4, however, I employ a finger at each end of the traverses by which the change of traverse is accomplished. These fingers are mounted upon a bar 40, fixed parallel with the axis of the mandrel, each finger being adjustable longitudinally on said bar. Each finger consists of the two members 41 and 42, jointed at 43. The end of each finger rests on the mandrel. Each finger contains a projection 44, which are inversely disposed and are formed at any angle of inclination to the axis of the mandrel which may be desired. These projections 44 are located out of the traversing-path of the wheel 1, so that the wheel 1 may be carried by its momentum past the face of the projection, leaving the traverse to be arrested by the collision between the face of the projection and the run of the strand between the wheel and mandrel. By this contrivance the length of the successive layers of the coil may be varied to any extent required, depending upon the form of the projections 44, and one or both ends of the coil may be made conical.

I do not wish to be limited to the details of mechanism above described.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In a winding-machine, in combination, the coil-receiver, a crane comprising a quadrilateral frame, an approximately triangular frame pivoted to the outer vertical side of the quadrilateral frame, a guide carried by the upper inclined side of the triangular frame and positioned adjacent to the quadrilateral frame, and a delivery-guide standing at an angle with the axis of said coil-receiver and mounted upon the extremity of the triangular frame, whereby the strand being wound produces the traverses by the sidewise movement of said guide.

2. In a winding-machine, in combination, the coil-receiver, a crane containing a plurality of pivotally-connected arms, the forward one of which arms stands at an angle with the axis of said coil-receiver, a delivery-guide mounted upon the extremity of said forward arm and a leader upon said forward arm whereby the strand being wound controls the traverse by the sidewise movement of said forward arm.

3. In a winding-machine, in combination, the coil-receiver, a crane containing a plurality of pivotally-connected arms, the pivotal connection of the forward arm of the same standing in a plane approximately at right angles with the axis of said coil-receiver at its middle, and a delivery-guide mounted upon said forward arm; whereby the traverses of said delivery-guide are free to be controlled by the pull of the strand being wound symmetrically on opposite sides of said plane.

4. In a winding-machine, in combination, the coil-receiver, a frictional device operating on said coil-receiver, a crane containing a plurality of pivotally-connected arms, a delivery-guide mounted upon the forward arm and a pair of guide-wheels one on each side of each pivotal connection; each pivotal line being approximately tangent to the adjacent pair of guide-wheels.

5. In a winding-machine, in combination, the coil-receiver, a crane containing a plurality of pivotally-connected arms, a vertical delivery-guide mounted upon the forward arm, a series of vertical guide-wheels in such position that the centers of said pivotal connections are in approximate alinement with the tangents to each pair of said guide-wheels.

6. In a winding-machine, in combination, the coil-receiver, a crane containing two pivotally-connected arms, the forward arm consisting of a converging frame, and the arm to which it is pivotally connected consisting of a braced quadrilateral frame, and a delivery-guide mounted at the extremity of the converging frame.

7. In a winding-machine, in combination, the coil-receiver, a crane-supporting column, a crane pivotally connected therewith and containing a plurality of pivotally-connected arms, a guide-wheel mounted upon the top of said column and overhanging the pivotal connection therewith, a coöperating guide-wheel mounted upon the top of the crane and also overhanging the pivotal connection with

said column, two guide-wheels on the ends of said arms adjacent to each other and both overhanging the pivotal connection between said arms and a delivery-guide mounted upon the extremity of the forward arm.

8. In a winding-machine, in combination, the coil-receiver, a crane containing a plurality of pivotally-connected arms, a delivery-guide mounted upon the extremity of the forward arm, a supply-spool holder and a frictional device operating upon the side of said spool-holder.

In testimony whereof I have signed my name in the presence of two subscribing witnesses.

ARCHIBALD D. SCOTT.

Witnesses:
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J. A. MILLER, Jr.