C. R. UNDERHILL.

WINDING MACHINE.

APPLICATION FILED OCT. 17, 1913.

1,166,948.

Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

Fig. 1

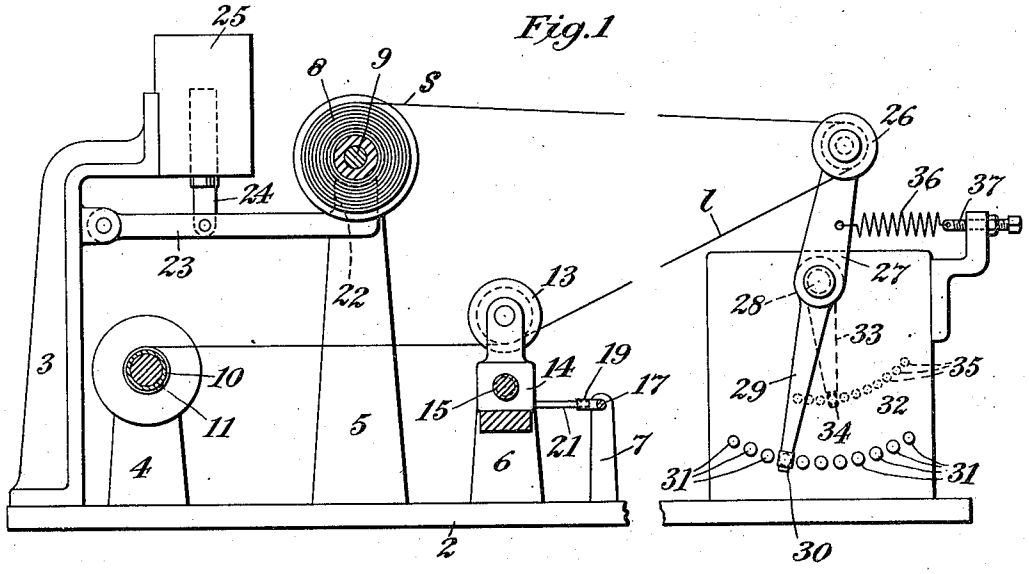
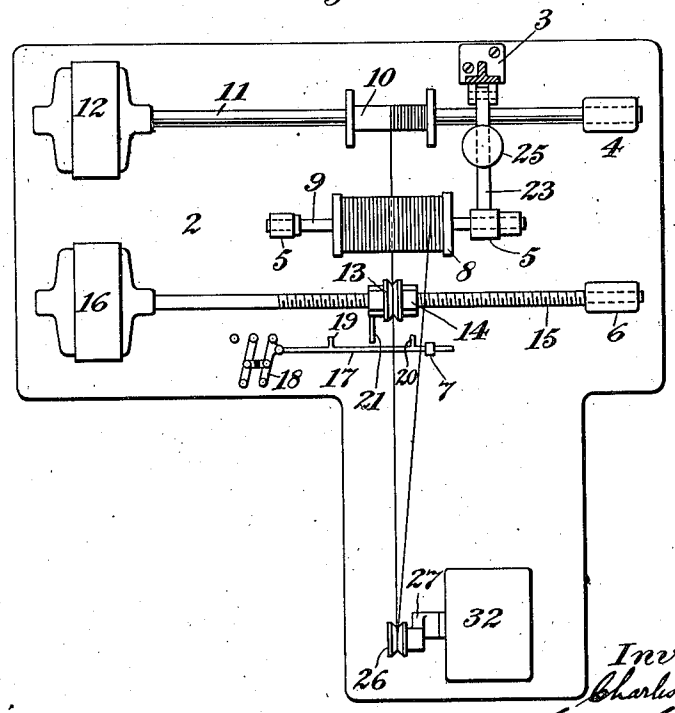


Fig. 2



Witnesses:
Chas. D. King.
Rose Eisenstadt.

Inventor:
Charles R. Underhill,
by
Attorney.

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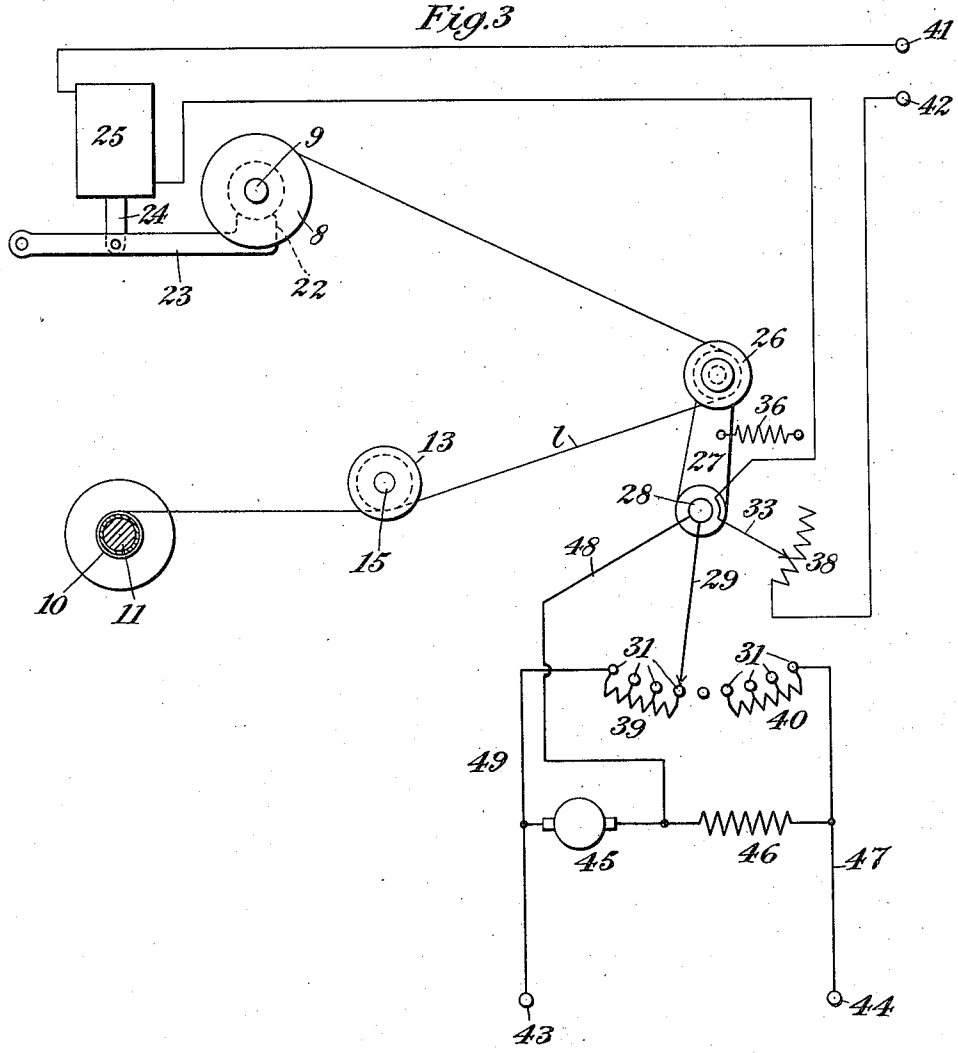
2 SHEETS—SHEET 2.

Fig. 3



Witnesses:
Chas. D. King.
Rose Eisenstadt.

Inventor:
Charles R. Underhill,
by C. L. Thompson.
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES R. UNDERHILL, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE ACME WIRE COMPANY, OF NEW HAVEN, CONNECTICUT, A CORPORATION OF CONNECTICUT.

WINDING-MACHINE.

1,166,948. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed October 17, 1913. Serial No. 795,623.

To all whom it may concern:

Be it known that I, CHARLES R. UNDERHILL, a citizen of the United States, and a resident of New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Winding-Machines, of which the following is a specification.

This invention relates to a winding machine, and particularly to means for controlling the tension of the wire or other strand being wound by such a machine, and the main object of the invention is to provide an improved winding machine for winding wires and other strands in which the tension on the strand and the rate of travel thereof may be maintained substantially constant.

It is well known that in winding magnets, etc., it is important to keep the tension on the wire throughout the winding operation as nearly constant as possible, and it is also well known that it is exceedingly difficult to maintain such a substantially constant tension. I believe that the solution of this problem is to be found in a mutual control between the speed of the winding mandrel and the speed of the spool or source of supply of wire to be wound upon that mandrel. In order to obtain such a mutual control lightness of parts is important, in order that a rapid acceleration or retardation of the speed of the traveling strand at the desired point or points may be obtained. It is especially important that the mandrel itself be light; and it should be driven in such a manner that all inertia and momentum capable of affecting the rate of travel of the strand at the winding point may be as far as possible eliminated. In order to accomplish this result the winding mandrel is preferably separated from all of the other driven parts of the machine and is operated separately by a motor not connected with any other part of the driven mechanism of the winding machine. In the present case the only connection between the winding mandrel and the other parts of the machine, with the exception of the means for tensioning the strand, is the wire or strand itself.

For the purpose of controlling the tension of the wire or strand being wound I make use of suitable means controlled by the tension of the strand itself for varying the rate of travel of such strand. This controlling action is preferably exercised at the two main points in the winding machine hereinbefore referred to, that is to say, at the winding point of the mandrel and at the point of supply of the strand delivered to the mandrel to be wound. In this case the tension of the strand being wound is the means employed for varying the rate of travel of the strand at the point of supply. It is also the means employed for varying the rate of travel of the strand at the winding point; but in this case the controlling action is exerted directly upon the driving means or motor by means of which the mandrel is operated, and through that motor the speed of travel of the mandrel and hence the rate of travel of the strand at the winding point will be regulated. In addition to the provision of means for controlling the rate of travel of the strand at the winding point and at the point of supply by the tension of the traveling strand itself, I also make the controls at the winding point and the point of supply interdependent in the preferred embodiment of my invention, in order that there may be an exceedingly sensitive interaction of the means for controlling the travel of the strand at these two points and a correspondingly sensitive response by each of these controlling means to the controlling action of the other. In order to obtain the best results I deem it desirable to employ electrical controlling means of the quick-acting type, the movable controlling parts of which are light and readily responsive when it is necessary to bring them into action, and the operation of this electrical controlling means, which not only controls but is also controlled by the rate of travel of the strand, is preferably governed by a loop in the strand between the point of supply and the winding point of the machine and is effected through a take-up device cooperative directly with such loop portion of the strand passing to the mandrel. By means of a suitable sensitive take-up device forming part of my automatic tension device for controlling the rate of travel of the wire being wound, every variation in the relative rate of travel of the strand at the point of

supply and the winding point respectively may be instantaneously and accurately indicated and measured, and a corresponding instantaneous and accurate variation of the rate of travel of the strand at the winding point may be effected, which variation will be substantially proportional to the change in the ratio of the speed at the two points mentioned. Thus, by providing a suitable take-up device coöperative with said loop and so constructed as to be responsive instantly to every increase or decrease of the speed of travel of the strand, either at the point of supply or at the winding point, the bend of the loop with which the controlled point of the take-up device coöperates, will be caused to indicate and measure automatically the variations in the speed ratio of the two points referred to, and the controlling point of the take-up will, in the construction employed by me, effect the corresponding necessary variations in the speed of travel of the supplying means and the mandrel, as for example, through the proper regulation of the action of a brake in the former case and the proper regulation of the speed of the motor for driving the mandrel in the latter case.

Other features of my present invention not hereinbefore referred to will be hereinafter described and claimed and are illustrated in the accompanying drawings, in which,

Figure 1 is a sectional side elevation broken at one point in the length thereof, of a simple type of winding machine embodying suitable means for automatically controlling the rate of travel of the strand being wound through the tension exerted on said strand; Fig. 2 is a sectional plan of the same shown on a smaller scale, and Fig. 3 is a diagrammatic view of the main elements of said machine and the electrical controlling means therefor.

Similar characters designate like parts in all the figures of the drawings.

Any suitable means may be employed for mounting and operating the several parts of my improved winding machine. The necessary mechanism of such a machine is quite simple and comprises principally suitable means for supporting and controlling the rotation of a spool or other supplying means, a mandrel, and means for turning the same, and means for controlling the rate of travel of the strand and for reversing the direction of travel of the feed device by means of which successive layers are wound upon the mandrel, this reversal, of course, taking place at the end of each helix wound. All of these operating parts may be mounted upon a suitable base, such as 2, or upon suitable standards rising therefrom, such as are shown at 3, 4, 5, 6 and 7.

The supports 4 and 5 are the principal ones, as on these are mounted the mandrel on which the strand is to be wound and the spool or source of supply from which such strand comes. Here the supply spool is indicated at 8 and is mounted on a short shaft or arbor, 9, on the supports 5 in such a manner as to turn freely unless its movement is positively retarded. The mandrel, which may be of the type shown at 10, is supported by the upright 4, in this case through a long winding arbor or shaft, 11, which constitutes in the construction shown part of the driving means for the mandrel, it being illustrated as the armature shaft of an electric motor, 12, employed for turning the mandrel.

The strand in passing from the spool or supplying means 8 to the winding mandrel 10, passes, as is usual, around a guide-sheave operative for laying the strand on the mandrel in coils in close succession. This guide-sheave may be of the type indicated at 13, it being suitably mounted in this case on a feed-nut, 14, mounted to travel back and forth along a feed-screw, 15, which may be rotated by any suitable driving means, such as an electric motor, 16. The feed-screw 15 constitutes in this case an extension of the armature shaft of the motor 16 and has its free end mounted in the upright 6, for support. It will be noticed that separate driving means or motors are employed for turning the feed-screw and the arbor of the winding mandrel respectively, in order that the work to be done in turning the winding mandrel may be reduced to the minimum.

For the purpose of reversing the direction of movement of the feed-nut 14 and the guide-sheave 13 traveling therewith, the direction of rotation of the motor 16 will be reversed. This may be accomplished in any suitable manner, a simple mechanical means being illustrated for the purpose of reversing the direction of current through the motor 16 at the proper time. This electro-mechanical reversing switch comprises, in the construction here illustrated, a slide, 17, one end of which is mounted to move back and forth in the support 7, while the other end is connected directly to a reversing switch, 18, of well-known construction, controlling the direction of the current through the motor 16. On the reversing rod or bar 17 are two projections, 19 and 20, which coöperate with a corresponding projection, 21, extending from the feed-nut 14. These parts are so constructed and combined that at the proper point near the end of its travel in one direction the projection 21 strikes one or the other of the projections 19 and 20 on the switch-bar 17 and shifts said switch-bar until the switch is in the opposite position for reversing the current through the

motor 16. On the approach to the opposite end of its travel in the new direction this operation is of course repeated through the other projection on the switch-bar and the switch-bar shifted in the opposite direction, and with it the switch 18, to send the current through said motor in the other direction. As the speed with which the feed-screw 15 travels should be substantially constant in one direction or the other, the reversing switch 18 is all that is required to control the operation of the motor 16. In the case of the winding mandrel 10, however, while the rate of rotation should be substantially constant, yet in order to obtain a proper regulation of the winding action provision must be made for varying the speed of said mandrel and for obtaining a variation in the speed substantially instantaneously. In order to accomplish this the motor 12 should be one in which such a variation of speed may be readily obtained. The motor employed is a series motor having suitable means for controlling the action thereof and obtaining a close regulation of the speed of rotation of the armature shaft 11. I prefer to regulate the speed of this shaft by shunting more or less of the current normally passing through the field windings or armature windings, as the case may be. The manner in which this regulating action is preferably secured will be hereinafter described more in detail.

In addition to obtaining a close regulation of the rate of travel of the wire or other strand at the winding point of the mandrel, as just described, I also preferably employ means for obtaining a close regulation of the rate of travel of said strand at the point of supply. In the construction here shown this regulation results from the employment of a brake having a graduated braking action preferably under electrical control. I have illustrated in this construction a brake, 22, mounted on the end of a brake-lever, 23, pivoted on the support 3 and connected at a suitable point to the core, 24, of a solenoid, 25, connected in a suitable regulating circuit. The braking action of this device may be closely regulated by correspondingly regulating the pull of the solenoid.

As before stated, the rate at which the strand travels is intended to be controlled by the tension thereon, this tension serving in the present case to control the rate of travel both at the point of supply and at the winding point. In order that the changes in the tension of the strand being wound may bring about a substantially instantaneous regulation of the speed of the motor 12 controlling the winding operation, or of the spool 8 controlling the paying out of the strand, or of both of these, the portion of the strand between the point of supply and the winding point is preferably carried around a suitable guide-point to form a loop and this guide-point is shiftable in a path of considerable length. The object of this is to obtain at the guide-point controlled by this loop a very sensitive action and to transmit the movement that takes place at this guide-point to another point controlling the rate of travel of the strand being wound. This guide-point in the present case is the axis of a guide-sheave, 26, mounted to turn in this instance on a rock-arm, 27, suitably pivoted at 28 and having, in the construction shown, a controller-arm, or switch-arm, 29, carrying a contact, 30, adapted to travel over a series of contacts, 31, of a suitable rheostat, 32, for the purpose of obtaining a fine regulation of the flow of current in a controlling electric circuit, in this case the circuit of the series motor 12 governing the winding mandrel. Here a second controller-arm or switch-arm, 33, is also in fixed relation with the rock-arm 27 and carries a contact, 34, movable over a series of contacts, 35, of said rheostat in a manner similar to that illustrated in connection with the contacts 30 and 31. This second switch-arm and row of contacts control in the present case the current through the solenoid 25. The rock-arm 27 together with the switch-arms 29 and 33 and the guide-sheave 26 constitute a light rocking element freely movable about the axis 28 in one direction under the influence of the tension exerted by the shortening loop, 1, of the strand, *s*, being wound, and also freely movable in the opposite direction under the influence of a suitable actuator, such as a light spring, 36, which opposes the pull of said shortening loop, as will be obvious. The tension of the spring 36 may be regulated as shown in Fig. 1, by a suitable adjusting screw, 37. As the strand travels around the various rotary elements from the spool 8 to the winding mandrel and the rate of travel of the strand at the point of supply or at the winding point, or both, varies from time to time, the length of the loop 1 will correspondingly change and as it does the rock-arm 27 with its guide-sheave 26 will be swung in one direction or the other and the ratio of the movements of the mandrel and the supply spool at every moment will be accurately indicated and measured by the position and movement of said rock-arm and the parts connected thereto. Said rock-arm will of course swing to the right in Fig. 1 as the tension on the strand between the point of supply and the winding point decreases, and will swing to the left as said tension increases and becomes effective to overcome the power exerted by the spring 36. As said rock-arm swings in one direction or the other the controller-arms 29 and 33 will correspondingly swing over the contacts 31 and 35 of the two

sets of resistances of the rheostat 32 and the current passing through the brake-controlling solenoid 25 and the series motor governing the rate of rotation of the mandrel will be correspondingly cut down or built up, as the case may be.

The manner in which the automatic electric controlling means or switch mechanism just described operates to regulate the rate of travel of the strand, both at the point of supply and the winding point, will be clear by referring to the diagram in Fig. 3, in which the controller-arms 29 and 33 are indicated by arrows as coöperating with the rows of contacts 31 and 35 of two sets of resistance coils, one of which is indicated at 38 and serves to control the solenoid 25, while the other is divided into two sections, 39 and 40, controlling respectively the armature and field windings of the series motor 12. 41 and 42 and 43 and 44 designate terminals which, it will be understood, are connected with a suitable source or sources of electric energy, and it will be clear that when there is no resistance 38 in the circuit of the solenoid 25 and no resistance 39 or 40 in shunt with the circuit of the armature 45, or the field windings, 46, of the series motor 12 the full strength of the current employed to energize the solenoid 25 will flow through said solenoid and the full strength of the current used in the motor 12 will pass through both the armature windings and the field windings of said motor. The manner in which the controller-arm 33, moving in either direction from a central point, cuts the sections of the resistance coil 38 into or out of circuit will be obvious. This solenoid circuit is shown in light lines in Fig. 3 to distinguish it from the circuit through the motor. When the controller-arm 29 is on the central contact of the series of contacts 31 the circuit of the motor 12 will be directly through the field windings and the armature windings thereof, as will be clear from the diagram. When, however, the arm 29 swings either to the right or to the left onto the contacts controlling either the resistance 40 or the resistance 39 a shunt of greater or less resistance around either the field windings or the armature windings, as the case may be, will be established and a portion of the current traversing such windings correspondingly shunted, as will be clear from said diagram. When the controller-arm 29 reaches its extreme right-hand position the field windings 46 will be completely shunted and all the current will pass from terminal 44 through conductor 47, resistance 40, controller-arm 29 and conductor 48, to and through the armature windings without passing through the field windings; while when in its extreme left-hand position all of the current will pass from said terminal 44 through conductor 47, through the windings 46, conductor 48, controller-arm 29 and conductor 49, to the opposite terminal 43 without passing through the armature windings 45, and thus an absolute short circuit of the armature will be established and the motor will be instantaneously stopped automatically when the controller-arm 29 reaches this extreme left-hand position.

It will be clear from the foregoing that by the means described there is obtained an interdependent control of the movements of the strand at the point of supply and the winding point respectively which control is exceedingly sensitive and is responsive substantially instantaneously to any variation whatever in the position of the principal controlling point, viz., the axis of the guide-sheave 26, which change takes place whenever there is a change in the ratio of the movements of the strand at such point of supply and winding point respectively. It will of course be clear that this change of ratio may be due either to an increase or a decrease of the rate of travel at the winding point, or to an increase or decrease of the rate of travel at the point of supply, or to a change in the rate of travel at both of said points. As the controlling point changes and the controller-arm swing in one direction or the other the flow of current through the solenoid 25 and the series electric motor 12 will be varied in the manner before described to produce the necessary changes in the braking action and in the speed of rotation of the armature shaft 11 automatically determined by the action of the electrical controlling means for measuring and indicating the variations in the tension of the strand, and for varying the rate of travel of the strand in accordance with such changes in tension.

What I claim is:

1. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical means coöperating with the strand at a point between the point of supply and the mandrel and controlled by the tension of the strand being wound for varying the rate of travel of the turning mandrel.

2. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical controlling means coöperative with the strand at a point between the point of supply and the mandrel for regulating the rate of travel of the turning mandrel.

3. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical controlling means for regulating the rate of travel of the strand at the turning mandrel said means embodying an element coöperative with the strand at a point between the point of supply and the

mandrel and controlled by the tension of the strand.

4. In a winding machine, the combination with a winding mandrel, of a motor for turning said mandrel, and electrical controlling means for regulating the rate of travel of the strand said means embodying an element coöperative with the strand at a point between the point of supply and the mandrel and controlling said rate of travel and controlled by the tension of the strand.

5. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical controlling means for regulating the rate of travel of the strand at the turning mandrel said means embodying an element controlling said rate of travel and a second element controlled by the tension of the strand.

6. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical means coöperative with the strand at a point between the point of supply and the mandrel and controlled by the tension of the strand being wound for varying the speed of said motor.

7. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical means coöperative with the strand at a point between the point of supply and the mandrel and controlled by an increase in the tension of the strand being wound for reducing the speed of said motor.

8. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical means coöperative with the strand at a point between the point of supply and the mandrel and controlled by a decrease in the tension of the strand being wound for increasing the speed of said motor.

9. In a winding machine, the combination with a winding mandrel, of a series motor for turning said mandrel and having field and armature windings, and means controlled by an increase in the tension of the strand being wound for shunting one of said windings.

10. In a winding machine, the combination with a winding mandrel, of a series motor for turning said mandrel and having field and armature windings, and means controlled by changes in the tension of the strand being wound for shunting both of said windings but each at a different time.

11. In a winding machine, the combination with a winding mandrel and with means for supplying a strand, of a motor normally operative for turning said mandrel, and circuit-controlling means governed by the tension of the strand between the point of supply and the mandrel for varying the speed of said motor.

12. In a winding machine, the combination with a winding mandrel, of an independent motor unconnected with the remainder of the winding machine and normally operative for turning said mandrel, and electrical means coöperative with the strand at a point between the point of supply and the mandrel and controlled by the tension of the strand being wound for varying the speed of said motor.

13. In a winding machine, the combination with a winding mandrel, of a motor for turning said mandrel, and an automatic tension device coöperative with the strand at a point between the point of supply and the mandrel and controlled by the tension of the strand and embodying electrical means for varying the rate of travel of the turning mandrel.

14. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, and electrical means controlled by said take-up device for varying the rate of travel of the turning mandrel.

15. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, and electrical means controlled by said take-up device for varying the rate of travel of the strand at the mandrel.

16. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, and automatic electrical means controlled by said take-up device for varying the rate of travel of the strand-supplying means and of the turning mandrel.

17. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device coöperative with and controlling a loop in the strand between the point of supply and the winding point, and electrical controlling means governed by said take-up device for varying the rate of travel of the strand.

18. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device coöperative with and controlling a loop in the strand between the point of supply and the winding point, and electrical controlling means for varying the rate of travel of the strand, said means including a contact-arm governed by said take-up device.

19. In a winding machine, the combination with a winding mandrel, of means for

supplying a strand, a take-up device cooperative with and controlling a loop in the strand between the point of supply and the winding point, and electrical means for regulating the rate of travel of said strand at each of said points in proportion to the movements of said take-up device.

20. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, a motor for turning the mandrel, and means for varying the speed of said motor in proportion to the movements of said take-up device.

21. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, a motor for turning the mandrel, a brake for said supplying means, and means for varying both the speed of said motor and the braking action in proportion to the movements of said take-up device.

22. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, electrically-operated means for regulating the rate of travel of the winding mandrel, and a rheostat for varying the operation of said electrically-operated means in proportion to the movements of said take-up device and having a contact-arm governed by said take-up device.

23. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, and electrical controlling means for varying the rate of travel of the strand, said means including a motor for turning the mandrel and a contact-arm governed by said take-up device and controlling the operation of said motor.

24. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, and electrical controlling means for varying the rate of travel of the strand, said means including a motor for turning the mandrel, and a rheostat governing the operation of said motor and having a contact-arm governed by said take-up device.

25. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, a motor for turning the mandrel, a brake for said supplying means, and electrical controlling means governing the operation of said motor and brake and including a rheostat having a pair of contact-arms governed by said take-up device and corresponding respectively to said motor and brake.

26. In a winding machine, the combination with a winding mandrel, of means for supplying a strand, a take-up device for controlling a loop in the strand between the point of supply and the winding point, a series motor for turning the mandrel, and means controlled by the take-up device for shunting one of the windings of said motor to vary the rate of travel of said motor and the strand.

27. In a winding machine, the combination with a winding mandrel, of automatic electrical means for supplying a strand, and means controlled conjointly by said mandrel and supplying means and coöperative with the strand at a point between them for regulating the rate of travel of the strand.

28. In a winding machine, the combination with a winding mandrel, of automatic electrical means for supplying a strand, and means controlled conjointly by said mandrel and supplying means and coöperative with the strand at a point between them for maintaining a substantially constant tension upon the strand.

29. In a winding machine, the combination with a winding mandrel, of automatic electrical means for supplying a strand, and means controlled conjointly by said mandrel and supplying means and coöperative with the strand at a point between them for maintaining a substantially constant tension upon the strand at the winding point.

30. In a winding machine, the combination with a winding mandrel, of a motor normally operative for turning said mandrel, and electrical controlling means coöperative with the material at a point between the point of supply and the mandrel for regulating the rate of travel of the turning mandrel.

31. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device for controlling a loop in the material between the point of supply and the winding point, and electrical means controlled by said take-up device for varying the rate of travel of the turning mandrel.

32. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device for controlling a loop in the material between the point of supply and the winding point, and electrical means controlled by said take-up device for varying the rate of travel of the material at the mandrel.

33. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device cooperative with and controlling a loop in the material between the point of supply and the winding point, and electrical controlling means governed by said take-up device for varying the rate of travel of the material.

34. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device cooperative with and controlling a loop in the material between the point of supply and the winding point, and electrical controlling means for varying the rate of travel of the material, said means including a contact-arm governed by said take-up device.

35. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device for controlling a loop in the material between the point of supply and the winding point, a motor for turning the mandrel, and means for varying the speed of said motor in proportion to the movements of said take-up device.

36. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device for controlling a loop in the material between the point of supply and the winding point, electrically-operated means for regulating the rate of travel of the winding mandrel, and a rheostat for varying the operation of said electrically-operated means in proportion to the movements of said take-up device and having a contact-arm governed by said take-up device.

37. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device for controlling a loop in the material between the point of supply and the winding point, and electrical controlling means for varying the rate of travel of the material, said means including a motor for turning the mandrel and a contact-arm governed by said take-up device and controlling the operation of said motor.

38. In a winding machine, the combination with a winding mandrel, of means for supplying a material, a take-up device for controlling a loop in the material between the point of supply and the winding point, and electrical controlling means for varying the rate of travel of the material, said means including a motor for turning the mandrel, and a rheostat governing the operation of said motor and having a contact-arm governed by said take-up device.

Signed at New Haven in the county of New Haven and State of Connecticut this 9th day of October A. D. 1913.

CHARLES R. UNDERHILL.

Witnesses:

MARY A. MURPHY,

EVA M. VISEL.