March 8, 1949. C. D. JENCKS 2,463,773

WINDING MACHINE

Filed April 14, 1944 2 Sheets-Sheet 1

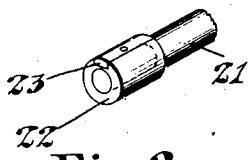

Fig.2.

Fig.1.

INVENTOR.
Charles D. Jencks.
BY
Kenway & Witter. Attys.

March 8, 1949. C. D. JENCKS 2,463,773

WINDING MACHINE

Filed April 14, 1944 2 Sheets-Sheet 2

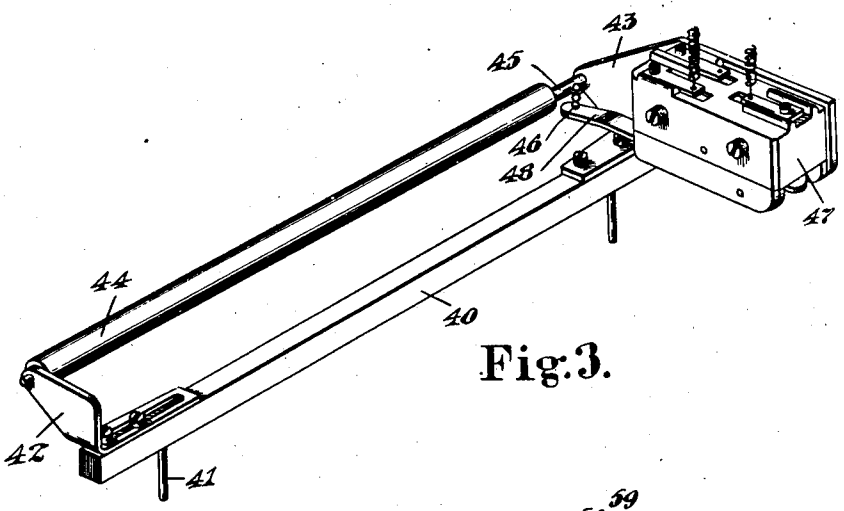

Fig.3.

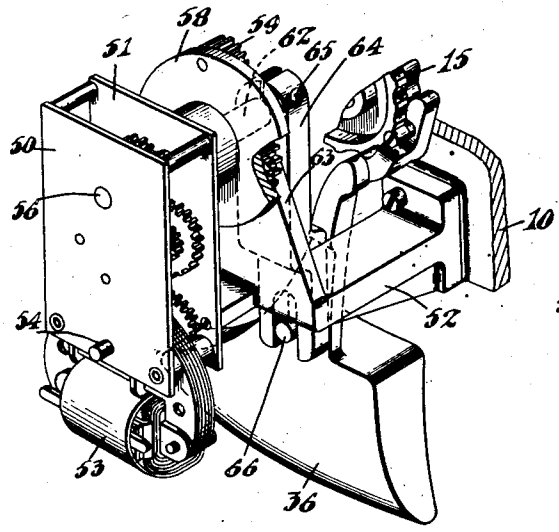

Fig.4.

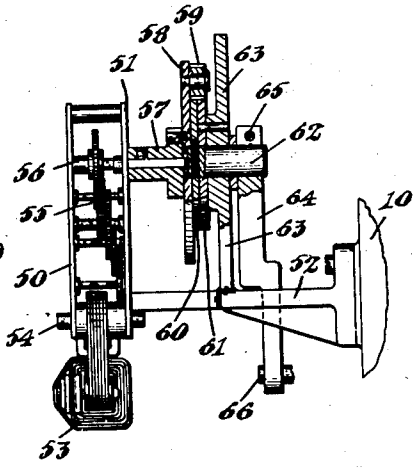

Fig.5.

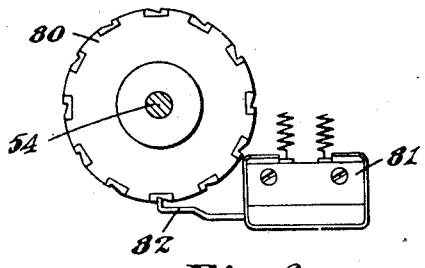

Fig.6.

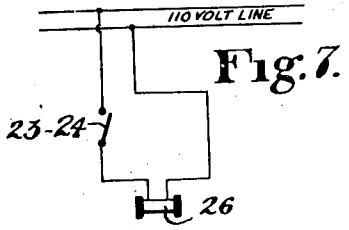

Fig.7.

INVENTOR.
Charles D. Jencks.
BY
Thurman & Witter
Attys.

Patented Mar. 8, 1949 2,463,773

UNITED STATES PATENT OFFICE

2,463,773

WINDING MACHINE

Charles Davis Jencks, Bristol, R. I., assignor, by mesne assignments, to The Werdna Company, Bristol Highlands, R. I., a partnership

Application April 14, 1944, Serial No. 530,980

17 Claims. (Cl. 242—18)

1

This invention relates to machines for winding yarn, thread or other filaments and consists in improvements whereby thread packages may be automatically wound at high speed with more exact control of density and accuracy in size, shape, contents and all other respects than has been possible heretofore. My invention also includes within its scope the novel process of winding filaments herein disclosed.

The invention consists in a new and improved winding machine in which a device for controlling the laying of the thread and the contour of the package is maintained always either in infinitely light contact with or barely out of contact with the surface of the package being wound, with the result that the thread is laid with extreme accuracy and uniformity and the package formed accordingly.

In the machine of my invention the thread is accurately controlled in its passage to the package by a controlling device which is caused to be moved away from the surface of the package by an independent source of power whose operation is automatically controlled by the growth of the thread package itself. Going more into detail, the improved machine has a control roll constructed and arranged to be moved or rocked by the merest touch from the package, in some cases accentuated by the traction of the thread as delivered to the package, and connections through which an independent source of power—herein shown as a motor—may be set in operation for retracting the control roll. In this respect my invention is to be distinguished from winding machines heretofore known in which a friction disk driven by traction on the package has been employed to operate a gear train for moving a package-supporting cradle to separate the package and thread guide. In the machine of my invention the control roll has no burden of operating a gear train and no gear train is employed between the control roll and the frame or back carrying the thread guide. On the contrary, the control roll has only to rock sufficiently to trip a finely balanced micro-switch or the like, an operation requiring only the slighest impulse. In this way I secure a lighter, quicker, more delicately responsive and more frequent control action than heretofore known and at the same time provide a positive control and retraction of the control roll under favorable power conditions. Substantially the same short length of thread is maintained at all times between the thread guide and the surface of the package and thus a thread package may be produced of any desired

2

and uniform density and of extreme accuracy in size, shape and length of thread. For example, I may produce at high speed packages uniform throughout of any natural or synthetic yarns, either elastic or non-elastic, softer to the touch, more uniform, lighter in density and with less initial tension in the wound strand than has been practicable heretofore. This, of course, is particularly desirable in dealing with any strand of an elastic nature and where package-dyeing is to be carried out.

As above explained, an important feature of my invention consists in causing the separation of the package and the control roll to take place by frequent steps of almost infinitesimal length. As an optional feature, however, I contemplate causing this separation to take place by a series of steps of predetermined amplitude. As herein shown this may be effected by mechanism employed optionally and operating to supply energizing current to the motor for a predetermined interval of time for each closing of the control switch and independently of the interval during which the control switch itself may be closed.

The process of my invention is characterized by the steps of directing a thread to a rotating package, maintaining a control roll adjacent to the surface of the package, and retracting the roll from actual contact with the package by power actuation independent of the package rotation and from time to time as the surface of the growing package meets the roll.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawings, in which:

Fig. 1 is a view in perspective of so much of a winding machine equipped with the mechanism of my invention as is necessary to understand its operation;

Fig. 2 is a fragmentary view in perspective showing a portion of the feeler roll;

Fig. 3 is a view in perspective of feeler mechanism of modified construction;

Fig. 4 is a view in perspective of a motor and its connections for operating the back;

Fig. 5 is a corresponding view in longitudinal section;

Fig. 6 is a view in elevation of mechanism comprising an optional feature of the invention; and

Fig. 7 is a diagram of the circuit employed with the mechanism shown in Fig. 1.

In carrying out my invention, any desired winding machine of conventional construction may be

employed insofar as the general construction of the elements for supporting and rotating the winding spindle and for imparting traversing movement to the thread guide. Accordingly, in Fig. 1 is shown only one of the upright side frames 10 of such a winding machine. In this frame is supported by suitable journal boxes and rotated at high speed a horizontal spindle 11 having a flange and a removable collar 12 at its outer end between which may be clamped the cop on which the thread package 13 is to be wound. In Fig. 1 the thread package is shown as cylindrical but it might, of course, be conical in shape.

The back carrying the thread guide and control device is supported to rock about the axis of a stud projecting outwardly from a boss 14 in the side frame 10, being held in place by a threaded hand wheel 15 on the outer end of the stud. The back includes an upwardly extending arm 16 carrying a transversely extending frame 17. In this frame a bearing is provided for a horizontal rod 18 from which extends an upright arm carrying the thread guide 19. The rod 18 is reciprocated at high speed by cam mechanism, not shown, in traversing the thread guide back and forth in a path parallel to the surface of the thread package 13.

In the upper portion of the frame 17 is removably secured an elongated yoke 20 having inwardly extending arms between which is journaled a long attenuated roll 21. This roll is journaled to turn freely upon cone-pointed screws set in the arms of the yoke and constitutes the control device or feeler member of the mechanism as will presently appear. At its left hand end it extends outwardly beyond the end of the thread package and is provided with a rotary switch comprising a fibre sleeve 22 in the periphery of which is set a metal key 23 as shown in Fig. 2. Resting upon the sleeve 22 are the in-turned ends of a pair of spaced metal leaf springs 24. These are supported by an insulated bracket secured to the frame 17 and are individually connected to wires 25 in the power circuit of a solenoid 26. The solenoid is mounted in a casing 27 secured to the frame of the machine and is arranged to oscillate an armature 28 pivotally mounted inside the casing 27. To the armature 28 is adjustably attached an angle carrier 29 and to this is secured a stirrup 30 carrying a pawl 31. The pawl 31 rests upon a ratchet disk 32 fast to the outer end of a shaft 33 journaled in arms projecting downwardly from the casing 27. Connected to the shaft 33 is a chain 34 which is arranged to be wound upon the shaft windlass fashion. The outer end of the chain is connected through a bracket 35 to a weighted segmental arm 36 bolted at its upper end to the upwardly extending arm 16 of the back. The arm 36 is so designed that the back as a whole tends always to rock forwardly toward the thread package 13. The back is restrained in its movement and retracted from time to time from the thread package by its connection to the chain 34. The armature 28 and the pawl 31 are moved toward the right when the solenoid is de-energized by a tension spring 38 connected to a stationary downwardly extending bracket 37 and to a pin projecting downwardly from the pawl itself.

In operation the pawl 31 may be lifted by hand from engagement with the ratchet disk 32 and the back moved, or allowed to move, toward the thread package to locate the thread guide 19 at the proper distance from the cop to initiate the winding operation. As the thread package grows

in diameter its surface will brush against the roll 21 and will therefore turn the roll in counter-clockwise direction as shown in Fig. 1. When in this turning of the roll, the key 23 is moved beneath the ends of the springs 24, the solenoid circuit is closed, the armature 28 is swung toward the left and the pawl 31 advances the ratchet disk 32 one tooth. The shaft 33 is therefore turned and the chain 34 shortened by being wound upon it. The weighted arm 36 is accordingly rocked toward the left and the back with the thread guide 19 retracted from the thread package. The roll 21 now remains out of contact with the thread package until the diameter of the package is again increased sufficiently to turn the roll 21 again, first to break the contact through the arms 24 of the rotary switch, releasing the pawl for movement toward the right, and then to re-establish contact again and so advance the ratchet wheel the distance of another tooth.

It will be understood that the thread after leaving the thread guide 19 passes downwardly in contact with the surface of the roll 21 facing toward the thread package. By locating the thread guide slightly above the medial zone of the thread package, the traction of the thread on the roll 21 is increased with the growth of the thread package, and if desired the mechanism may be adjusted so that this traction of the thread on the roll is sufficient to turn the roll without waiting for actual contact with the thread package itself. Thus the thread guide and package are automatically separated and an approximately uniform short length of thread is maintained between the thread guide and the package throughout the winding operation by the operation of an independent source of power controlled in its action through relay mechanism by the actual growth in diameter of the thread package.

The solenoid 26 is an independent source of power in the sense that it is a motor operated by energy supplied independently of that driving the winding spindle and it will be apparent that motors of any convenient size or type may be substituted for that herein shown and that electric switches for controlling the motor may be employed of different types from the rotary switch illustrated in detail in Fig. 2.

In Fig. 3 is illustrated an alternative type of switch which may be connected to the feeler roll and incorporated in the mechanism of my invention with good advantage. In Fig. 3 the bar 40 corresponds to the yoke-shaped frame 20 of Fig. 1 and is removably retained in the frame 17 of the back by dowel pins 41. It is provided at opposite ends with brackets 42 and 43 in which is journaled for free rotation a feeler roll 44 corresponding to the roll 21 of Fig. 1. The roll 44 is maintained in position adjacent to and parallel with the surface of the thread package being wound. It is somewhat longer than the package in that it has a shouldered end 45 which extends beyond one end of the package and is connected to a short chain 46 which, when the roll is turned in counter-clockwise relation, is wound, windlass fashion, upon the end of the roll. Mounted upon the right hand bracket 43 of the bar 40 is a micro-switch 47 having an operating arm 48 which extends downwardly and is connected to the chain 46 at a point beneath the end 45 of the roll.

The switch 47 is a commercial article which may be secured in size appropriate to control the service circuit supplying the solenoid 26 or any other electric motor utilized for retracting the

back. The movement of the arm 48 is effective to close the circuit through the switch and the whole construction is balanced so that a slight lifting effect only is necessary for this purpose. Accordingly, when the package diameter increases to the point where the surface of the package brushes against the roll 44, or the traction of the thread in passing about the roll between the thread guide and the package surface is increased, the roll is turned in a counter-clockwise direction, the switch arm 48 is lifted, the solenoid 26 is is energized, and the ratchet wheel 32 is turned through one tooth to retract the back with the roll and thread guide from the package. As soon as contact of the thread package and the roll is interrupted, or traction on the thread relieved, the weight of the switch arm 48 is sufficient to rock the roll 44 back to its initial position where it remains until further increase in the thread package diameter again brings about contact with the roll.

In Figs. 4 and 5 is illustrated an electric motor which may be employed as the independent source of power for retracting the back in place of the solenoid shown in Fig. 1 and with certain advantages which will be presently pointed out. In this construction the parts of a rotary electric motor are mounted between side plates 50 and 51 and supported by a bracket 52 fast to the upright side frame 10 of the machine. The motor includes field windings 53 and a rotary armature driving a transverse shaft 54. The shaft 54 operates a gear train, indicated collectively by reference character 55, which drives a shaft 56 journaled in the upper portion of the side plates at greatly reduced speed as compared to that of the motor shaft 54. The shaft 56 extends through the right hand side plate 51 and secured thereto is a flanged hub 57 to which is pinned a carrier disk 58. The carrier disk 58 has a pinion 59 mounted near its periphery which meshes with the large gear 60 and also with a gear 61 which is of the same diameter as the gear 60 but has one more tooth in its periphery. The gear 60 is pinned to the inner or left hand end of a short shaft 62 which is journaled in an arm 63 extending upwardly from the bracket 52. The carrier disk 58 and the two gears 60 and 61 are arranged concentrically side by side upon the inner end of the shaft 62. The gear 61 is held stationary by being pinned to the arm 63. It will be understood that in the above described mechanism when the carrier disk 58 makes one complete revolution carrying the pinion 59 with it, the gear 60 is advanced one tooth with respect to the gear 61. This reduction, together with the reduction introduced by the gear train 55, provides a reduction of the order of one to one million between the motor shaft 54 and the short shaft 62.

Secured to the right hand end of the short shaft 62 is a downwardly extending arm 64 which is oscillated slowly toward the left, as seen in Fig. 4, as the shaft 62 is turned in its bearing bracket 63. The arm 64 is split at its upper end and frictionally retained in position on the shaft 62 by a transverse adjusting screw 65. At its lower end the arm 64 is forked to receive a pin 66 projecting outwardly from the weighted arm 36 of the back.

Accordingly, when the switch 47 is instantaneously closed by rocking of the control roll 44, the motor above described is momentarily energized and the arm 64 swings the weighted arm 36 of the back forwardly, retracting the roll 44 and thread guide from the surface of the thread package. As soon as the contact is broken, the motor ceases to operate and the back remains at rest until a new contact is established. The adjustable frictional connection between the arm 64 and the shaft 62 is provided in order that lost motion may be provided for rocking the back inwardly by hand preparatory to winding a new thread package; that is to say, after the thread package has been completed and removed from its spindle 11, the back may be rocked inwardly by the operator who has only to supply sufficient force to overcome the frictional connection between the shaft 62 and the arm 64. It will be noticed when this is done that even if the back is rocked sufficiently to bring the control roll 44 into contact with the cop for the new package, rotation of the cop will immediately retract the back and establish the desired relationship between the control roll 44 and the thread guide 19 on the one hand, and the surface of the package being wound on the other.

It has been found that in some instances it is desirable to retract the back through a predetermined distance each time the feeler roll is rocked, and to effect this different mode of procedure means may be provided for insuring operation of the motor for a predetermined interval each time the switch is closed. This may be effected as suggested in Fig. 6 by providing a toothed disk 80 upon the motor shaft 54, or upon any convenient shaft which is advanced when the motor circuit is closed. With the disk 80 is associated a second micro-switch 81 having an operating arm 82 normally bearing against the periphery of the disk and occupying an open circuit position whenever it is seated in one of the notches between the teeth of the disk 80 as shown, for example, in Fig. 6. The switch 81 controls a second service circuit to the motor and the arrangement is such that when the disk 80 is rotated by the initial closing of the switch 47, the switch arm 82 is forced outwardly by the inclined tooth surface of the disk 80, the switch 81 is closed and energy is supplied to the motor until the next notch of the disk 80 is brought into operative position permitting the arm 82 to rise and break the circuit through the switch 81. It will thus be seen that when the motor is once set in operation it continues to operate for a predetermined interval of time sufficient for the disk 80 to advance one tooth, the switch 81 being held closed during that interval and opening the motor circuit at the conclusion thereof.

By the judicious selection of the elements above described, it is possible to maintain the feeler roll and thread guide at all times close to the surface of the thread package and to effect separation by a multiplicity of infinitesimally short steps, or by including the auxiliary switch of Fig. 6, to effect the same separation by a series of longer steps at more infrequent intervals. The range of use of the winding machine is thus greatly increased and it may be adapted for winding yarns varying greatly in their elasticity and hardness and for producing packages of accurate shape and size but varying in density from a hard solid package to a package that is extremely soft and compressible.

The mechanism above described provides a closer and more accurate control of the steps of directing and laying the strand upon the package and of maintaining a control member in close proximity to the package surface than has been heretofore possible, but in providing the new and improved package for the first time produced by the process of my invention, it is necessary

also to insure that the strand shall arrive at the thread guide with uniform tension from start to finish of the winding operation. To satisfy this requirement it is contemplated that the winding mechanism herein described should be used in combination with furnishing mechanism capable of feeding the strand at definite predetermined rates over a wide range of speed and always with an effectively uniform tension. Such furnishing mechanism is shown, for example, in United States Letters Patent No. 2,333,705, dated November 9, 1943, Paul F. Cooper. That patent discloses one among several furnishing mechanisms well known and available to the industry.

While my invention has been illustrated as embodied in a machine in which the package is wound on a spindle rotating about a fixed axis in combination with a rocking back, it would be within the scope of the invention to embody it in winding machines in which the axis of the package is moved during the winding operation or in which a rotary thread guide is employed rather than the reciprocating thread guide herein shown. The essential feature of the present invention is a relative separation of the package surface and thread guide by mechanically operated means under relay control. In this sense it is of secondary importance whether the source of power is of different character from that employed to drive the winding mechanism. In the invention as herein illustrated, electric motors are shown as independent sources of power for operating the back, and these operate under the relay control of the rotary switch shown in Fig. 1 or the micro-switch shown in Fig. 3. It would be within the scope of the invention, however, to drive the back operating mechanism mechanically and to control power actuation from such a source by relay means similar to that hereinabove disclosed.

It has been found by actual practice of the process herein disclosed that the strand of yarn is so delicately handled in being delivered to the thread package that wear and tear on the yarn itself is practically obviated and that even the finest fibres are not broken.

Having thus disclosed my invention and described in detail illustrative embodiments thereof, I claim as new and desire to secure by Letters Patent:

1. A yarn winding machine comprising a rotatable package support and a thread guide mounted for longitudinal and transverse movements one with respect to the other, a rotary feeler mounted adjacent to the surface of a package being wound on said support and rotated from time to time by contact with the package, and an electrically operated source of power connected in circuit with said feeler, having mechanical connection with said thread guide for retracting the thread guide and being controlled by rotary movement of said feeler.

2. A yarn winding machine comprising a rotatable package support and a thread guide mounted for longitudinal and transverse movements one with respect to the other, a feeler movably mounted adjacent to the surface of a package being wound on said support and operated by contact with the package, an electric circuit arranged to be opened and closed by movement of the feeler, and an independent source of power controlled by current in said circuit and operating to separate the thread guide and thread package.

3. A winding machine including a support for a rotating thread package, a back movable toward and from said support and carrying a freely movable roll disposed parallel to the support and extending beyond one end thereof, a thread guide movable in the back, an electric switch having operating connections with the roll at a point beyond one end of the package being wound, and an independent motor controlled by said switch and having connections for retracting the back.

4. A winding machine including a support for a rotating thread package, a rocking back carrying a feeler roll freely rotatable adjacent to the surface of the thread package, a thread guide in said back located to lead thread about the feeler roll in passing to the thread package, the traction of thread on said roll being increased by the approach of the thread package surface to the feeler roll and tending to turn the roll, a switch opened and closed by turning of the roll, and an independent source of power having connections with the back to retract the latter and energized by current controlled by said switch.

5. A winding machine having a power driven spindle for a thread package, a rocking back carrying a freely rotatable roll disposed adjacent to the package being wound and adapted to contact the latter, an electric motor having connections for retracting the back, and a motor operating circuit arranged to be energized only while said roll is turned by contact with the surface of the package.

6. A winding machine having a power driven spindle for a thread package, a rocking back carrying a freely rotatable roll, means normally holding said roll in a predetermined initial position, an electric motor, an operating circuit for the motor including a switch operated by movement of said roll from its initial position, and mechanism driven by the motor for retracting said back.

7. A winding machine having a power driven spindle for a thread package, a movable back carrying a freely rotatable roll, an electric switch, means tending always to hold said roll in a predetermined initial position in which said switch is open, an electric motor, an operating circuit therefor controlled by said switch, and mechanism driven by the motor for retracting said back.

8. A winding machine having a power driven spindle for a thread package, a movable back carrying a freely rotatable roll disposed parallel to the surface of the package, an electric switch having an arm connected to said roll and tending at all times to open the switch circuit and turn the roll to a predetermined initial position, an electrically operated source of power mechanically connected to said back for retracting it in a series of steps from the package being wound, and a power circuit including said switch and said source of power.

9. A winding machine having power driven means for winding a thread package, means for guiding a strand of thread to the package, a feeler movably mounted adjacent to the surface of the package being wound and operated by contact with the package to cause relative separation of said package and thread guiding means in step-by-step manner, independent power mechanism for effecting such separating movement, and means for determining the length of such steps independently of the feeler.

10. A winding machine having power driven means for winding a thread package, a roll dis-

posed parallel to the surface of the package and movable bodily with respect thereto, a relay switch operated by roll contact with the surface of the package, power mechanism controlled by said switch for retracting the roll, a second switch controlling power to said mechanism, and timing mechanism for said second switch.

11. A winding machine having power driven means for winding a thread package, means for guiding a strand of thread to the package, a feeler mounted for oscillation adjacent to the package surface and operated by contact with the package to cause relative separation of the package and thread guiding means independent power actuated mechanism for effecting such separation, and a slip connection permitting the said guiding means to be positioned independently of its power actuation.

12. The process of winding soft thread packages, which comprises the steps of leading thread to a rotating spindle by a thread guide reciprocating longitudinally with respect to the spindle, and positively and intermittently retracting the thread guide from the spindle in steps of predetermined amplitude timed to take place consecutively as the circumference of the package from time to time approaches within a predetermined distance of the thread guide.

13. A winding machine having a power driven spindle for a thread package, a movable back carrying a thread guide and a pivotally mounted roll adapted to contact the package being wound and to be oscillated by such contact out of its initial position and to return automatically to said initial position when relieved of contact, an electric switch connected to said roll and arranged to be thrown by the osccillatory movement thereof, electrically operated mechanism for controlling the position of the back, and an operating circuit therefor including said switch.

14. In a winding machine having a power driven spindle for a thread package and a back, one being movable away from the other, and means for controlling the relative position of the package and back; a control device for said means comprising an elongated member pivotally mounted on the back adjacent to the surface of the thread package and disposed in parallel relation thereto, whereby the member may be rocked from time to time by contact with the thread package as the latter increases in size, and means for returning said member to a predetermined initial position each time it is removed from contact with the thread package.

15. A winding machine comprising a rotatable package support, a back carrying a thread guide, said back and support being constructed and arranged for separation with respect to each other, mechanism operable to effect relative separation of said back and support, a feeler roll pivotally mounted on said back for contacting a package being wound on said support and adapted to be turned upon frictional contact with the package, and means operable by said roll upon turning movement thereof for controlling the operation of said mechanism.

16. A winding machine comprising a rotatable package support, a back carrying a thread guide, said back and support being constructed and arranged for separation with respect to each other, means operable to effect relative separation of said back and support, a feeler roll pivotally mounted on said back for contacting a package being wound on said support and adapted to be turned in one direction upon frictional contact with the package, means operable by said roll upon movement thereof for controlling the operation of said first-mentioned means, and means for returning said roll to its initial position after said back and package have separated.

17. A winding machine comprising a rotatable package support, a back carrying a thread guide, said back and support being constructed and arranged for separation with respect to each other, mechanism operable to effect relative separation of said back and support, a feeler roll pivotally mounted on said back for contacting a package being wound on said support and adapted to be turned upon frictional contact with the package, said roll extending beyond the sides of the package, and means operable by said roll upon turning movement thereof for controlling the operation of said mechanism.

CHARLES DAVIS JENCKS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,131,147	Siegenthaler	Sept. 27, 1938
2,295,535	Abbott	Sept. 15, 1943
2,335,965	Ribavaro	Dec. 7, 1943
2,335,975	Stahl et al.	Dec. 7, 1943
2,338,085	Abbott	Jan. 4, 1944