Jan. 4, 1944. E. J. ABBOTT 2,338,085

WINDING MACHINE

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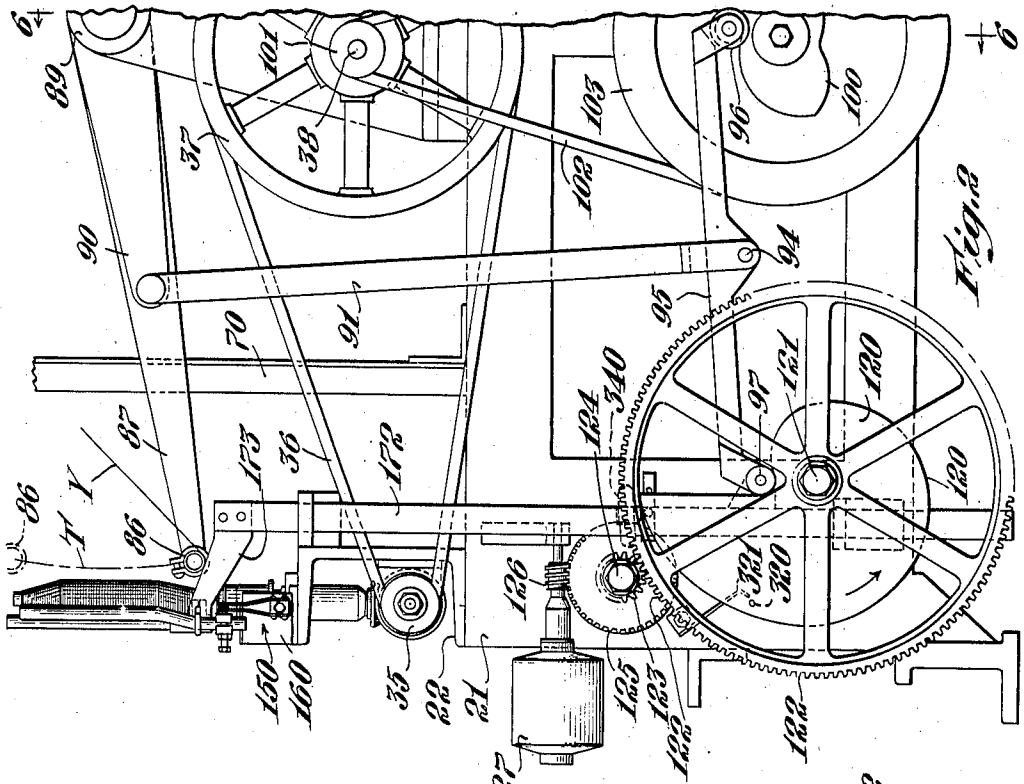


Fig. 3

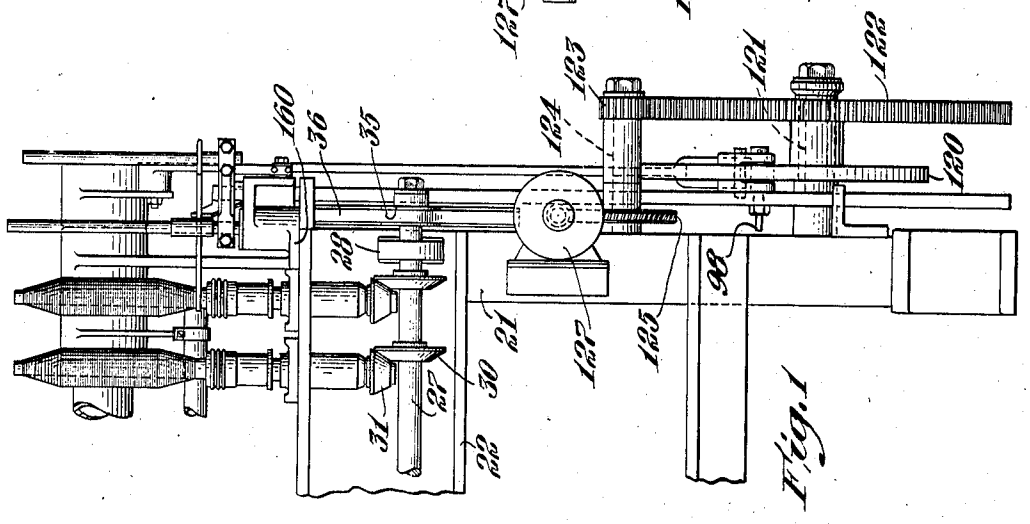


Fig. 1

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WINDING MACHINE

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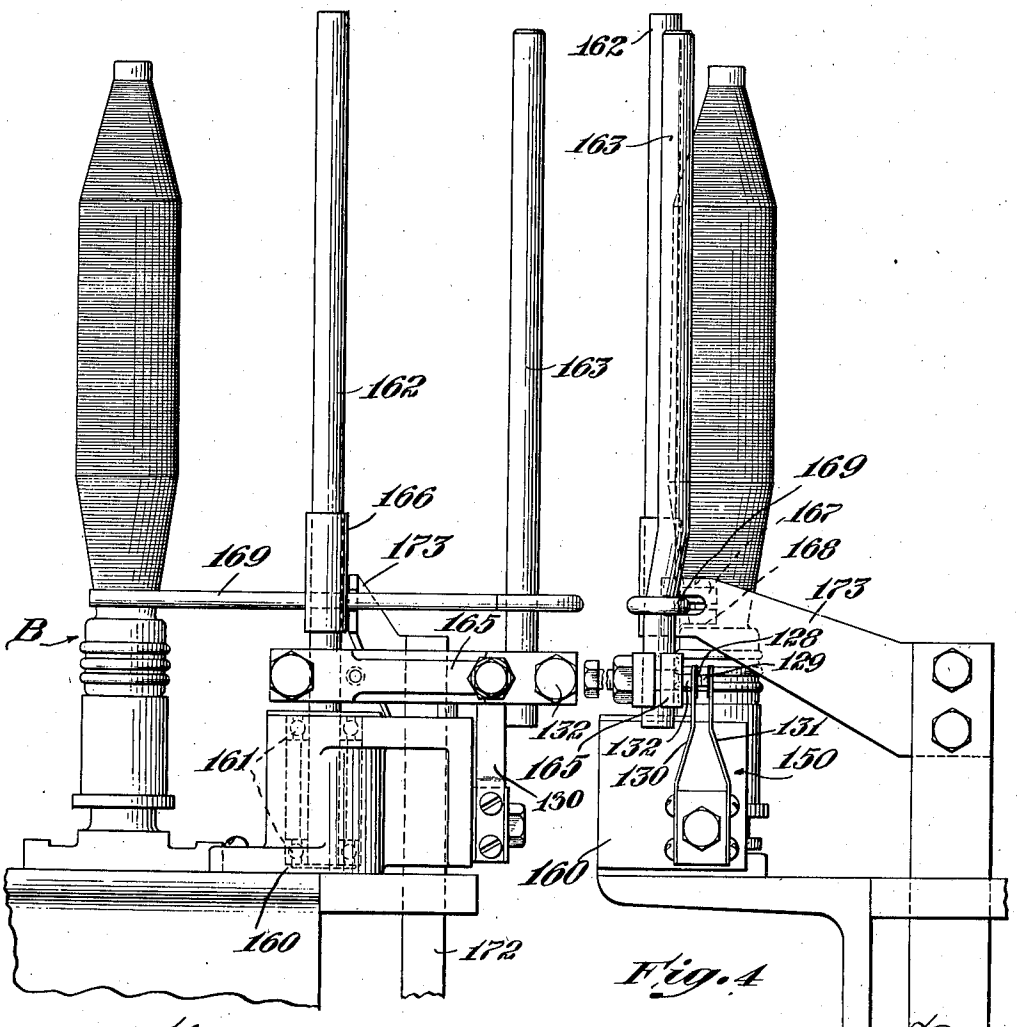


Fig. 3

Fig. 4

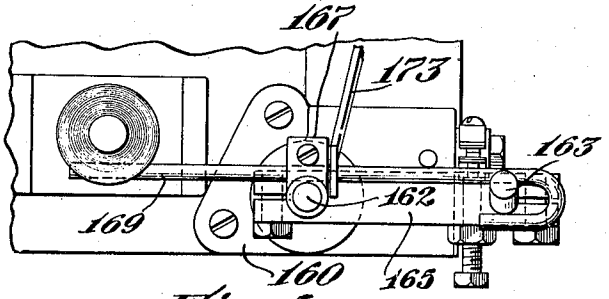


Fig. 5

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WINDING MACHINE

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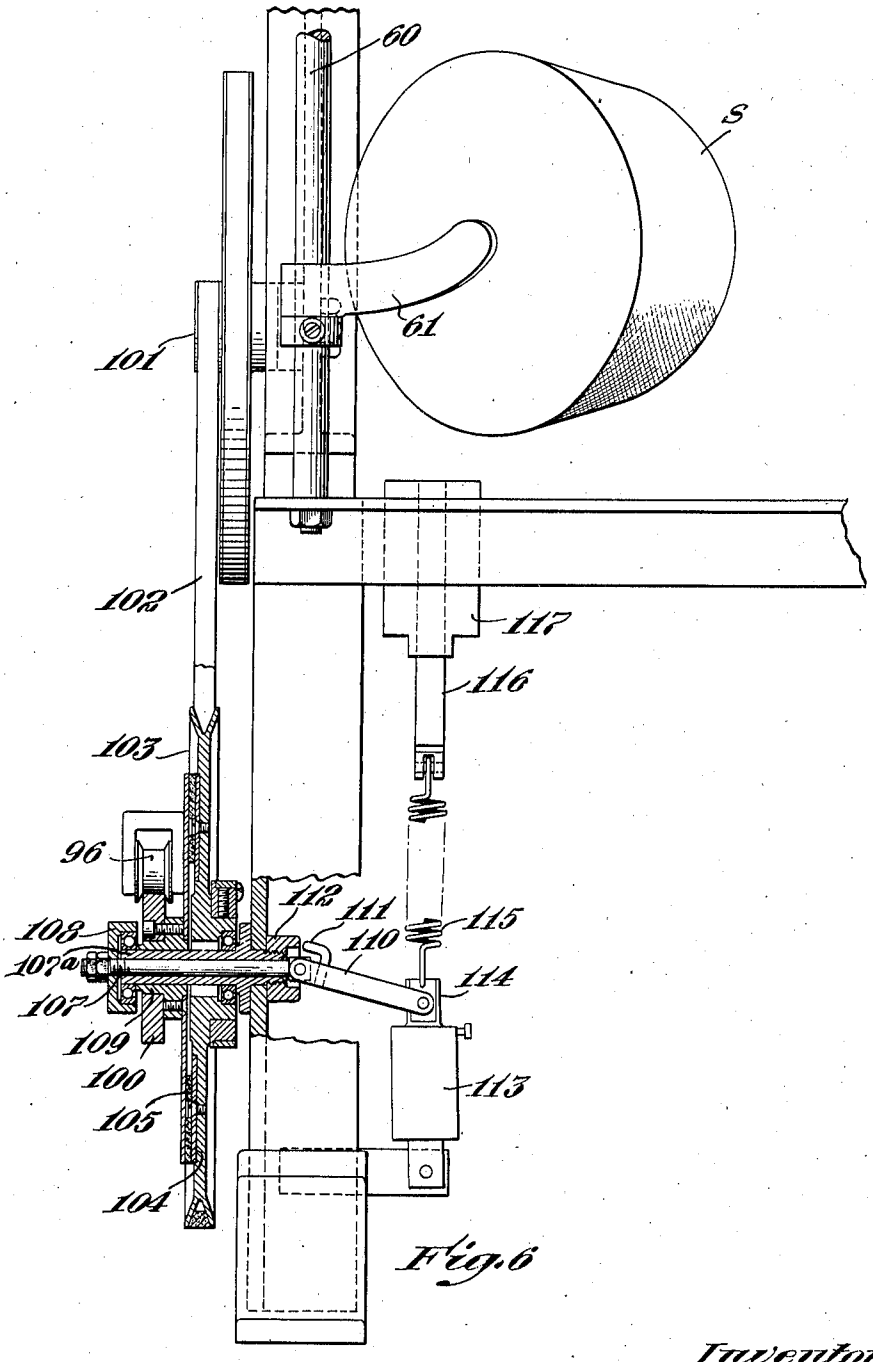


Fig. 6

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WINDING MACHINE

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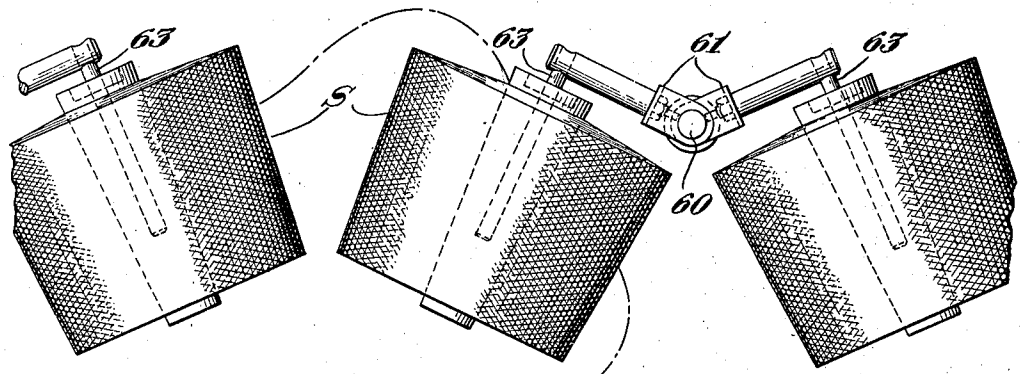


Fig. 8

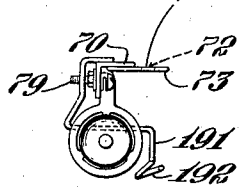
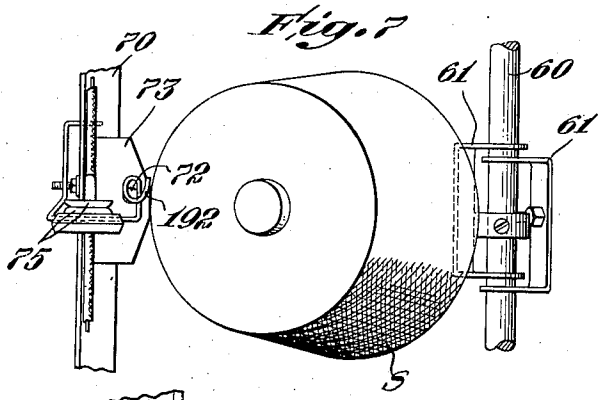


Fig. 7



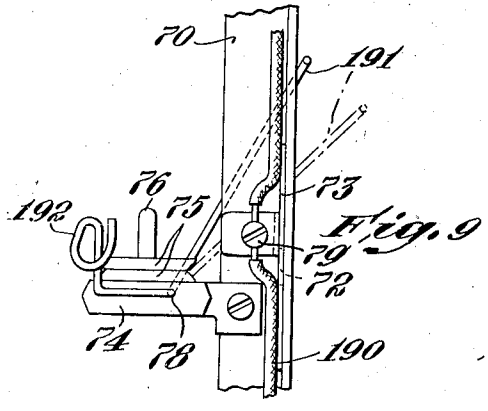


Fig. 9

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WINDING MACHINE

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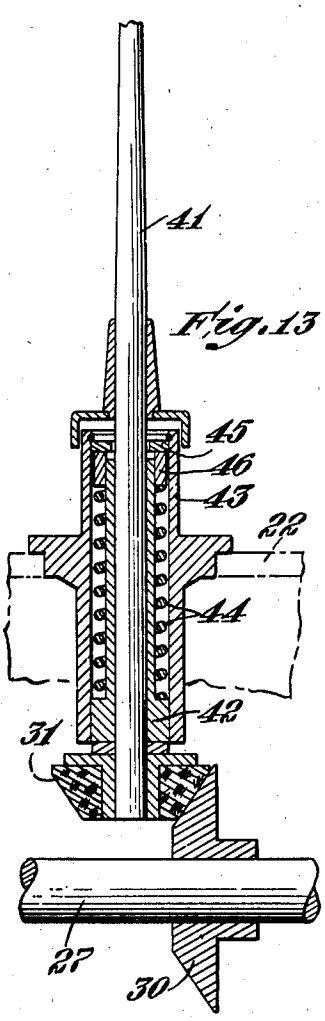


Fig. 13

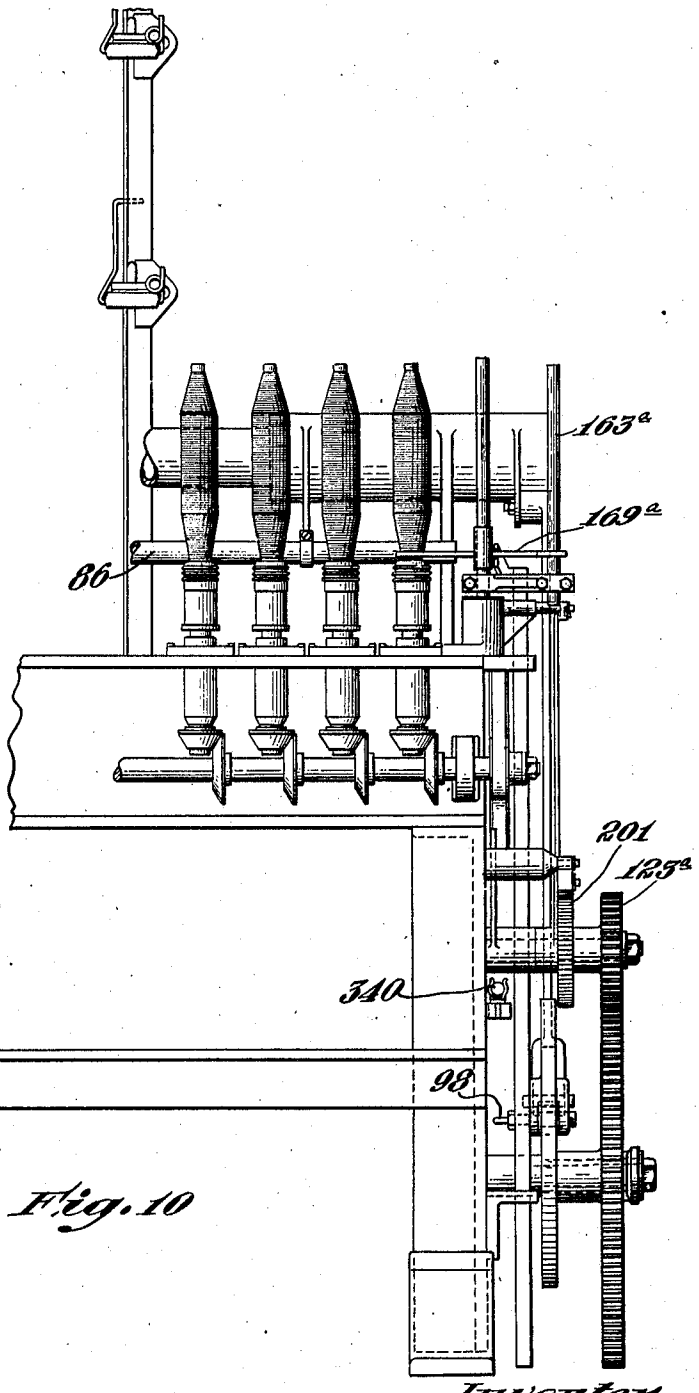


Fig. 10

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WINDING MACHINE

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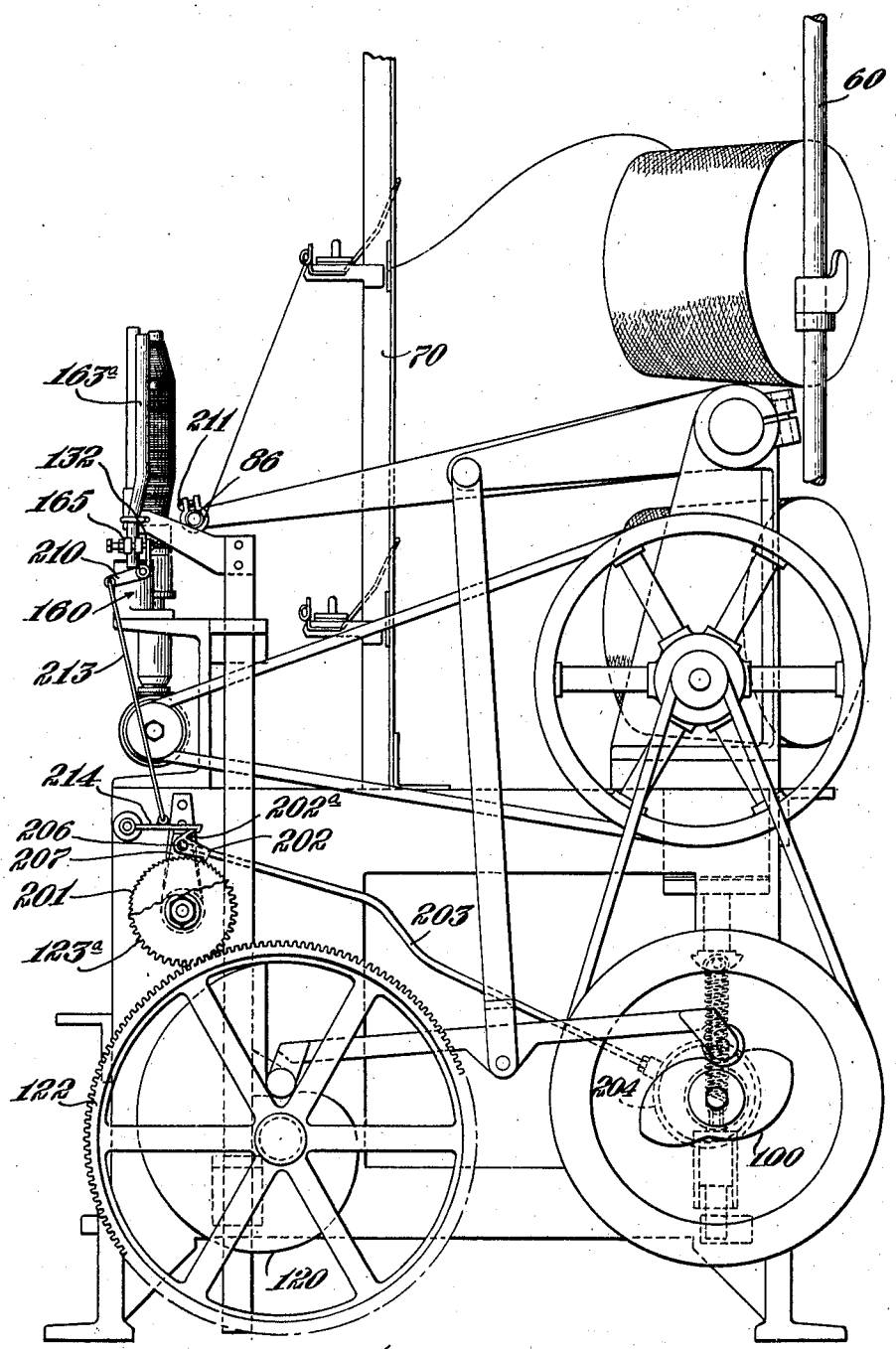


Fig. 11

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WINDING MACHINE

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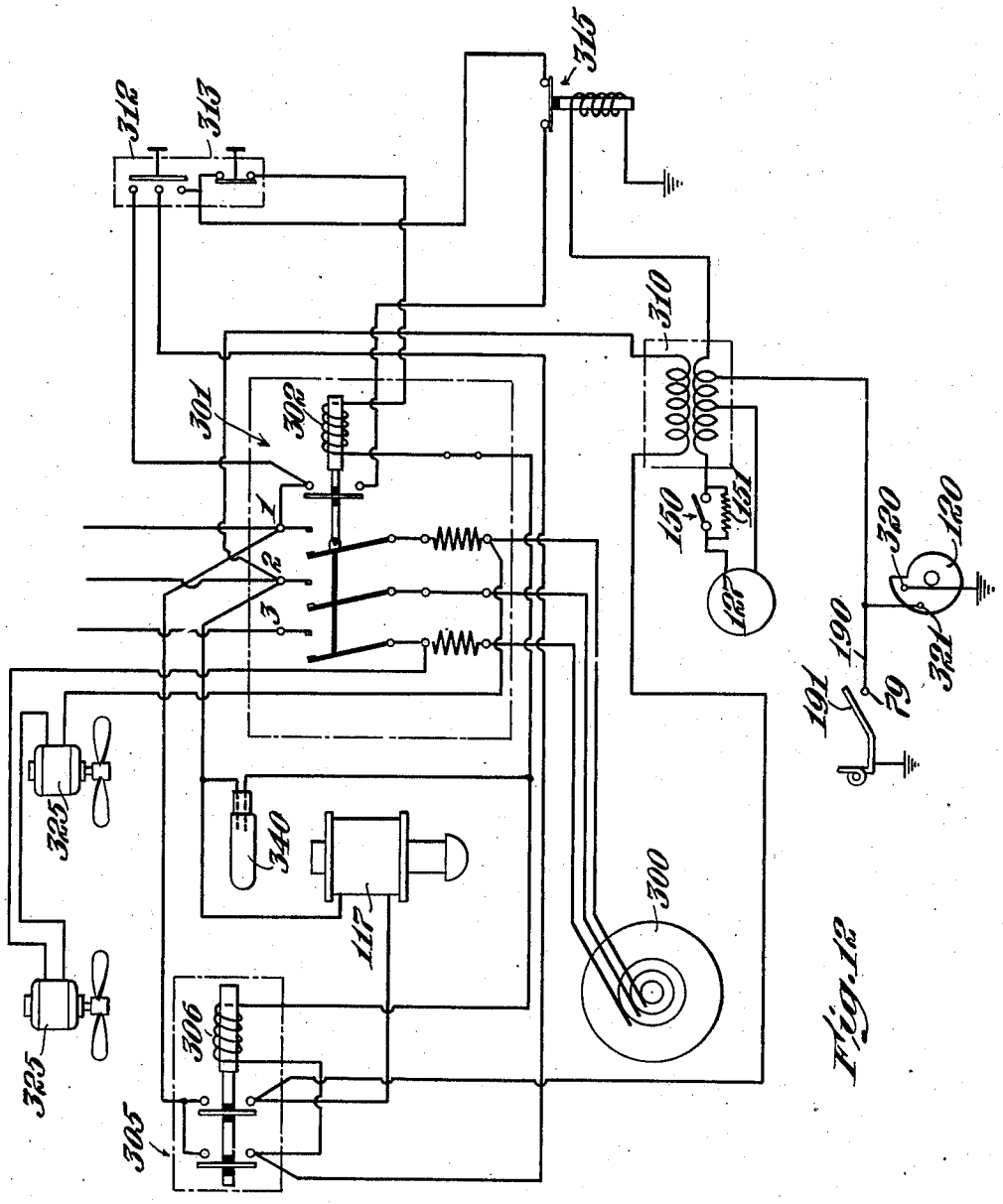


Fig. 12

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UNITED STATES PATENT OFFICE

2,338,085

WINDING MACHINE

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Application August 1, 1940, Serial No. 349,103

41 Claims. (Cl. 242—43.5)

This invention relates to winding machines and has for its principal objects to provide improved mechanism for the control of many of the operations of winding, including the advance of traverse mechanism axially during the winding, the stopping of winding upon the detection of breakage or exhaustion of the yarn being wound, the winding of a bunch or reserve winding on the bobbin before the main winding, the return of traverse mechanism to the position for the starting of winding, the winding of an open spiral on the finished main body of winding, and the stopping of the machine in condition for easy changing of the bobbins.

The invention further aims to provide improved mechanism for controlling the axial location of the zone of traverse in accordance with the detected growth of the winding package and affords mechanism of this type having improved accuracy and sensitivity. The invention also provides a simplified type of control of the traverse in which the detected growth of one winding package of a group controls the shifting of the zone of traverse as to all of the winding packages. The invention further provides improved arrangements in which the shifting of the zone of traverse is accomplished by motor driven means controlled by feeler mechanism which in itself is not required to supply the power for accomplishing the shifting movement of the traverse.

In its preferred forms shown in this application the invention is applied to a machine for simultaneously winding a considerable number of bobbins in which the bobbins are most expeditiously changed in sets as in the manner of typical spinning machines, and the invention provides for automatically controlling the various operations of winding in such manner that, aside from repairing any breaks or exhaustion of yarn, all that the operator is called upon to do is to change the bobbins and operate a push button to start the machine.

The invention provides improved control mechanism permitting the winding to be stopped at any stage upon the detection of breakage or exhaustion of a yarn, and to be started after repair of the breakage or exhaustion but without disruption of the pattern of winding traverse.

The copending application of Edward J. Abbott, Serial No. 323,203, filed March 9, 1940, now Patent No. 2,295,535, discloses a winding machine having therein a winding package holder and a yarn traversing element, a detector responsive to the position of the surface of the package, power driven means for shifting the relative positions of the package holder and traversing device, and means whereby the detector controls said power driven shifting means in accordance with the growth of yarn on the surface of the package, and this combination is employed also in the machines illustrated in the present application. In said copending application the illustrated machine has a traversing device that is shifted generally transversely to the axis of the winding package, and in the present application the two illustrated machines have traverse devices that are shifted generally axially of the winding package.

Other objects of the invention and features of advantage and utility will be apparent from the following more detailed description and drawings, wherein the invention is explained by a description of two examples thereof.

In the drawings:

Fig. 1 is a front view of the right hand end portion of a winding machine according to the invention;

Fig. 2 is a right end view of the machine of Fig. 1;

Fig. 3 is a front view on a larger scale than Fig. 1 showing the endmost winding spindle and bobbin and the winding package detector mechanism;

Fig. 4 is a right end view of the mechanism of Fig. 3;

Fig. 5 is a fragmentary plan of the mechanism of Figs. 3 and 4;

Fig. 6 is a fragmentary view partly in section on the line 6—6 of Fig. 2, showing a driving connection for the fast motion of the traverse mechanism, including a clutch adapted to release the fast motion from its driving mechanism.

Fig. 7 is a fragmentary front view of a portion of the creel showing also one of the yarn-guide, tension and detector units;

Fig. 8 is a fragmentary plan view of the apparatus of Fig. 7;

Fig. 9 is a right side view on a larger scale than Fig. 7 showing one of the yarn guide, tension and detector units;

Fig. 10 is a view similar to Fig. 1 showing a modified form of control of the slow traverse motion by the winding package detector mechanism; and

Fig. 11 is a right end view of the machine of Fig. 10.

Fig. 12 is a wiring diagram of the machine of Figs. 1 to 9.

Fig. 13 is a vertical sectional view through one of the spindles and its driving connections.

Referring to Figs. 1 to 9, inclusive, the frame of the machine includes suitable end members of which one is shown at 21 in Figs. 1 and 2, and any similar suitable intermediate cross members which together support a longitudinal C-shaped channel 22 which serves as a support for the vertical winding spindles shown more fully in Fig. 13 of which the machine may contain for example forty.

A horizontal shaft 27, mounted in bearings 28 at intervals along the frame, carries V-shaped pulleys 30 frictionally contacting with V-shaped cork pulleys 31 on the bottoms of the respective spindles to drive the latter. This horizontal spindle driving shaft 27 is driven through a pulley 35, belt 36, and pulley 37 from a main shaft 38 which is driven by suitable main motor (not shown but indicated at 300 in the wiring diagram of Fig. 12).

Referring to Fig. 13 each spindle 41 is rotatably mounted in a bolster 42 which is vertically slidable in a spindle holder or casing 43 which is secured to the upper flange of the channel 22. In order to supplement the weight of the spindle and bolster in holding the cork pulley 31 in contact with the metal pulley 30, a spring 44 is provided and arranged so that its bottom presses downwardly on the lower enlarged portion of the bolster 42 thus pressing the bolster and spindle downwardly and holding the cork pulley 31 in tight contact with the driving pulley 30. The upper part of the bolster 42 floats in the upper part of the spintle casing 43 so that the rotating spindle can rotate about its center of gravity at high speed. A flange 45 extending inwardly from the spindle casing has an opening large enough to allow some freedom of motion of the spindle for this purpose. In order to prevent undue vibration of the spindle a frictional resistance to such vibration is provided by a collar 46 which surrounds the bolster 42 fitting the bolster just loosely enough to allow the bolster to slide up and down. The upper edge of the collar 46 frictionally contacts the flange and is pressed against it by the upper end of the spring.

Vertical tubes 60 (Figs. 6 and 7) serve as supports for pivotally mounted brackets 61 holding the supply package pegs 63. In front of and spaced between the vertical tubes 60, vertical angle irons 70 are arranged to carry the yarn guide, tension and detector units through which the yarns pass from the supply packages S to the traverse mechanism. As shown in Figs. 7 and 8, in the normal positions of the pivoted brackets 61, a pair of pegs 63 and supply packages S point toward a hole 72 in a plate 73 which is carried by the angle iron 70.

The pegs 63 of the creel are adapted for magazining of the supply packages S, that is, on a pair of pegs 63 that point to a common hole 72 the tail end of the yarn of one package can be tied onto the head end of yarn of the other package.

A yarn guide, tension and detector unit may for example be constructed as follows: A bracket 74 may carry any suitable tension device such as a pair of discs 75 held by a pin 76, the yarn running between the discs from the guide hole 72 in the plate 73. A drop wire indicated generally at 191 is in the form of a bell crank pivotally mounted on the bracket 74 at 78. One end of this drop wire is provided with a pigtail 192 through which the yarn runs after passing the tension discs 75. Normal tension on the yarn holds the drop wire in its full line position of Fig. 9, but upon breakage of the yarn the drop wire drops until it is checked by a bolt 79 which is insulated from the frame and connected to an electric wire 190. Upon breakage of the yarn a circuit is closed between wire 190 and the frame of the machine, which as explained in connection with the wiring diagram of Fig. 12, operates to stop the main motor 300.

Traversing mechanism

In approaching the winding spindles 41, each of the winding yarns Y runs underneath and partly around a horizontal tube 86 which is adapted to swing in the arc T from the full line position of Fig. 2 to the dotted line position of that figure, close to the surface of the winding package. The tube 86 is supported at intervals across the winding machine by arms 87 which are secured to a tubular shaft 89 adapted to oscillate in suitable bearings.

The shaft 89, arms 87 and yarn-guiding tube 86 are adapted to be oscillated with the necessary motion to build a filling wound package by means of an arm 90 connected to shaft 89, and a lifter link 91. The appropriate motion is a composite one consisting of a relatively quick short traverse component through for example approximately 1½ inches and a relatively slow progressive component or shifting of the short range of traverse from one end to the other of the winding package.

Referring to Fig. 2, the lower end of the lifter link 91 is connected to mechanism which combines both components of the traverse motion, and for this purpose is preferably pivotally connected at 94 to a link 95 having at its right end a follower 96 adapted to receive the quick short-traversing motion and at its left end a follower 97 adapted to receive the long progressive traversing motion, the link 95 thus combining these two components of the traverse motion.

Referring to Figs. 2 and 6, the quick motion follower 96 is driven by a double heart-shaped cam 100 having the necessary contour so that one revolution of the cam results in two of the short, quick strokes of traverse. As shown in Figs. 2 and 6, the cam 100 is driven from the main shaft 38 by a connection consisting of a pulley 101, belt 102, pulley 103 and friction clutch consisting of a plate 104, which is fastened onto the pulley 103 and a plate 105 which is fastened into the cam 100.

A shaft 107 surrounded by a stationary sleeve 107a and slidable lengthwise therein carries a cap 108 at its outer end, the cap containing ball bearings of which the inner race is adapted to react on a sleeve 109 which is fastened to both the cam 100 and the friction plate 105 and is rotatable on the stationary sleeve 107a. (Fig. 6). The shaft 107 extends inwardly through the frame of the machine and at its inner end is pivotally connected to a link 110 having integral therewith a finger 111 adapted to abut against a boss 112 on the frame. The inner or right hand end of link 110 is connected to the plunger 114 of a dashpot 113, the plunger 114 being connected by a suitable spring 115 to the armature 116 of a solenoid 117.

In the starting of the quick-traverse motion at the beginning of winding a set of packages, the solenoid 117 is energized by electrical connections to be described later, lifting the armature 116, and through the spring 115 lifting the

dashpot plunger 114 against the retarding action of the dashpot, thus raising the right end of link 110. Through the reaction of the boss 112 on finger 111 the link 110 pulls the shaft 107 to the right in Fig. 6, thus pulling the two friction plates 104 and 105 together and causing the cam 100 to be driven.

In stopping the quick traverse motion at the completion of winding a set of packages, the solenoid 117 is de-energized and the parts returned to their position shown in Fig. 6. The cam 100 is no longer driven but is free to rotate about shaft 107. The weight and pressure of the link 95 and follower 96 (Fig. 2) acting on the cam 100 restore the cam to its lowest position, that is the position shown in Fig. 2 where the follower 96 sits at one of the two equally low places on the cam. This assures that at the end of the winding operation the yarn-guiding tube 86 will, so far as the quick-traversing motion is concerned, be left at its lowest point and further that when the quick-traversing component is started again it will begin at the lowest point in its stroke.

Slow progressive traverse motion

The slow progressive component of the traverse motion is imparted to the follower 97 by a cam 120 having a gradual rise and quick fall, and which is so proportioned that one revolution of the cam from its low point in which it is shown in Fig. 2 will progressively raise the traversing tube 86 through a distance equal to the total length of winding on the package minus the length of the short quick-traversing stroke.

In the form of the machine shown in Figs. 1 and 2 the cam 120 is driven through gearing comprising a shaft 121 on which the cam is mounted, a gear 122, pinion 123, shaft 124, worm wheel 125 and a worm 126 by a shaded pole electric motor 127. The motor 127 is operated at intervals by control mechanism now to be described so as to bring about the slow progressive movement at the proper rate to cause the finished package to have the desired contour. That is, as the part of the package on which the winding is taking place attains its correct diameter, detector mechanism operates to start the motor 127 and advance the cam 120 so that the zone of winding is shifted axially a sufficient distance.

Winding package detector and traverse control mechanism

The shaded pole electric motor 127 is controlled by a switch 150 which as shown in Fig. 4 preferably comprises a pair of contacts 128 and 129 held respectively by resilient arms 130 and 131 normally out of contact, but adapted to be closed by the pressure against arm 130 of the end of an adjustable bolt 132 carried by a swinging arm 165, which is operated by the package detector.

Referring to the wiring diagram in Fig. 12, there is shunted across the switch 150 a resistance 151 of sufficient conductivity to tend to operate the motor 127 but insufficient to run the motor when the switch 150 is open. When the switch 150 has its contacts very lightly closed, the motor begins to run, but as the contacts become more firmly closed the motor runs faster. Thus the switch 150 and its connections to the motor enable the motor to be run at a variable speed depending upon the degree of pressure with which the switch contacts are closed.

As shown in Figs. 1 to 5, inclusive, a bracket 160 is fastened on the upper right hand end portion of the C-shaped flange 22, this bracket 160 serving to support the detector and switch mechanism. Within the bracket 160 and mounted on ball bearings 161, there is rotatably mounted a vertical rod 162. A second approximately vertical rod 163 is clamped between split end portions of the arm 165 of which the other end is clamped onto rotatable rod 162. Thus, rod 163 swings about the vertical axis of the rod 162 as a center. A sleeve 166 vertically slidable on rod 162 carries rearwardly directed clamp portions 167 and 168 which clamp between them an approximately horizontal detector wire 169. As shown in Figs. 3 and 5, the left end of the detector wire 169 is adapted to contact with the winding on the bobbin B while the right end is bent into a loop surrounding the rod 163.

Referring to Figs. 2, 3, and 4, a vertical lifter rod 172 is connected near its bottom to the cam follower 97 that is operated by the slow progressive traverse motion cam 120 and at its top carries a bracket 173 having a forked end straddling the detector wire 169. Thus the detector wire is progressively raised as the slow progressive traversing motion shifts the range of traverse axially of the package.

The left end of the detector wire 169 is thus held opposite to the lowermost portion of the range of quick traversing movement. When the yarn reaches the desired diameter at this point it forces the left end of the detector wire 169 away from the axis of the bobbin or toward the observer in Fig. 3 thus forcing the right end of the detector wire and the rod 163 and arm 165 to the right in Fig. 4, closing the switch 150. Then as explained above, the motor 127 is actuated to move the cam 120 and shift the zone of traverse.

The ultimate shape of the wound package is determined by the shape of rod 163 and by providing detachable rods 163 of different shapes, different packages may be wound. In the preferred form illustrated, the rod 163 is shaped to impart to the package a conical nose and conical base with the middle portion of uniform diameter. Referring to Fig. 4, it will be observed that the rod 163, in the part of its height corresponding to the lower conical portion of the package is inclined to the right, resuming a vertical direction at approximately the level where the finished package assumes a cylindrical shape. Thus at the lower part of the rod 163 where the rod 163 has an inclined profile, the detector wire 169 is effective to close the switch 150 at diameters of the package less than those at which it is effective to close the switch in the main central part of the package in which region the rod 163 has a straight vertical profile. For example, at the lowest level of the detector wire, corresponding to the bottom of the package, the portion of the bent rod 163 engaged by the detector wire 169 occupies a position such as to direct the bobbin-feeling end of the detector wire in close to the surface of the bobbin; accordingly at that level a relatively slight thickness of wound yarn on the bobbin will react on the detector wire to move the bent rod 163 and close the switch 150. At the level corresponding to the beginning of the straight vertical portion of rod 163 a thickness of wound yarn such as present in the main straight body portion of the wound bobbin is required in order to cause the detector wire to move the rod 163 to close the switch. In between the extreme bottom of the package

and the level corresponding to the beginning of the straight vertical portion of the rod 163 the profile of the inclined part of rod 163, inclined between the position of its lower end and the position if its straight upper portion, determines for each level the diameter of wound yarn that is required in order to cause the detector wire to move the rod 163 to close the switch.

General sequence of operation

With the parts of the apparatus in the positions shown in Figs. 1 and 2 but with empty bobbins placed on the spindles, the machine is started to operating by briefly closing the push-button switch 312 indicated in wiring diagram of Fig. 12.

Although the main motor 300 and the solenoid 117 are energized at the same time, engagement of the clutch 104, 105 is delayed after the starting of the main motor by reason of the delaying action of the dashpot 117 (Fig. 6). Thus about 50 revolutions of the spindles take place before the clutch 104, 105 is engaged and the short, quick traversing motion caused by the cam 100 begins. During this interval of untraversed winding, a reserve bunch of yarn is wound on each bobbin. During the winding of this reserve bunch and for a short time thereafter the slow progressive component of the traverse is inactive since the portion of the package with which the detector contacts has not as yet reached the shape determined by the profile rod 163. As soon as the portion of this package on which the winding is taking place reaches the appropriate diameter as determined by the profile rod, the detector and associated mechanism act to set the cam 120 in motion.

During the winding of the package the detector 169 is raised in conformity with the slow progressive component of the traverse and although this detector 169 does not partake of the short relatively quick component of the stroke, it keeps pace with the progressive axial growth of the package. This is advantageous in enabling the detector to maintain continuous contact with the package rather than to be thrust abruptly against the package.

An instant before the cam 120 reaches its top position, a contact pin 320 on the cam makes an electrical connection with a stationary electric contact 321, with the result, as explained below, of de-energizing the main motor 300.

After the cam 120 reaches its top position the follower 97 drops rapidly to the low position shown in Fig. 2 and in so dropping a pin 98 on link 95 trips and momentarly opens a pivotally supported switch 340, de-energizing the solenoid 117 and releasing the clutch shown in Fig. 6 so as to uncouple the short quick traverse cam 100 from its driving connections, allowing the pressure of the follower 96 on this cam to restore it to the low position. (The pivotal support for switch 340 is such that the switch is normally closed and is not opened by upward movement of the pin 98.)

During their last few revolutions of the spindles with the traverse tube 86 in its low position, a few turns of yarn are wound upon the lowest part of the outside of each package. The operator, with the machine stopped, then merely has to pull each wound package off its spindle and substitute an empty bobbin, the last few coils of yarn wound on the package being transferred onto the bare spindle during this process as is well-known in spinning machines, there being clamped by the butt of the new bobbin.

Modified form of winding package detector and traverse control mechanism

In the machine shown in Figs. 10 and 11 parts corresponding to those of the other figures are indicated by similar reference characters. In these figures the generally vertical rod 163a which is moved by the detector 169a, instead of operating a switch, operates mechanical connections that govern driving of the cam 120. Referring to Figs. 10 and 11 the cam 100 is driven in the same manner as in the preceding figures. The cam 120 instead of being driven by a separate motor has its gear wheel 122 driven by a pinion 123a onto which is fastened a ratchet wheel 201 adapted to be driven by a pawl 202. The pawl 202 is pivotally mounted at 206 on an oscillating arm 207 continuously oscillated by a connecting link 203 from an eccentric 204 mounted on the driving shaft of the cam 100, so that when the pawl 202 engages the ratchet wheel 201, the ratchet wheel is turned to the extent of several teeth each revolution of the eccentric 204.

On the bracket 160 there is provided a bell crank 210 of which the generally vertical arm is adapted to contact with the adjustable bolt 132 on the swinging arm 165 of the feeler mechanism. The bell crank 210 has its other arm connected by a link 213 to a latch 214 adapted to engage an arm 202a on the pawl 202. When the latch 214 is in its low position as shown in Fig. 11 and engages and detains the arm 202a, movement of the pawl 202 to the right with the oscillating arm 207 instead of turning the ratchet wheel 201 merely causes the pawl to swing upwardly about its pivot point 206 the pawl thus being prevented from engaging the teeth of the ratchet wheel. Thus with the parts in this position the slow progressive component of the traverse does not take place.

When however the detector 169 makes contact with the winding package and is swung by the winding package so as to swing the arm 165 to the right in Fig. 11, this acts through the bell crank 210 and link 213 to disengage the latch 124 from the pawl, and thereupon the progressive component of the traverse is started. This continues until the detector reaches a place on the winding package where it is no longer pushed by the package sufficiently to cause the rod 163a to hold the latch disengaged, whereupon the latch drops and the progressive movement temporarily stops.

It will be seen that in both embodiments of the invention there is provided a power driven means, driven independently of movement of the detector, causing the progressive shifting component of the traverse, and means (electrical in Figs. 1 to 9 and mechanical in Figs. 10 and 11) whereby the detector controls such shifting means in accordance with the growth of the yarn on the surface of the package.

Wiring diagram of electrical control of the machine of Figures 1 to 9

Fig. 12 is an electrical diagram of the controls for the machine of Figs. 1 to 9. A main motor 300 shown as a three-phase motor is provided for operating the main shaft 38 (Fig. 2) that in turns drives the winding spindles and the pulley 103 of the friction clutch 104, 105 for driving the quick-traverse cam 100. Motor 300 is shown in Fig. 12 as controlled by a magnetic switch indi-

cated generally at 301 operated by a coil 302 and normally open excepting when coil 302 is energized. From phase (1) of the current supply there is a circuit extending to a magnetic switch 305 and from thence in branches as follows: From switch 305 through the magnetic coil 306 of magnetic switch 305 thence through mercury switch 340 (which is normally closed) to phase (2); from switch 305 through the primary coil of a transformer 310 to phase (2); from switch 305 through the solenoid 117 (that acts to engage the friction clutch 104, 105) to phase (2). From phase (1) of the current supply there is a circuit extending to the right hand upper contact of switch 301 and from thence in branches as follows: To the upper pole of a three-pole push button starting switch 312 thence to a push button stop switch 313 thence to magnetic coil 302 (which closes the magnetic switch 301), through mercury switch 340 to phase (2). From this same upper contact of switch 301, to the upper pole of the three-pole push button starting switch 312, thence from the middle pole of that switch to magnetic coil 306 of switch 305 (which closes switch 305), through mercury switch 340 to phase (2); through switch 301 to the lower right hand contact thence through a magnetic circuit-opening switch 315 through stop switch 313, magnetic coil 302 (that keeps magnetic switch 301 closed) through mercury switch 340 to phase (2).

The shaded pole motor 127 is connected to receive its current supply from a group of the secondary windings of the transformer 310, being connected in series with the switch 150 that is controlled by the swinging bracket 165 (Figs. 3 and 4). From one or more other groups of the secondary windings of the transformer 310 is taken a low voltage current adapted to operate the magnetic circuit opening switch 315 and extending partially through the ground afforded by the frame of the machine so as to be closed either by dropping of any one of the detector drop wires 191 or by the contact 320 on the cam 120 making connection with the stationary contact 321. This latter connection is made just an instant before the slow-traverse cam follower 97 drops from the high part of the cam to its low position.

Suitable electric fans 325 are shown as deriving their current from phases (1) and (3) and connected so as to be deenergized when the magnetic switch 301 is open.

With the magnetic switch 301 open, magnetic switch 305 open, motors 127 and 300 stopped and the traverse mechanism in its full line position of Fig. 2, the normal cycle of operations is as follows: Momentarily closing the push button starting switch 312 (the stopping switch 313 and mercury switch 340 being normally closed) establishes a circuit which energizes the magnetic coil 302 of the switch 301, closing this switch and starting the main motor 300 which starts the winding. This momentary closure of starting switch 312 also establishes a circuit energizing magnetic coil 306 of switch 305. Both switches 301 and 305 are then held closed during normal running by their respective magnetic coils. The magnetic coil 302 is kept energized by a circuit which includes the magnetic circuit-opening switch 315, and magnetic coil 306 is kept energized by a circuit which includes the mercury switch 340.

The solenoid 117 is immediately energized but the dash pot 113 delays the engagement of the friction clutch 104, 105 until a few turns of yarn have been wound on the bobbin, this delay providing a reserve or bunch winding near the base of each bobbin. When engagement of the frictional clutch 104, 105 is effected, the quick-traverse cam 100 begins operation.

The slow-traverse motor 127 is operated from time to time by closure of the switch 150 in response to detection of growth of the winding packages, the slow-traverse mechanism gradually shifting the range of quick-traverse motion of the rod 211 as the packages are built.

It will be observed from the wiring diagram of Fig. 12 that the push button stop switch 313, the drop wires 191, and the contacts 320, 321 can each act to break the circuit through coil 302 and allow the main motor switch 301 to open and stop the motor 300 without however de-energizing the clutch solenoid 117. Thus during the winding even though the motor 300 is de-energized, the solenoid 117 remains energized and keeps the friction clutch 104, 105 connected. Thus when the winding is stopped for the repair of a broken yarn and is started again, the quick-traverse movement will begin again where it left off, and without any delay such as would be occasioned if the dash-pot 113 wrere required to operate.

Assuming that the packages are wound to their full length, contacts 320 and 321 will become connected, de-energizing the main motor. As the main motor and winding spindles coast to a stop, the slow-traverse cam follower 97 drops to its low position, causing an open spiral of yarn to be wound around each package from the top to the bottom, and a few turns of yarn to be wound at the base of the bobbin. As this cam follower 97 drops the mercury switch 340 is tripped and momentarily opened, de-energizing magnetic coil 306 and allowing switch 305 to open and de-energize solenoid 117, releasing the friction clutch 104 and allowing the quick-traverse cam 100 to be turned to its low position by the pressure of its follower.

Thereupon the bobbins of the machine can be changed by the operator in the manner customary with spinning machines. In changing the bobbins it is preferable to let one or two turns of the yarn wrap around the spindle before breaking the yarn. Then when the next bobbin is put on it is already engaged by the yarn to be wound. After the bobbin has been changed, merely pressing a starter button 312 will begin the cycle of operations again. Thus all the operator has to do is to start the machine going, piece up any breaks that may occur during the winding, and change the bobbins when full.

For the machine of Figs. 10 and 11, the wiring shown in Fig. 12 may be simplified by eliminating the motor 127, switch 150 and resistance 151.

I claim:

1. A winding machine having therein a plurality of holders for winding packages, and a traversing element extending past the several holders transversely of the winding packages and mounted for movement in a path adjacent to and generally lengthwise of the several winding packages, the traversing element comprising a tube, the machine including yarn guiding means positioned to direct the yarns to the said tube from directions such that the several yarns bend around the tube in running onto the winding packages.

2. A winding machine having therein a plurality of holders for winding packages, and a

traversing element extending past the several holders transversely of the winding packages and mounted for movement in a path adjacent to and generally lengthwise of the several winding packages, the traversing element comprising a tube and means for mounting the tube comprising a rock shaft and arms connecting the tube and rock shaft, the machine including yarn guiding means positioned to direct the yarns to the said tube from directions such that the several yarns bend around the tube in running onto the winding packages.

3. A winding machine having therein a plurality of holders for winding packages, and a traversing element extending past the several holders transversely of the winding packages and mounted for movement in a path adjacent to and generally lengthwise of the several winding packages, the traversing element comprising a tube and means for mounting the tube comprising a hollow rock shaft and arms connecting the tube and rock shaft, the machine including yarn guiding means positioned to direct the yarns to the said tube from directions such that the several yarns bend around the tube in running onto the winding packages.

4. A winding machine having therein means for traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam shaped to impart the short stroke of traverse, and means for imparting the progressive movement of said short stroke relative to the package, and the machine including means for automatically returning said cam to a position of minimum throw at the end of winding a package.

5. A winding machine having therein means for traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam and a follower pressing against the cam, the cam being shaped to impart the short stroke of traverse, means driving the cam, and means operative upon completion of the package to uncouple the cam from said driving means, the cam thereupon being free to be restored to low position by the pressure of the follower.

6. A winding machine having therein means for traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam and a follower pressing against the cam, means for driving the cam and means for disconnecting the cam from its driving means, the cam having two points of maximum throw and intervening points of minimum throw and having a sufficiently steep rise and fall that when disconnected from its driving means the pressure of the follower will return the cam to a point of minimum throw.

7. A winding machine having therein means for traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam and a follower pressing against the cam, means for driving the cam and means for disconnecting the cam from its driving means, the cam having a plurality of points of maximum throw and intervening points of minimum throw and having a sufficiently steep rise and fall that when disconnected from its driving means the pressure of the follower will return the cam to a point of minimum throw.

8. A winding machine having therein a plurality of holders for winding packages, means for guiding the winding yarn onto the packages, means for imparting to the yarn guiding means a short stroke of traverse having a length of a fraction of the total length of the package, means for imparting to the yarn guiding means a progressive shifting movement such as to carry the short stroke of traverse lengthwise of the package, a detector responsive to the attained diameter of one of the winding packages, means whereby said detector controls said progressive shifting movement, and connections for causing the said detector to partake of the said progressive shifting movement but not of the said short stroke of traverse.

9. A winding machine having therein means for guiding the winding yarn onto the winding package, means for imparting to the yarn guiding means a short stroke of traverse having a length of a fraction of the total length of the package, means for imparting to the yarn guiding means a progressive shifting movement such as to carry the short stroke of traverse lengthwise of the package, a detector responsive to the attained diameter of the package, means for moving said detector lengthwise of the package in accordance with the progressive shifting movement but without said short stroke of traverse, and means whereby said detector controls said progressive shifting movement.

10. A winding machine having therein means for guiding the winding yarn onto the winding package, means for imparting to the yarn guiding means a short stroke of traverse having a length of a fraction of the total length of the package, the means including a cam for imparting to the yarn guiding means a progressive shifting movement such as to carry the short stroke of traverse lengthwise of the package, driving means for said cams, a detector responsive to the attained diameter of the package, means whereby the detector controls the driving means for the cam, and means operated by the said cam for progressively shifting the detector lengthwise of the package.

11. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, power means for operating said shifting means, a detector responsive to the attained diameter of the winding package, and means whereby said detector controls the operation of said shifting means by said power means.

12. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, a motor for driving said shifting means, a detector responsive to the attained diameter of the winding package, and an electric circuit controlling the motor and controlled by said detector.

13. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, a motor for driving said shifting means, a detector responsive to the attained diameter of the winding package, and an electric circuit controlling the motor and controlled by said detector, said circuit including a switch adapted to be closed by the detector upon the package attaining a predetermined diameter.

14. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, a motor for driving said shifting means, a detector responsive to the attained diameter of the winding package, and an electric circuit controlling the motor and controlled by said detector, said circuit including a switch adapted to be closed by the detector, and a resistance shunted across the switch and providing a current tending to but insufficient to start the motor when the switch is open.

15. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, a motor for driving said shifting means, a detector responsive to the attained diameter of the winding package, and an electric circuit controlling the motor and controlled by said detector, said circuit including means for supplying to said motor a current tending to but insufficient to start the motor and a switch controlled by the detector for causing an increased amount of current to be supplied to the motor.

16. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, power means for driving said shifting means, a detector responsive to the attained diameter of the winding package, and means controlled by said detector for controlling the connection of the shifting means to its driving means.

17. A winding machine having therein a holder for a winding package, a yarn guide for distributing the winding yarn on the package, means for shifting said yarn guide progressively lengthwise of the package, a pawl and ratchet connection for transmitting driving motion to the shifting means, a detector responsive to the attained diameter of the winding package, and means controlled by said detector for rendering said pawl and ratchet connection effective and ineffective.

18. A winding machine having therein a plurality of holders for winding packages, yarn guiding means for distributing the winding yarns on the plurality of winding packages, builder mechanism adapted to advance the yarn guiding means lengthwise of the said packages, a detector responsive to the attained diameter of one of the winding packages, and means whereby said detector controls the lengthwise advance of said yarn guiding means by the builder mechanism.

19. A winding machine having therein a plurality of holders for winding packages, yarn guiding means for distributing the winding yarns on the plurality of winding packages, builder mechanism adapted to advance the yarn guiding means lengthwise of the said packages, a detector responsive to the attained diameter of one of the winding packages, means for advancing the detector lengthwise of its package, and means whereby said detector controls the lengthwise advance of said yarn guiding means by the builder mechanism.

20. A winding machine having therein a plurality of holders for winding packages, yarn guiding means for distributing the winding yarns on the plurality of winding packages, builder mechanism adapted to advance the yarn guiding means lengthwise of the said packages, means for continually comparing the attained diameter of the portion of one package at which winding is taking place with a profile representative of the desired shape of all the winding packages, and means controlled by said comparing means for controlling the said advance of said yarn guiding means by the builder mechanism.

21. A winding machine having therein means for guiding the winding yarn onto the winding package, means for imparting to the yarn guiding means a short stroke of traverse having a length of a fraction of the total length of the package, means for imparting to the yarn guiding means a progressive shifting movement such as to carry the short stroke of traverse lengthwise of the package, means acting automatically upon completion of each full stroke of said long traverse means to restore both said long traverse means and said short traverse means to positions such that the yarn guiding means is at its endmost position at the base of the winding package.

22. A winding machine having therein means for guiding the winding yarn onto the winding package, a relatively fast-moving cam and a relatively slow-moving cam, and means for combining the motions of said cams and transmitting to the yarn guiding means a short stroke of traverse progressively shifting lengthwise along the winding package, the machine including means acting automatically upon the completion of one cycle of motion by the slow-moving cam to restore the fast-moving cam to a position of minimum throw.

23. A winding machine having therein means for guiding the winding yarn onto the winding package, a relatively fast-moving cam and connections therefrom to the yarn guiding means, said cam being adapted to impart to the yarn guiding means a short stroke of traverse, means for progressively shifting the short stroke of traverse lengthwise along the winding package, the machine including means acting automatically upon the completion of the package to restore said fast-moving cam to a position of minimum throw.

24. A winding machine having therein means for rotating a winding yarn package, means for traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam and follower adapted to impart the short stroke of traverse, means for driving the cam including a clutch normally disengaged before the beginning of winding, starting means adapted to start rotation of the winding package and driving of the cam, and means for delaying engagement of said clutch after starting of rotation of the winding package.

25. A winding machine having therein means for rotating a winding yarn package, means for traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam and follower adapted to impart the short stroke of traverse, means for driving the cam including a clutch normally disengaged before the beginning of winding, starting means adapted to start rotation of the winding package and driving of the cam, said starting means including a solenoid adapted to cause engagement of the clutch and a dash pot adapted to delay engagement of the clutch after starting of the rotation of the winding package.

26. A winding machine having therein means for rotating a winding yarn package, means for

traversing the winding yarn with a relatively short stroke progressively moved along the length of the winding package, the traversing means including a cam and follower adapted to impart the short stroke of traverse, means for driving the cam including a clutch, means including a solenoid for engaging the clutch, and starting mechanism including means for energizing the solenoid.

27. A winding machine having therein means including a motor for rotating a winding package, traversing means including a builder cam, a second motor for driving the builder cam, means for de-energizing the packaging-rotating motor, said de-energizing means comprising a circuit controlled by rotation of the builder cam to a predetermined point in its cycle, and means for de-energizing the second motor after de-energization of the package-rotating motor thereby to allow the builder cam to complete its cycle of rotation.

28. A winding machine having therein means including a motor for rotating a winding package, traversing means including a builder cam and a faster moving short stroke cam, a second motor for driving the builder cam, means including a clutch for driving the short stroke cam, and means controlled by the rotation of the builder cam for de-energizing the package rotating motor, for releasing said clutch and for de-energizing said second motor.

29. A winding machine having therein means including a motor for rotating a winding package, traversing means including a builder cam of generally spiral shape having a relatively steep fall from its position of maximum throw to its position of minimum throw, means actuated as a consequence of rotation of the cam to a position before said fall to de-energize the package rotating motor, a second motor for driving said cam, and means actuated as a consequence of rotation of the cam to a position during said fall to de-energize said second motor.

30. A winding machine having therein a winding package holder and a yarn traversing element, means for imparting to the traversing element a stroke of less length than the length of the winding package, a detector responsive to the position of the surface of the package, power driven means driven independently of movement of the detector by the package for shifting the range of stroke of the traverse lengthwise of the winding package, and means whereby the detector controls said power driven means in accordance with the growth of yarn on the surface of the package.

31. A winding machine having therein a winding package holder and a yarn traversing element, means for imparting to the traversing element a stroke of less length than the length of the winding package, a detector responsive to the position of the surface of the package, a motor and connections driven by said motor for shifting the range of stroke of the traverse lengthwise of the winding package, and means whereby said detector controls said motor.

32. A winding machine having therein a winding package holder and a yarn traversing element, means for imparting to the traversing element a stroke of less length than the length of the winding package, a detector responsive to the position of the surface of the package, mechanisms for shifting the range of stroke of the traverse lengthwise of the winding package, means for connecting said shifting mechanism to a source of power, and means whereby said detector controls said connecting means.

33. A winding machine having therein a traversing yarn guide, a cross link, a fast-moving cam adapted to react on the link adjacent to one end thereof, and a slow-moving cam adapted to react on the link adjacent to the other end thereof, and a connection from the link adjacent to the middle thereof to the yarn guide, the fast-moving cam serving to impart to the yarn guide a stroke of traverse of less length than the length of the winding package and the slow-moving cam serving to shift said stroke of traverse lengthwise of the winding package.

34. A winding machine having therein means for driving the winding package, a yarn guide adapted to distribute the winding yarn on the winding package, means for imparting to said yarn guide a traversing stroke of less length than the length of the finished package, means including a cam for shifting the stroke of traverse of the yarn guide lengthwise of the winding package, the cam having a cycle of motion comprising a slow rise during the main part of winding of the package, and a rapid fall after the package has been wound to its full length, and means actuated as a consequence of the cam attaining a position slightly in advance of its maximum rise to stop said driving means.

35. A winding machine having therein means including an electric motor for driving the winding package, a yarn guide adapted to distribute the winding yarn on the winding package, means for imparting to said yarn guide a traversing stroke of less length than the length of the finished package, means including a cam for shifting the stroke of traverse of the yarn guide lengthwise of the winding package, the cam having a cycle of motion comprising a slow rise during the main part of winding of the package, and a rapid fall after the package has been wound to its full length, and an electric circuit for stopping said motor, said circuit including a contact closed as a consequence of the cam attaining a position slightly in advance of its maximum rise.

36. In a winding machine, means for holding a winding package during winding, yarn traversing means, a movably mounted feeler adapted to contact the surface of the winding package, means for shifting the feeler lengthwise of the winding package as the package grows, a movable profile element against which the feeler bears and means operated by movement of the profile element to control the yarn-traversing means.

37. In a winding machine, means for holding a winding package during winding, yarn traversing means, a feeler adapted to contact the surface of the winding package, means for shifting the feeler lengthwise of the winding package as the package grows, a pivotally mounted profile element against which the feeler bears and means operated by pivotal movement of the profile element to control the yarn-traversing means.

38. A winding machine having therein means for holding a winding package during winding, a traversing yarn guide, means for imparting to said yarn guide a traversing stroke of less length than the length of the finished package, means for shifting the stroke of traverse lengthwise of the winding package, a movably mounted feeler adapted to contact the surface of the winding package, a movable profile element against which the feeler bears and means operated by movement of the profile element to control said shifting means.

39. A winding machine having therein means for holding a winding package during winding, a traversing yarn guide, means for imparting to said yarn guide a traversing stroke of less length than the length of the finished package, means for shifting the stroke of traverse lengthwise of the winding package, a movably mounted feeler adapted to contact the surface of the winding package, a movable profile element against which the feeler bears, means operated by movement of the profile element to control said shifting means, and means whereby said shifting means causes the feeler to move lengthwise of the package as the package grows.

40. A winding machine having therein means for holding a winding package during winding, a traversing yarn guide, means for imparting to said yarn guide a traversing stroke of less length than the length of the finished package, means for shifting the stroke of traverse lengthwise of the winding package, a profile element, a pivoted arm carrying the profile element, a feeler adapted to contact the surface of the winding package and bearing against the profile element, the feeler being mounted for pivotal movement about the axis of said pivoted arm and for movement along said axis, means operated by movement of the profile element to control said shifting means, and means whereby said shifting means causes the feeler to move lengthwise of the package as the package grows.

41. A winding machine having therein means for rotating a winding package, means for distributing the winding yarn on the package, means for shifting said yarn guide progressively axially of the package, power means for operating said shifting means, a detector responsive to the attained diameter of the winding package, and means cooperating with the detector to control the operation of said shifting means by said power means to wind a package having a predetermined profile.

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