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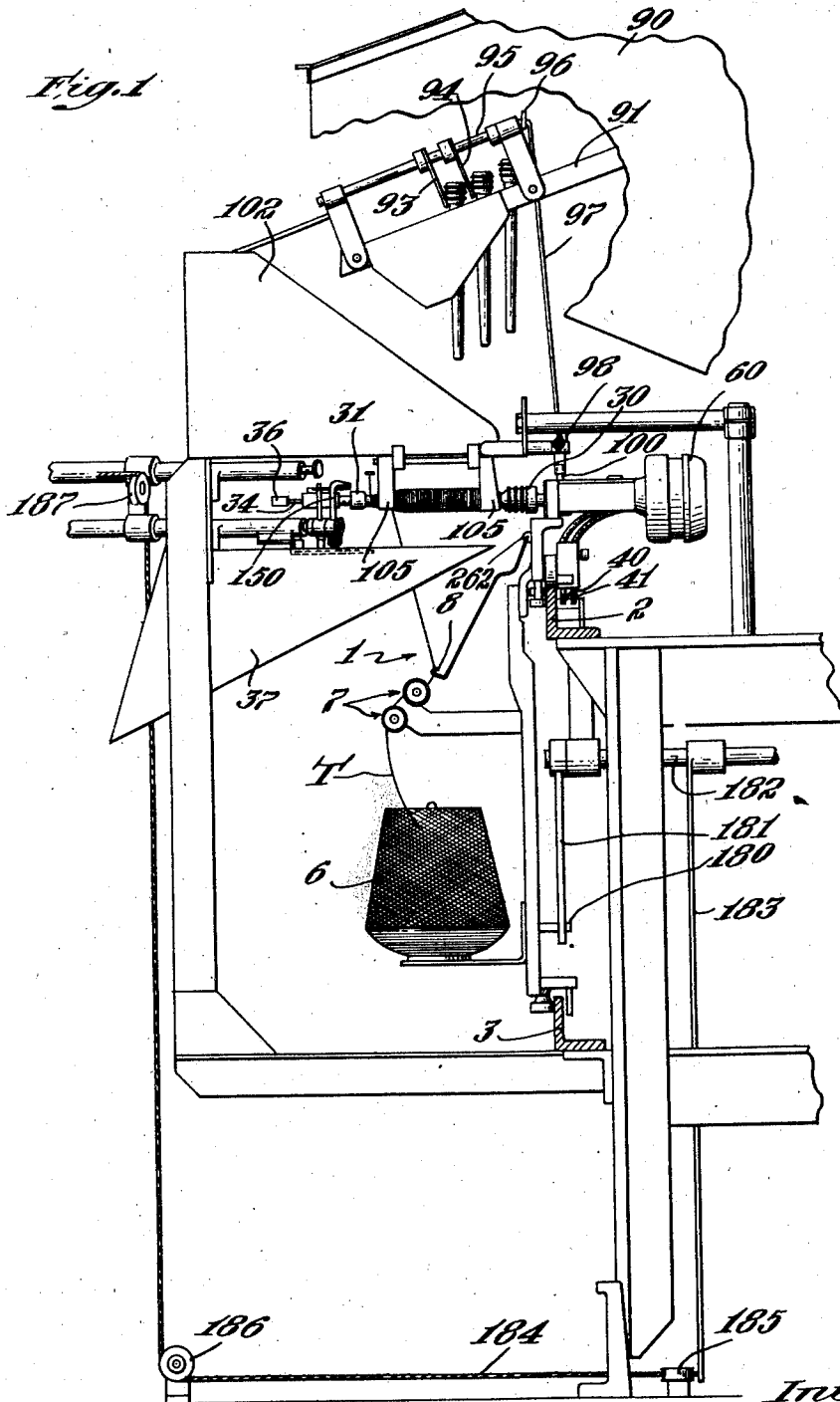
E. J. ABBOTT ET AL

2,426,167

WINDING MACHINE

Filed Oct. 28, 1944

8 Sheets-Sheet 1



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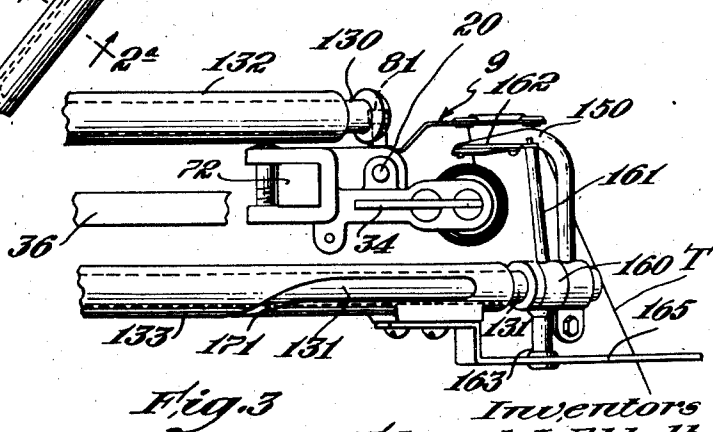
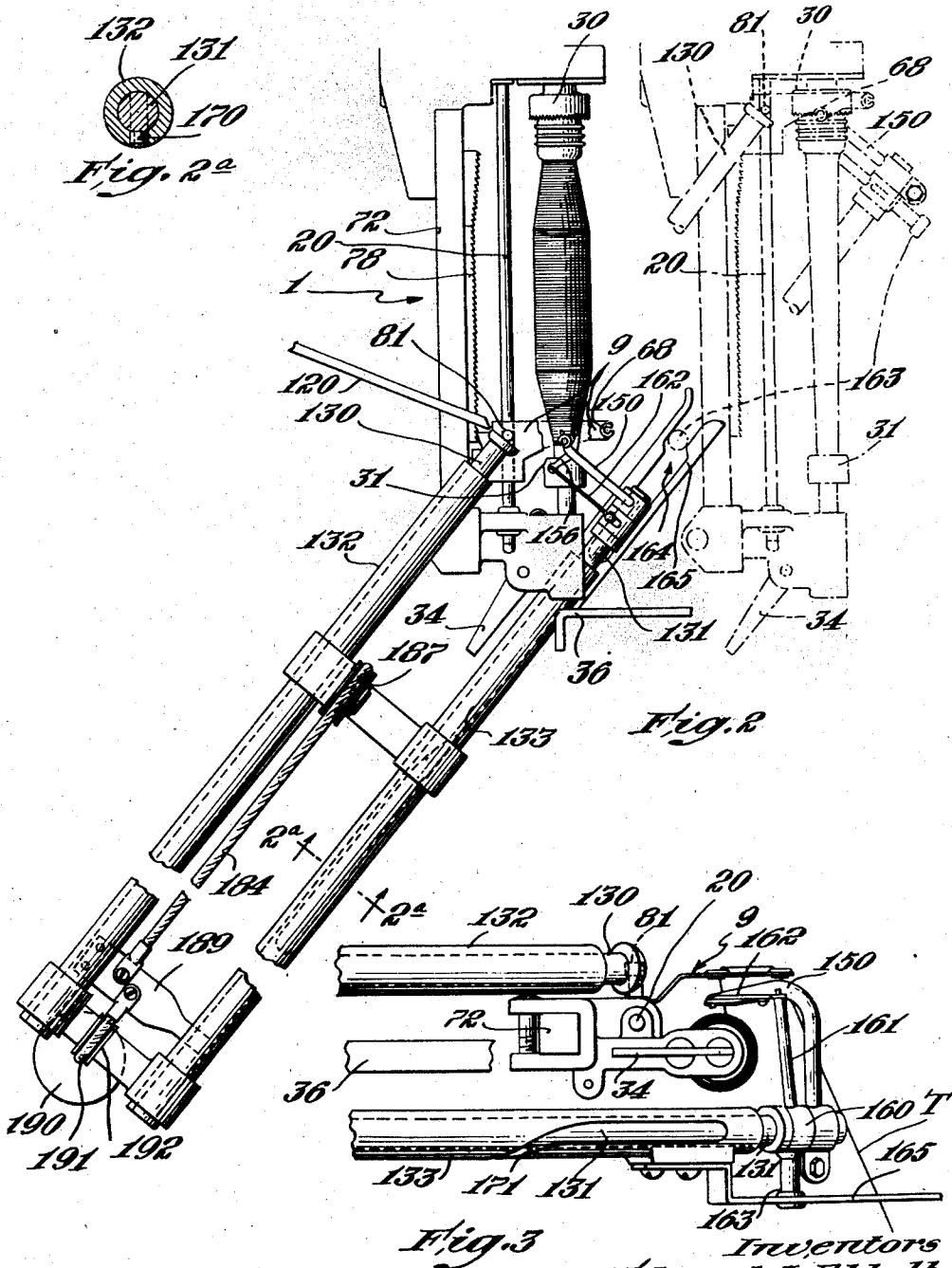
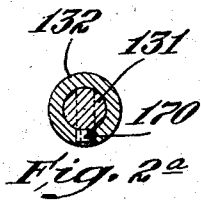
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WINDING MACHINE

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8 Sheets-Sheet 2



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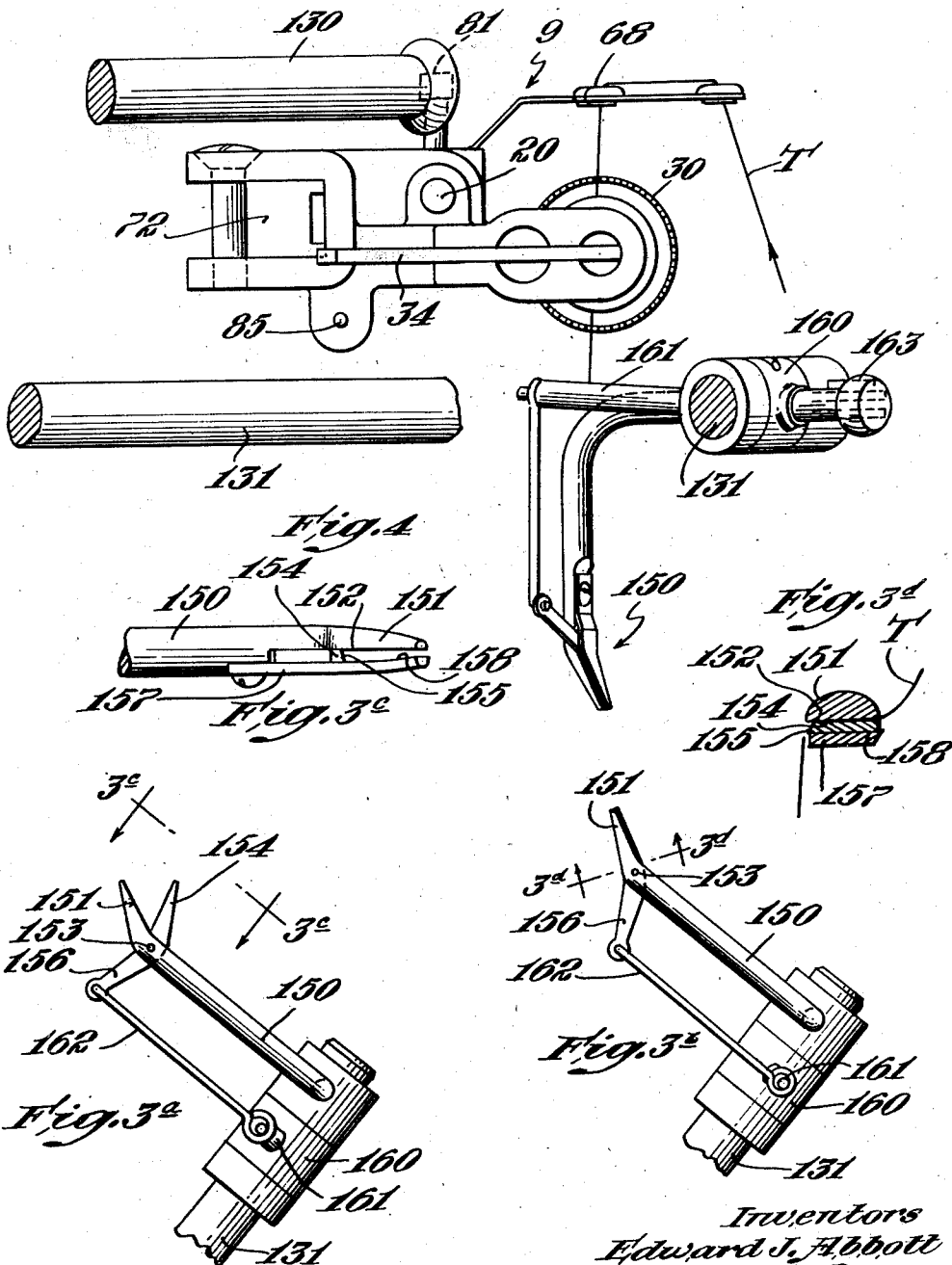
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8 Sheets-Sheet 3



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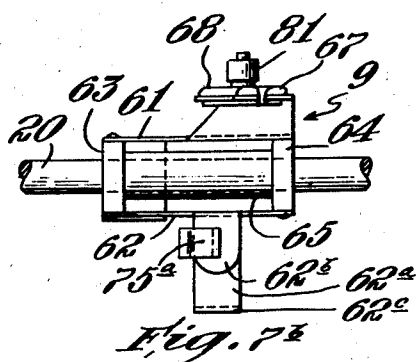
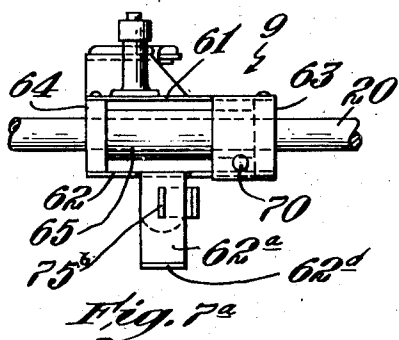
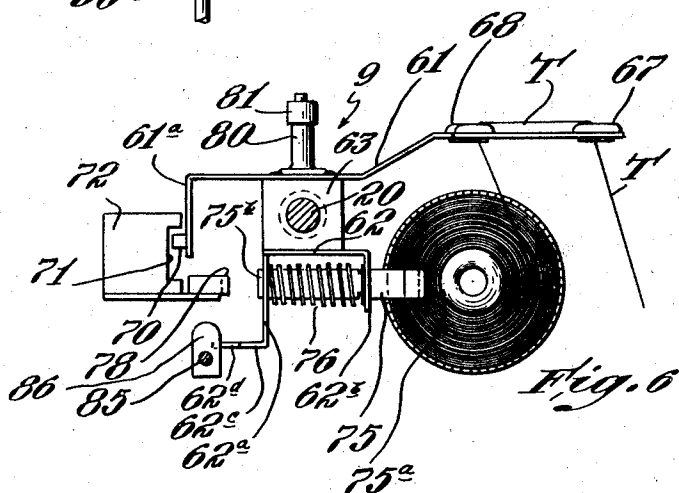
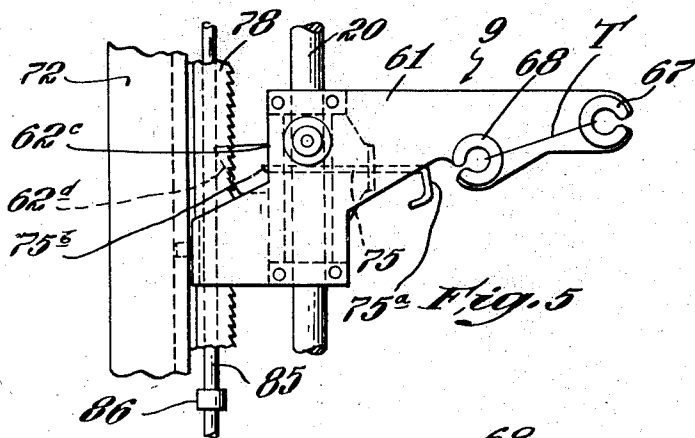
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8 Sheets-Sheet 4



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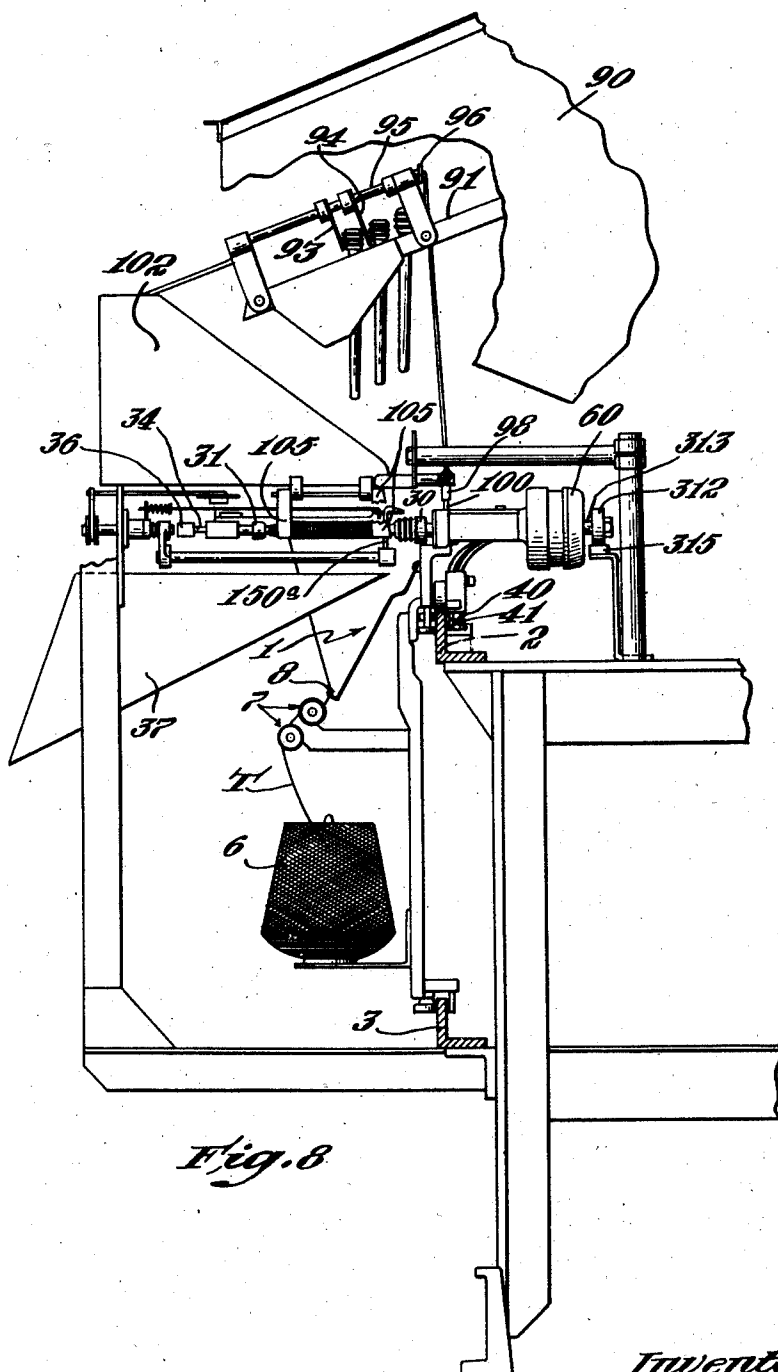


Fig. 8

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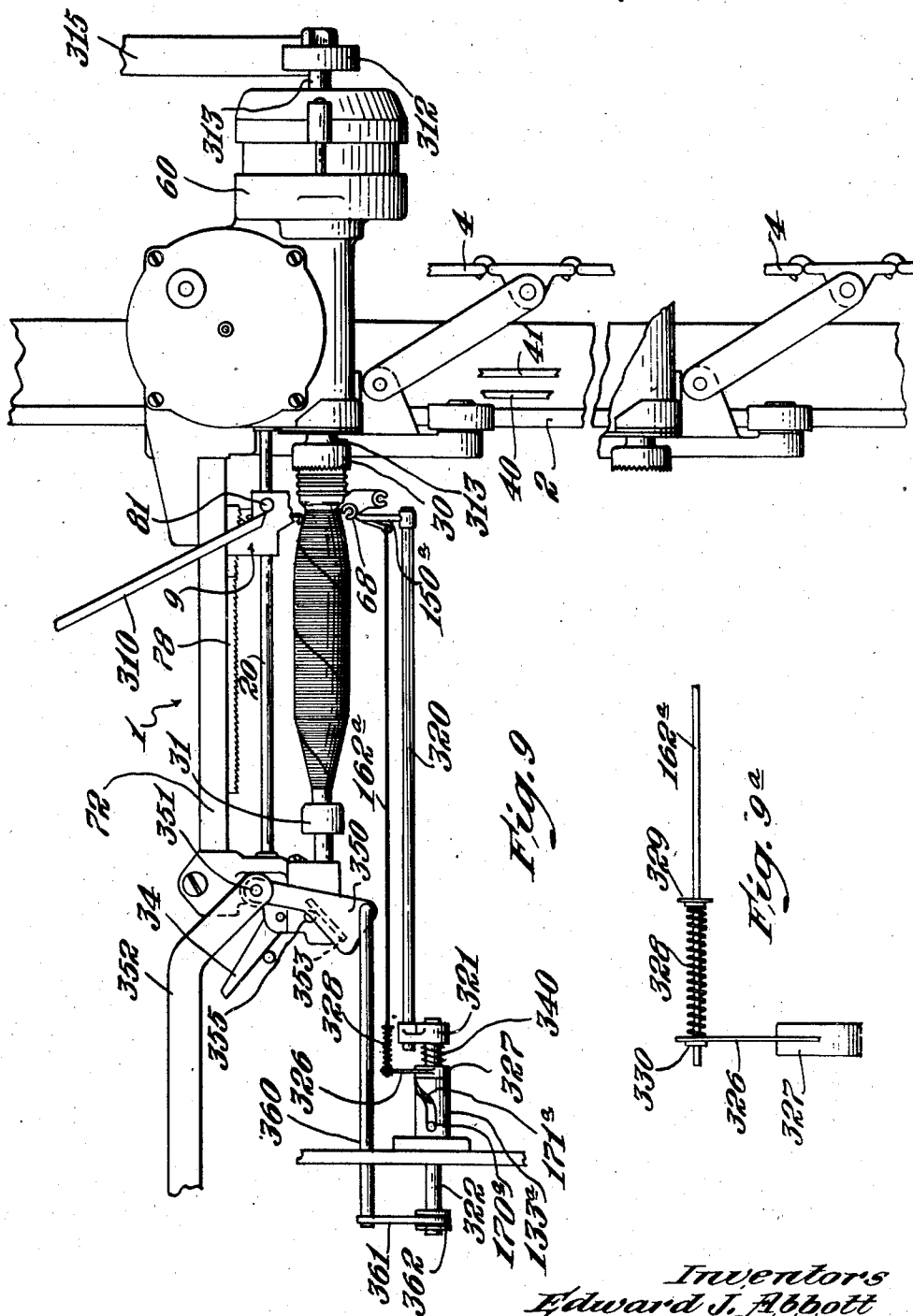
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WINDING MACHINE

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8 Sheets-Sheet 6



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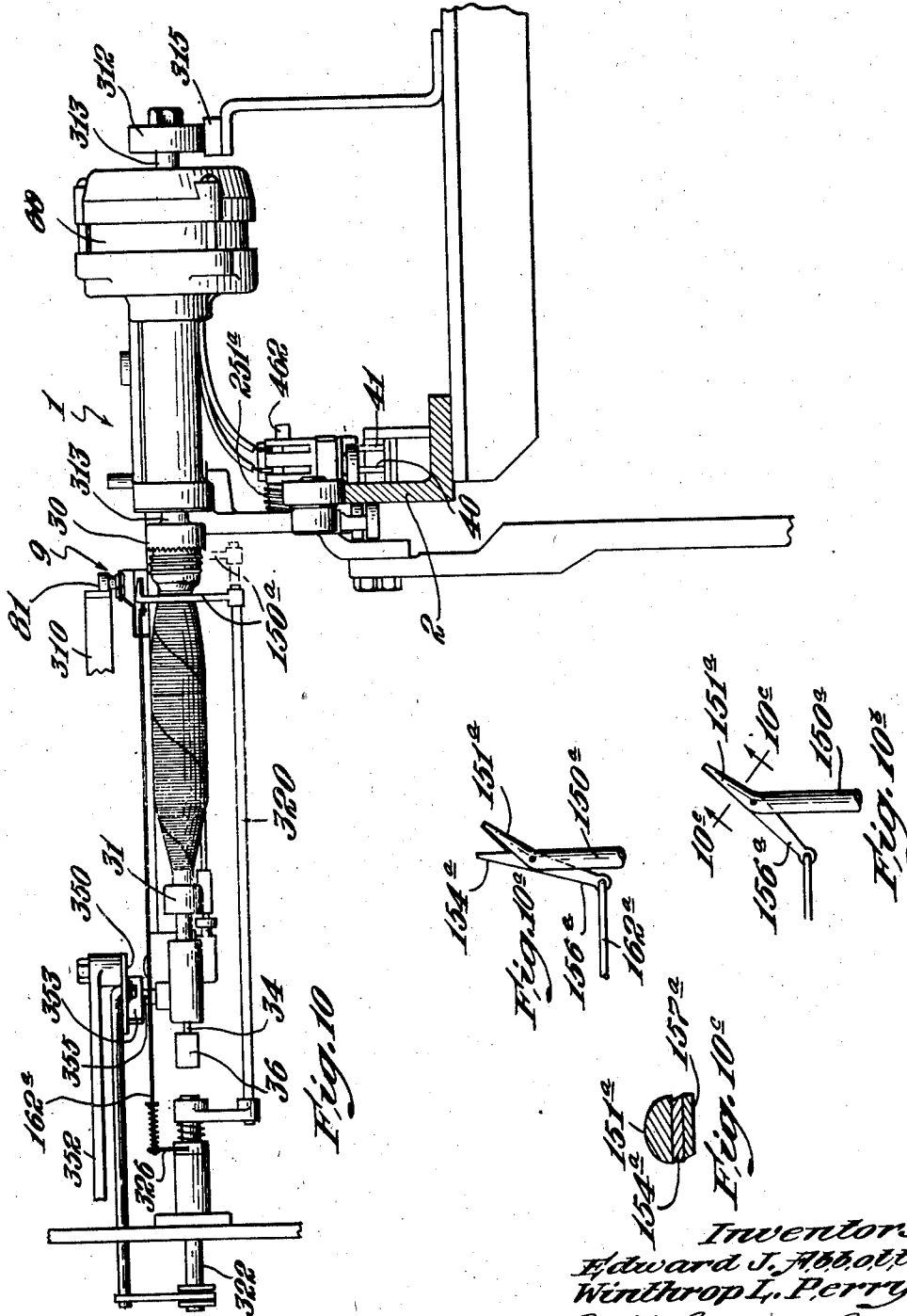
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WINDING MACHINE

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8 Sheets-Sheet 7



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WINDING MACHINE

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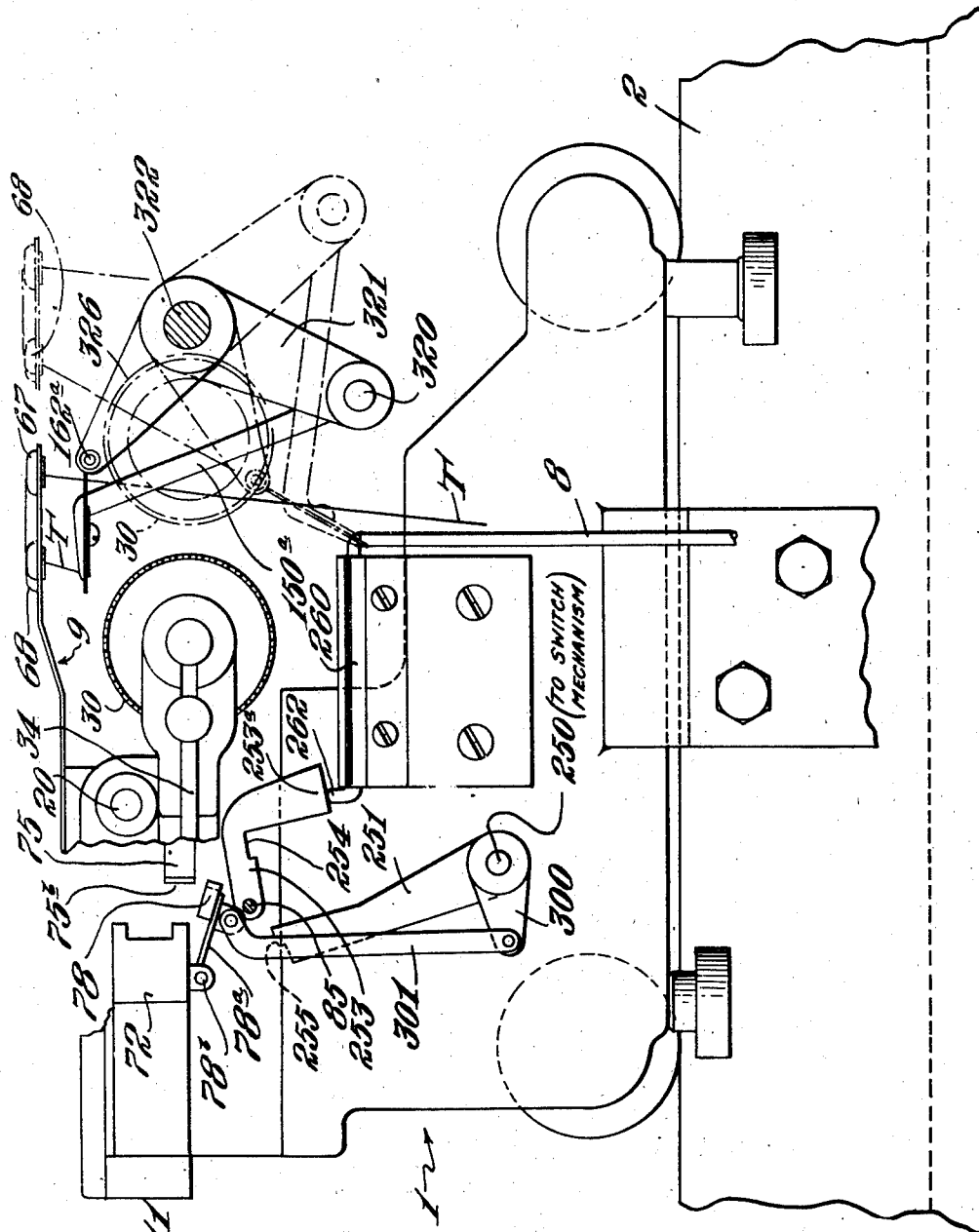


Fig. 11

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UNITED STATES PATENT OFFICE

2,426,167

WINDING MACHINE

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65 Claims. (Cl. 242—32)

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This invention relates to automatic winding machines, and more especially to mechanism for automatically changing the winding bobbin and starting winding on a fresh bobbin.

The invention has various features that are of special utility in the automatic winding of filling wound bobbins, that is, bobbins on which the thread is laid in nested conical layers. Among the objects of the invention are to simplify the handling of the filling wound bobbin as it leaves the winding position, to provide improved mechanism for associating the thread to be wound with the fresh bobbin and to provide a more positive control of the thread during the association of the thread with the fresh bobbin.

Preferred forms of the invention utilize a winding unit tending mechanism to tend a plurality of winding units in succession, and this preferred construction is illustrated and described herein, although it will be apparent that many features of the invention can be utilized in machines in which tending mechanism attends to the changing of bobbins on only a single winding unit, or attends to the changing of bobbins on a plurality of winding units simultaneously.

Other objects of invention and features of advantage will be apparent from this specification and its drawings wherein the invention is explained by way of example.

In the drawings

Fig. 1 is a vertical sectional view showing one side of the frame and track of a traveling unit winding machine, looking in the direction from which winding units approach the observer, showing mechanism for supplying fresh bobbins to the winding units in succession and mechanism for associating the thread with a fresh bobbin, and one winding unit approaching the mechanism;

Fig. 2 is a plan view of mechanism for associating the thread with a fresh bobbin, showing this mechanism cooperating with a winding unit, in two positions of the winding unit;

Fig. 2^a is a fragmentary sectional view on the line 2^a—2^a of Fig. 2;

Fig. 3 is a fragmentary view of the mechanism of Fig. 2, showing a part of the winding unit in front elevation in its full line position of Fig. 2;

Fig. 3^a is a fragmentary plan view of the clamping and cutting bill of Figs. 2 and 3 in the open position.

Fig. 3^b is a similar view of this bill in closed position;

Fig. 3^c is an enlarged fragmentary view of the open bill of Fig. 3^a, taken on the line 3^c—3^c of Fig. 3^a;

Fig. 3^d is an enlarged fragmentary sectional view through the blades of the closed bill of Fig. 3^b, taken on the line 3^d—3^d of Fig. 3^b;

Fig. 4 is a fragmentary view of the mechanism

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of Fig. 2, showing a part of the winding unit in front elevation in its broken line position of Fig. 2;

Fig. 5 is a plan view of the thread guide assembly of a winding unit and fragments of associated parts of the winding unit;

Fig. 6 is a front elevation, with certain parts in vertical section, of the mechanism of Fig. 5;

Fig. 7^a is a left elevation of the thread guide assembly;

Fig. 7^b is a right elevation of the thread guide assembly;

Fig. 8 is a view like Fig. 1 of a modified form of machine;

Fig. 9 is a plan view of mechanism for associating the thread with a fresh bobbin, in the machine of Fig. 8, and one of the winding units and a fragment of another of the winding units of the machine;

Fig. 9^a is a fragmentary view showing a detail of part of the bill operating mechanism of Fig. 9;

Fig. 10 is a right elevation of the apparatus of Fig. 9;

Fig. 10^a is a fragmentary plan view of the clamping and cutting bill of Figs. 9, 10 and 11 in the open position;

Fig. 10^b is a similar view of this bill in closed position;

Fig. 10^c is an enlarged fragmentary sectional view through the blades of the closed bill of Fig. 10^b, taken on the line 10^c—10^c of Fig. 10^b; and

Fig. 11 is a diagrammatic view in the nature of a front elevation, partly in vertical section, showing the winding unit and the thread cutting and clamping bill of Fig. 9, and showing in broken lines subsequent positions of the thread guide and bobbin center of the winding unit and the thread cutting and clamping bill.

In both of the forms illustrated in the drawings, the invention is shown as embodied in a traveling multiple unit filling bobbin winding machine having many of the features shown in Reissue Patent No. 22,492, of Edward J. Abbott, in application Serial No. 386,136, of Edward J. Abbott and Winthrop L. Perry, filed March 31, 1941, Patent No. 2,377,367, and in application Serial No. 526,016 of Edward J. Abbott, Winthrop L. Perry, and Joseph E. Ring, filed March 11, 1944, now Patent No. 2,395,028.

The several winding units indicated generally by the reference character 1 are conveyed around a track comprised of upper and lower rails 2, 3 (shown in cross-section in Fig. 1) by a suitable driven chain 4 through a closed path having straight and semi-circular portions in the general manner described in the above Reissue patent and applications.

In each winding unit the thread from a supply package 6 passes up through a suitable tension device 7, under the pivoted wire ball 8 of a thread

detector, to a thread guide assembly indicated generally by the reference character 9 and shown in detail in Figs. 5 to 7^b, inclusive.

From the thread guide assembly 9 the thread passes downwardly onto the rotating bobbin. The bobbin is held at its base end by a hollow driven center 30, and at its tip end by a hollow rotatable outer center 31 which is spring-pressed inwardly to grasp the bobbin but which can be retracted by a pivoted lever 34 to discharge the bobbin. A stationary abutment 36 (Fig. 2) is located at the place where bobbins are changed, to hold the lever 34 inwardly and thus hold the outer center 31 retracted while the full bobbin is being discharged and until the unit comes into position to grasp a fresh bobbin from the bobbin-supplying mechanism hereinafter described.

Each winding unit receives electric current from stationary rails 40, 41 by suitable brushes which are pressed down onto the rails at the place where winding starts, and are lifted up off the rails when the thread breaks or exhausts, or the winding bobbin is full, or the unit is about to reach the bobbin-changing position, controlling mechanism similar to that described in said application Serial No. 386,136 being employed for this purpose.

The brushes on each winding unit are connected to an electric motor 60 which is directly coupled to drive the inner hollow bobbin-holding center 30 and also coupled through suitable gearing to drive a traverse cam which in turn reciprocates the traverse rod 20, as described in said application Serial No. 386,136. The stroke of reciprocation of the traverse rod is relatively short, compared to the length of the bobbin, and the thread guide assembly 9, on the traverse rod, is progressively advanced along the traverse rod away from the base and toward the tip of the bobbin so as to distribute the thread on the bobbin in overlapped conical layers.

The thread guide assembly 9, shown in detail in Figs. 5 to 7^b, includes an upper plate 61 and a lower plate 62 connected by vertical end pieces 63, 64 of fiber-composition material which frictionally engage the reciprocating traverse rod 20. The thread guide assembly also includes a tubular element 65 of fiber-composition material also frictionally engaging the traverse rod between the two end pieces 63, 64. The engagement of the thread guide assembly with the traverse rod thus is such that the thread guide assembly can reciprocate with the short stroke of the traverse rod but, also, through suitable means, can be held stationary during the end portion of the rearward stroke of the traverse rod, with the result of causing the thread guide assembly to progress along the traverse rod, and can be shifted rearwardly along the traverse rod in preparation for beginning the winding of a fresh bobbin.

Thread T runs from the pivoted thread detector 8 (Fig. 1) up through an outer eye 67 in the upper plate 61, thence over the plate 61 to an inner eye 68 and thence down through eye 68 to the winding bobbin.

The upper plate 61 of the thread guide assembly is provided with a downturned portion 61^a (Fig. 6) carrying a pin 70 which is slidably received in a recess 71 in a horizontal bar 72 which constitutes a part of the frame of the winding unit, thus opposing the tendency of the thread to turn the thread guide assembly in a clockwise direction as viewed in Fig. 6.

The lower plate 62 of the thread guide assembly is provided with downturned portions 62^a, 75

62^b which are slotted to receive a slidable feeler member 75. The feeler member is bent at its right end (Fig. 5) to provide an inclined portion 75^a adapted to be engaged by the last-laid conical layer of thread on the bobbin, to push the feeler member toward the left, the feeler member being yieldingly urged in the opposite direction toward the winding bobbin by means of a coil spring 76 which is compressed between a portion of the feeler member and the downturned portion 62^a (Fig. 6).

The left end of the feeler member 75 is cut off on an angle in the form of a ratchet tooth 75^b, as shown in Fig. 5, and a stationary ratchet bar 78 carried by the bar 72 is adapted to be engaged by the tooth 75^b when the feeler member is pushed to the left an amount corresponding to the predetermined desired diameter of the wound bobbin. Engagement of the tooth 75^b with the stationary ratchet bar 78, as the traverse rod moves rearwardly, detains the thread guide assembly, allowing the traverse rod to slide rearwardly with respect to the thread guide assembly and thus advancing the thread guide assembly progressively step by step along the traverse rod in accordance with the growth of the wound thread on the bobbin.

The thread guide assembly is provided with an upstanding pin 80 carrying a roller 81 at its upper end, this roller being engageable by various devices as hereinafter described, to slide the thread guide assembly in either direction along the traverse rod after the completion of winding of the conical layers of thread on the bobbin.

Each winding unit includes winding-stopping mechanism adapted to operate under various circumstances, among which is that of the thread guide assembly reaching a predetermined outer position corresponding to the outermost conical layer of the wound bobbin. This winding-stopping mechanism, described more fully in connection with the form of the invention shown in Figs. 8 to 11, includes a rotatable rod 85 carrying an upstanding finger 86, normally in the position shown in Fig. 6. A horizontal extension 62^c of the downturned portion 62^a of the thread guide assembly is provided with an inclined edge 62^d adapted to strike the finger 86 and tilt it and the rod 85 in a counterclockwise direction to actuate the winding-stopping mechanism.

Following the completion of a filling wound bobbin in a winding unit and discharge of the wound bobbin from between the centers 30, 31 and following the positioning of the thread from the thread guide in position to be engaged by the fresh bobbin, as hereinafter described, the winding unit, with its center 31 retracted, reaches a bobbin-supplying apparatus such as described in said application Serial No. 386,136, where the center 31 is allowed to close upon a fresh bobbin, and force it into the hollow center 30. As indicated in Fig. 1, the bobbin-supplying apparatus includes a hopper 90 from which empty bobbins are fed onto an inclined track consisting of spaced rails 91, of which one is shown in Fig. 1. The bobbins hang by their enlarged base portions from the rails 91, and are released one at a time by means of pivoted stops 93, 94 which are actuated by means of a shaft 95, crank 96, lifter rod 97 and bell-crank 98 by a pin 100 on each passing winding unit. A bobbin discharged from the lowermost pivoted stop 93 slides off the rails 91 and enters between spaced plates 102, 102, of which one is shown in Fig. 1. The bobbin slides down the inclined upper edges of plates

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102 suspended by its enlarged base portion similarly to its passage down the rails 91, 91, and is then detained and held horizontally by pivoted bobbin-holding fingers 105, 105 in position to be received, as described above, between the centers 30, 31 of a passing winding unit and withdrawn from these fingers.

The several forms of machines described in the above Reissue patent and applications discharge the fully wound bobbin and detain it below the winding position for the purpose, among others, of permitting the thread from the thread guide to be pushed over to the hollow center corresponding to the center 30 of this application, so that it can be engaged between the hollow center and the fresh bobbin while the old fully wound bobbin is still thus detained. Finally, in said Reissue patent and applications, after the fresh bobbin is in position and the thread thus engaged therewith, the thread is severed between the fresh bobbin and the old bobbin, and the old bobbin discharged from the winding unit.

In the two illustrated forms of the present invention, the detention of the completed bobbins, during the taking on of a fresh bobbin, is rendered unnecessary, the thread being clamped and cut, preferably at the same time, at a place between the thread guide and completed bobbin. The completed bobbin is then discharged from its winding position, and the clamped thread extending to the thread guide is positioned across the center which receives the base of the fresh bobbin. Two forms of apparatus for thus associating the thread with the fresh bobbin in the automatic winding of filling wound bobbins are herein shown and described.

In the form of apparatus of Figs. 1 to 4, inclusive, a stationary cam 120 (Fig. 2) located above the path of travel of the winding units is adapted to engage the upstanding roller 81 on each thread guide assembly to slide the thread guide assembly along its traverse rod and position it axially of the wound bobbin at the position shown in full lines in Fig. 2. It will be understood that the thread guide assembly will normally have tripped its stop mechanism, hereinabove described, as a consequence of the bobbin being fully wound, with the result of deenergizing the motor 60 and stopping rotation of the bobbin and reciprocation of the thread guide assembly. The thread guide assembly will stop with its eye 68 somewhere within the zone defined by the length of the last conical layer of thread on the bobbin, and in the event that the winding is stopped by the bobbin being fully wound, such last conical layer will extend to within a short distance from the tip of the bobbin, as shown in Fig. 2. If stoppage of winding is brought about by actuation of the thread detector 8 by breakage or exhaustion of the thread supply, then the last conical layer will be nearer to the base of the bobbin and the thread guide will accordingly stop in the zone of such last conical layer. Wherever stopped, the thread guide eye is first brought to a predetermined position axially of the wound bobbin (such as shown in full lines in Fig. 2) by means of the stationary cam 120.

Two plungers 130 and 131, slidably mounted in horizontal tubes 132 and 133 at approximately 45° to the axes of the bobbins, are adapted to act on each traveling winding unit when it reaches the full line position of Fig. 2. Plunger 130 engages the upstanding roller 81 on the thread guide assembly, pushing the thread guide assembly along the traverse rod parallel to the

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axis of the bobbin to a position wherein the inner eye 68 of the thread guide assembly is adjacent to the outer edge of the hollow center 30, preferably directly above the outer edge of this hollow center, as shown in the broken line position of Fig. 2. During the first part of this movement of the thread guide assembly, and just before the feeler member 15 can be forced into contact with the ratchet bar 78 by encountering the full-diameter portion of the wound bobbin, the winding unit reaches the stationary abutment 36 which forces the lever 34 inwardly, retracting the outer bobbin-holding center 31. Thus, the bobbin is displaced from its winding position, leaving the thread guide assembly free to be pushed to the rear without the feeler being forced into locked engagement with the ratchet bar 78. The bobbin, discharged from the centers 30, 31 falls into a stationary chute 37 (Fig. 1) and slides down this chute and to the left and out of the machine into any suitable receptacle.

Means is provided for clamping the thread at a point between the thread guide and the wound bobbin while the latter is still held by the centers 30, 31, and means is provided for cutting the thread leading to the wound bobbin, and in the preferred forms of invention illustrated, these means are combined in the form of a combined clamp and cutter in the nature of a bill adapted to cut and clamp the thread and carry the cut and clamped thread adjacent to the center 30 and to the opposite side thereof from the thread guide eye 68.

The bill, indicated by the reference character 150, is mounted on the plunger 131 (Fig. 2) and is shown in more detail in Figs. 3^a to 3^b. The bill has at its outer end a fixed blade 151 leaving a clamping edge 152, has pivotally secured thereto at 153 a pivoted blade 154 having a cutting edge 155, and has fixedly secured thereto a spring blade 157 having a cutting edge 158. An extension 156 of the pivoted blade 154 is adapted to open and close this pivoted blade.

Movement of the thread guide assembly to the full line position of Fig. 2 brings the thread which extends from the thread guide eye 68 to the bobbin into position to be received by the open blades of the bill. A collar 160 on the plunger 131 carries an upstanding arm 161 (Figs. 3 and 3^a) connected by a link 162 to an extension 156 of the pivoted blade 154 (Fig. 3). Collar 160 carries a downwardly extending actuating pin 163 (Fig. 3) adapted to slide in a cam slot 164 in a horizontal cam plate 165 secured to the stationary tube 133. As shown in Fig. 2, cam slot 164 has a bend at a place such that shortly after the plunger 131 begins to move from its full-line position of Fig. 2, the pin 163, collar 160, pin 161 and link 162 are actuated to close the movable blade. Thus, the thread extending to the thread guide eye 68 is clamped between blades 151 and 154 (Fig. 3^a) and the thread formerly extending to the bobbin is cut off by cutting edges 155 and 158. The thread clamped between blades 151 and 154 is firmly held but can be pulled out.

The bill operating plunger 131 is movable with the plunger 130, being connected thereto by a cross-bar 189. A roller 170 on plunger 131 moves in a cam groove 171 in the stationary tube 133, the cam groove being shaped to rotate the plunger 130 approximately 90° after discharge of the wound bobbin and before reaching the broken-line position of Fig. 2. As a result, the bill is rotated about the inclined axis of the plunger 131 to the position of Fig. 4 wherein the

clamped thread extends to the opposite side of the center 30 from the thread guide eye 68. With the clamped thread thus extending across the center 30, the winding unit reaches the bobbin-holding fingers 105, 105 of Fig. 1, the lever 34 passes off the end of the stationary abutment 36, and the outer center 31 closes upon a fresh empty bobbin, forcing it into the center 30 and gripping the thread. The plungers 130 and 131 quickly return to their full line positions, and at the beginning of this return movement, the end of the thread is pulled out from the bill. Upon passing this apparatus, the winding unit is automatically started to winding, as, for example, by means similar to what is described in said Reissue patent or said applications.

Any suitable means may be employed for actuating the plungers 130 and 131 in the manner described above each time a winding unit reaches these plungers. A preferred form of actuating means includes a horizontal pin 180 (Fig. 1) on the rear of each traveling winding unit, a lever 181 adapted to be swung by each passing pin, a shaft 182 turned by the lever 181, a lever 183, a wire rope 184 connected at one end to the lever 183, and passing around pulleys 185, 186, 187, and a cross-bar 189 (Fig. 2) connected to the other end of rope 184 and suitably connected to the reciprocable plunger 130 and to the reciprocable and rotatable plunger 131. Suitable means is provided for restoring the parts to the full line position of Fig. 2, for example a counterweight 190 connected to a wire rope 191 which passes over a pulley 192 and is connected to cross-bar 189.

In describing the form of the invention shown in Figs. 8 to 11 the description of parts already described will in general not be repeated, numerous of the respectively corresponding parts being designated by the same or similar reference characters in the several forms of the invention.

In connection with the device of Figs. 8 to 11, the winding-stopping and starting mechanism, previously briefly mentioned in connection with the device of Figs. 1 to 4, will be described in more detail. Stopping and starting of the winding on each unit is accomplished by a suitable electric switch mechanism which, for example, may be similar to that shown in Fig. 17 of said application Serial No. 386,136, which stops the winding by allowing the brushes to rise out of contact with the stationary conductor rails, and starts the winding by pressing the brushes down into contact with the conductor rails after the unit has passed the bobbin-supplying mechanism.

The brushes thus move with a crank shaft 250 of the switch mechanism, this shaft having an arm 251 on the outer side of the head portion of the winding unit (Fig. 11), and being urged in a counterclockwise direction in Fig. 11 by a coil spring 251^a (Fig. 10). The brushes are permitted to rise out of contact with the conductor rails when the crank shaft 250 and arm 251 are allowed to turn counterclockwise to the position of arm 251 shown in Fig. 11. A boss 462 on the switch mechanism of the unit (Fig. 10) is adapted to be engaged by a stationary abutment such as a stationary roller (not shown) to restore the brushes into contact with the conductor rails to start the winding. As the brushes are restored into contact with the conductor rails and winding thereby started, the crank shaft 250 and arm 251 are thereby turned clockwise in Fig. 11. Rod 85 (referred to previously in connection with Figs. 5 and 6) carries a latch member 253 of

which a notch 254 is adapted to receive and hold a projection 255 at the top of arm 251, thus latching the arm 251 in an upright position, and holding the switch mechanism closed.

When the latch 253 is raised as shown in Fig. 11, arm 251 is free to move counterclockwise to its position there shown and the switch mechanism thereby allowed to open to stop winding. Latch 253 may be raised to the position shown in Fig. 11 in either of two ways. The thread guide assembly may reach the projection 86 on rod 85 and the cam surface 62^d (Fig. 6) tilt the projection 86, thereby turning the rod 85 and raising the latch.

The thread detector 8, pivotally mounted in a bracket 260 is provided with a crank arm 262 extending rearwardly under a downturned portion 253^a of latch 253. Thread detector 8 is normally held up as shown in Figs. 1 and 8 by the tension of the thread. However, when the thread breaks or exhausts, detector 8 can drop raising its rearwardly extending crank arm 262, and accordingly raising the latch 253. When the switch mechanism closes in starting winding, the tension of the thread returns the thread detector to a position in which the latch 253 can again hold the arm 251, and thus hold the switch mechanism closed.

In the device of Figs. 8 to 11, the ratchet bar 78, which cooperates with the thread guide assembly to advance the thread guide assembly progressively, is removed from its normal position upon the completion of the conical layers of winding, for the purpose of permitting the thread guide assembly to be moved backwardly over the full-diameter portion of the wound bobbin which is still held in winding position. It will be observed that, during winding of the conical layers of thread, the ratchet bar 78 restrains the thread guide assembly, including its feeler, against movement from the zone of the last conical layer of wound yarn toward the base of the bobbin. Means for disabling the ratchet bar from so restraining the thread guide assembly and feeler will now be described. The ratchet bar 78, instead of being in fixed relation to the supporting bar 72, as for instance in Figs. 2 and 6, is mounted as shown in Fig. 11 on a plate 78^a hinged at 79^b to the bar 72. A lever 300 on shaft 250 and a link 301 connect the ratchet bar 78 to the shaft 250 of the winding-stopping and starting mechanism so that when winding is stopped the ratchet bar is lowered out of the path of the tooth 75^b of the feeler member of the thread guide assembly, as shown in Fig. 11. When winding begins, the ratchet bar 78 resumes its active position, similar to that shown in Fig. 6.

A stationary cam 310 (Fig. 9) is provided above the winding units in position to engage the upstanding roller 81 of the thread guide assembly and plow the thread guide assembly from its outermost position adjacent to the last conical layer of wound thread over to its rearmost position adjacent to the base end of the bobbin, as shown in Figs. 9 and 10.

It will be noticed that the feeler 75 of each winding unit is adapted to move outwardly away from the axis of the wound bobbin to at least the largest diameter of the body of thread wound on the bobbin, so that the feeler and the thread guide assembly can be moved to the region of the base of the bobbin while the wound bobbin is held by the centers 30 and 31 preparatory to replacement of the bobbin by the winding unit tending mechanism. Simultaneously with this movement

of the thread guide assembly, the bobbin is slowly rotated so that the thread from the thread guide is wound on the bobbin in the form of an open spiral, as also shown in Figs. 9 and 10. The means for causing this slow rotation of the bobbin preferably comprises a smooth pulley 312 on the inner end of the motor shaft 313 that rotates the hollow center 30, and a stationary friction surface consisting of a strip of cork or the like 315, disposed along the path of travel of the winding units.

With the thread guide assembly positioned as shown in Figs. 9 and 10, the thread extending from the eye 68 of the thread guide to the spiral on the bobbin is brought into the open blades of a cutting and clamping bill 150^a. Bill 150^a is similar to bill 150 of Figs. 1 to 4 but has its blades shaped so that in closing its pivoted blade 154^a swings clockwise instead of counterclockwise. Bill 150^a is carried by the inner end of a rod 320 which is fastened into an arm 321 mounted on a shaft 322 which is reciprocable and rotatable in a sleeve 133^a. An extension 156^a of the intermediate pivoted blade 154^a of the bill is connected to a link 162^a. Link 162^a is slidably mounted in an arm 326 which extends from a collar 327 on the shaft 322. Link 162^a, which is slidable toward the left with respect to arm 326, is yieldingly urged to the right with respect to this arm 326 by a spring 328, which acts against a collar 329 on the link, and an enlargement 330 on link 162^a prevents the link from leaving the arm 326 (Fig. 9^a). The collar 327 carrying the arm 326 is yieldingly urged to the left away from arm 321 by a spring 340. In the inactive position of these parts, shown in Figs. 9 and 10, the positions of the rods 320 and link 162^a are so related to each other that the pivoted blade 154^a of the bill 150^a is open for the reception of the thread extending from the thread guide to the bobbin.

A preferred mechanism for actuating the bill 150^a includes a plate 350 pivoted at 351 on a bracket 352 on a stationary part of the machine, the plate carrying on its lower face a downwardly extending cam element 353. A pin 355 extending upwardly from each winding unit is adapted to engage the cam element 353 and swing it and the plate 350 in a counterclockwise direction (Fig. 9). This motion of the plate 350 is transmitted to the shaft 322 by a rod 360, and an arm 361 which works in a grooved collar 362 on the shaft 322. Thus, the shaft 322, rod 320 and bill 150^a are moved to the right, the final position of the bill being shown in broken lines in Fig. 10.

In the first part of this motion, as the arm 321 separates further from the collar 327, the relative positions of the rod 320 and link 162^a are displaced so as to close the pivoted blade 154^a upon the other blades of the bill, as shown in Figs. 10^b and 10^c, clamping and cutting the thread in the full line position of Fig. 11.

With the thread thus cut and clamped, the winding unit encounters the bobbin-doffing cam 36, the center 31 is retracted, and the bobbin is discharged from the centers 30 and 31 as above described.

The shaft 322 (Fig. 9) carries a pin 170^a working in a cam slot 171^a in the stationary sleeve 133^a. Cam slot 171^a is so shaped that in the initial movement of shaft 322 the shaft merely reciprocates and in the later stages of its movement, the shaft also rotates in a counterclockwise direction, as shown in Fig. 11. By these motions of the shaft 222, the bill is carried to the broken line

positions of Figs. 10 and 11, adjacent to the plane of the outer edge of the center 30 and on the opposite side of the center from the thread guide eye 68 which then occupies the broken line position of Fig. 11.

With the thread thus held across the center 30, a fresh bobbin is received and clamped between the centers, then the end of the thread is pulled out from the bill and winding is started again on the winding unit. The bill 150^a and its associated parts are restored to the position shown in Fig. 9 and in full lines in Fig. 10 by any suitable restoring means such, for example, as the counterweight 190 of Fig. 2.

A further patent application of Edward J. Abbott and Winthrop L. Perry, for Winding machine, filed on the same date as this application, Serial No. 560,737, shows certain features of this invention applied to winding machines having a modified form of thread guide assembly and modified mechanisms for winding the open spiral of thread on the exterior of the bobbin.

We claim:

1. In an automatic winding machine the combination of means including a center for holding a rotatable winding bobbin, elements adapted to clamp the thread between them, means for causing said elements to clamp the thread, and means effective after clamping the thread for moving said elements and the thread clamped between them from one side of said center to another generally opposite side of said center.
2. In an automatic winding machine the combination of means including a center for holding a rotatable winding bobbin, elements adapted to clamp the thread between them, means for causing said elements to clamp the thread, and means effective after clamping the thread for moving said elements and the thread clamped between them longitudinally of the axis of winding.
3. In an automatic winding machine the combination of means including a center for holding a rotatable winding bobbin, elements adapted to clamp the thread between them, means for causing said elements to clamp the thread, and means effective after clamping the thread for moving said elements and the thread clamped between them longitudinally of the axis of winding and from one side of said center to another generally opposite side of said center.
4. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, the machine including means for discharging the bobbin from said center, a thread guide for distributing a thread on the winding bobbin, a combined clamp and cutter comprising clamping and cutting elements adapted to clamp the thread and cut the thread between the clamped portion and the bobbin, the machine including means effective after such clamping of the thread for moving said clamping and cutting elements and the thread clamped thereby longitudinally of the axis of winding, to carry the thread across said center.
5. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, the machine including means for discharging the bobbin from said center, a thread guide for distributing a thread on the winding bobbin, a combined clamp and cutter comprising clamping and cutting elements adapted to clamp the thread and cut the thread between the clamped portion and the bobbin, the

6. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, the machine including means for discharging the bobbin from said center, a thread guide for distributing a thread on the winding bobbin, a combined clamp and cutter comprising clamping and cutting elements adapted to clamp the thread and cut the thread between the clamped portion and the bobbin, the machine including means effective after such clamping and cutting of the thread for moving said clamping and cutting elements and the thread clamped thereby longitudinally of the axis of winding.

8. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin so as to distribute the thread on the bobbin in nested conical layers, elements adapted to clamp the thread between them, means for operating said elements to clamp the thread at a place between the wound bobbin and the thread guide, and means effective after clamping the thread for moving said elements and the thread clamped between them from the side of said center on which the path of the thread guide is located to another generally opposite side of said center.

10. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin so as to distribute the thread on the bobbin in nested conical layers, elements adapted to clamp the thread between them, means for operating said elements to clamp the thread at a place between the wound bobbin and the thread guide,

11. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter comprising clamping and cutting elements adapted to clamp the thread at a place between the wound bobbin and the thread guide and cut the thread between the clamped portion and the bobbin, the machine including means effective after such clamping of the thread for moving said clamping and cutting elements and the thread clamped thereby longitudinally of the axis of winding, to carry the thread across said center.

13. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter comprising clamping and cutting elements adapted to clamp the thread at a place between the wound bobbin and the thread guide and cut the thread between the clamped portion and the bobbin, the machine including means effective after such clamping and cutting of the thread for moving said clamping and cutting elements and the thread clamped thereby longitudinally of the axis of winding.

14. An automatic winding machine comprising means for holding a rotatable winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter comprising clamping and cutting elements adapted to clamp the thread at a place between the wound bobbin and the thread guide and cut the thread between the clamped portion and the bobbin, the machine including means for moving said clamping and cutting elements and the thread clamped thereby longitudinally of the axis of winding and from the side of said center on which the path of

the thread guide is located to another generally opposite side of said center.

15. A multiple unit automatic winding machine comprising a plurality of winding units each including a thread guide and bobbin holding means including a center for the base of the bobbin, each unit being adapted to discharge its bobbin from said center, and the machine including a clamp operative with respect to the threads of the winding units in succession to clamp the thread extending between the bobbin and thread guide, said clamp being movable to position the thread for engagement between the center and a fresh bobbin.

16. A multiple unit automatic winding machine comprising a plurality of winding units each including a thread guide and bobbin holding means including a center for the base of the bobbin, each unit being adapted to discharge its bobbin from said center, and the machine including a clamp operative with respect to the threads of the winding units in succession to clamp the thread extending between the bobbin and thread guide, said clamp being movable, after discharge of the bobbin from its center, to position the thread for engagement between the center and a fresh bobbin.

17. A multiple unit automatic winding machine comprising a plurality of winding units each including a thread guide and bobbin holding means including a center for the base of the bobbin, each unit being adapted to discharge its bobbin from said center, and the machine including a clamp operative with respect to the threads of the winding units in succession to clamp the thread extending between the bobbin and thread guide and carry the thread longitudinally and transversely of the axis of winding to a position adjacent to said center and on the opposite side thereof from the path of the thread guide.

18. A multiple unit winding machine including a plurality of winding units adapted to travel in a procession, a winding unit tending mechanism past which said units travel, each winding unit including a center for holding the base of the winding bobbin, the tending mechanism including means for supplying fresh bobbins to the centers of the passing units, and a combined clamp and cutter engageable with the threads of the passing units and movable to a position to hold the thread across the center of the winding unit at a place of reception of a fresh bobbin by the unit.

19. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative movement between the winding units and the tending mechanism to bring the tending mechanism into co-operative relation to the winding units successively, the several winding units each including a center for holding a winding bobbin in winding position, and the tending mechanism including a clamp adapted to clamp the thread of each winding unit successively, and means operative by said relative movement to move said clamp to a position adjacent to the said center of the winding unit.

20. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative movement between the winding units and the tending mechanism to bring the tending mechanism into co-operative relation to the winding units successively, the several winding units each including a cen-

ter for holding a winding bobbin in winding position, and the tending mechanism including a combined clamp and cutter adapted to clamp and cut the thread of each winding unit successively, and means operative by said relative movement to move said combined clamp and cutter to a position adjacent to the said center of the winding unit.

21. A multiple unit winding machine including a plurality of winding units adapted to travel in a procession, a non-traveling winding unit tending mechanism past which the winding units travel, the several winding units each including a center for holding a winding bobbin in winding position, and the tending mechanism including a clamp adapted to clamp the thread of each winding unit successively, and means operative by the traveling movement of the winding units to move said clamp to a position adjacent to the said center of the winding unit.

22. A multiple unit winding machine including a plurality of winding units adapted to travel in a procession, a non-traveling winding unit tending mechanism past which the winding units travel, the several winding units each including a center for holding a winding bobbin in winding position, and the tending mechanism including a combined clamp and cutter adapted to clamp and cut the thread of each winding unit successively, and means operative by the traveling movement of the winding units to move said combined clamp and cutter to a position adjacent to the said center of the winding unit.

23. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative traveling movement between the winding units and the tending mechanism, the tending mechanism including a thread positioning member having a movement of reciprocation in a path diagonal to the path of said relative movement, so as to move longitudinally of the axis of winding.

24. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative traveling movement between the winding units and the tending mechanism, the tending mechanism including a thread clamp having a movement of reciprocation in a path diagonal to the path of said relative movement, so as to move longitudinally of the axis of winding.

25. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative traveling movement between the winding units and the tending mechanism, the tending mechanism including a thread clamp and cutter having a movement of reciprocation in a path diagonal to the path of said relative movement, so as to move longitudinally of the axis of winding.

26. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative traveling movement between the winding units and the tending mechanism, each winding unit including a thread guide, and the tending mechanism including a thread guide positioning member having a movement of reciprocation in a path diagonal to the path of said relative movement, so as to move longitudinally of the axis of winding.

27. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, a cutting and clamping bill, means for operating the bill to cut the thread

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adjacent to the thread guide and hold the end of thread which extends to the thread guide, and means for moving the bill, carrying said cut end of thread, to a position where the thread extending to the thread guide lies across said center.

28. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, a cutting and clamping bill, means for operating the bill to cut the thread adjacent to the thread guide and hold the end of thread which extends to the thread guide, and a carrier for the bill having a motion parallel to the axis of winding to carry the held end of thread to said center and a rotary motion to carry the held end of thread to the opposite side of the center from the thread guide.

29. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter, means for operating the clamp and cutter to cut the thread adjacent to the thread guide while the thread guide is adjacent to the outermost conical layer of thread wound on the bobbin, means for discharging the wound bobbin from said holding means, means for moving the thread guide toward the position to be occupied by the base of a fresh bobbin, means for moving the clamp and cutter to a position adjacent said center and on the opposite side thereof from the path of the thread guide, and means for supplying a fresh bobbin to said holding means.

30. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter, means for operating the clamp and cutter to cut the thread adjacent to the thread guide while the thread guide is adjacent to the outermost conical layer of thread wound on the bobbin, means for discharging the wound bobbin from said holding means, means for moving the clamp and cutter toward said center, and means for causing the clamp and cutter to close upon the thread during such movement.

31. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter, means for operating the clamp and cutter to cut the thread adjacent to the thread guide while the thread guide is adjacent to the outermost conical layer of thread wound on the bobbin, means for discharging the wound bobbin from said holding means, means for moving the clamp and cutter toward said center, and means for rotating the clamp and cutter during such movement.

32. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the

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thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a thread positioning member adjacent to the tip of the bobbin adapted to engage the thread extending from the thread guide to the wound thread on the bobbin, and means acting after stopping of winding to move the thread guide to a predetermined place adjacent to the tip of the bobbin for reception of the thread by said thread positioning member.

33. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter adjacent to the tip of the bobbin adapted to engage the thread extending from the thread guide to the wound thread on the bobbin, and means acting after stopping of winding to move the thread guide to a predetermined place adjacent to the tip of the bobbin for reception of the thread by said clamp and cutter.

34. An automatic winding machine comprising means for holding a winding bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a clamp actuable to clamp the thread at a place adjacent to the base portion of wound thread on the bobbin substantially short of the base end of the bobbin, means for carrying the thread from a place adjacent to the outermost conical layer of the wound thread on the bobbin to said clamp, means for severing the thread extending from the clamp to the bobbin, means for discharging the wound bobbin from said holding means, and means for moving said clamp longitudinally of the axis of winding while said clamp is clamped upon the severed thread, thereby to carry the thread into position to be associated with a fresh bobbin.

35. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse toward the tip of the bobbin so as to distribute the thread on the bobbin in nested conical layers, means acting after the winding of the last conical layer on the bobbin to move the thread guide back toward the position of winding of the base portion of thread of the bobbin, means for rotating the bobbin during such backward movement of the thread guide, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin, a clamp positioned to receive the run of thread extending from the thread guide to said spiral on the bobbin substantially short of the base end of the bobbin, means for severing the thread extending from the clamp to the bobbin, means for discharging the wound bobbin from said holding means, and means for moving said clamp longitudinally of the axis of winding while said clamp is clamped upon the severed thread, thereby to carry the thread into position to be associated with a fresh bobbin.

36. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to

the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter adapted to engage the thread leading to the wound bobbin at a place adjacent to the base portion of wound thread on the bobbin substantially short of the base end of the bobbin and to cut the thread extending from the combined clamp and cutter to the bobbin, means for carrying the thread from a place adjacent to the outermost conical layer of the wound thread on the bobbin to said combined clamp and cutter adjacent to the said base portion of wound thread, means for discharging the bobbin from said center, and means for moving said combined clamp and cutter longitudinally of the axis of winding while said combined clamp and cutter is clamped upon the cut thread, thereby to carry the thread to a position adjacent to said center.

37. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter adapted to engage the thread leading to the wound bobbin at a place adjacent to the base portion of wound thread on the bobbin and to cut the thread extending from the combined clamp and cutter to the bobbin, means for moving the thread guide from a position adjacent to the outermost conical layer of the wound thread on the bobbin to carry the thread to said clamp adjacent to the said base portion of wound thread, means for discharging the bobbin from said center, and means for moving said combined clamp and cutter longitudinally of the axis of winding while said combined clamp and cutter is clamped upon the cut thread, thereby to carry the thread to a position adjacent to said center.

38. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a clamp adapted to engage the thread leading to the wound bobbin at a place adjacent to the base portion of wound thread on the bobbin substantially short of the base end of the bobbin, means for carrying the thread from a place adjacent to the outermost conical layer of the wound thread on the bobbin to said clamp adjacent to the said base portion of wound thread, means for rotating the bobbin during such carrying of the thread to wind the thread in the form of an open spiral on the wound bobbin, means for cutting the thread extending from the clamp to the bobbin, means for discharging the bobbin from said center, and means for moving the clamp longitudinally of the axis of winding while said clamp is clamped upon the cut thread, thereby to carry the thread to a position adjacent to said center.

39. An automatic winding machine comprising means for holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip

of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a clamp adapted to engage the thread leading to the wound bobbin at a place adjacent to the base portion of wound thread on the bobbin substantially short of the base end of the bobbin, means for moving the thread guide from a position adjacent to the outermost conical layer of the wound thread on the bobbin to carry the thread to said clamp adjacent to the said base portion of wound thread, means for rotating the bobbin during such carrying of the thread to wind the thread in the form of an open spiral on the wound bobbin, means for cutting the thread extending from the clamp to the bobbin, means for discharging the bobbin from said center, and means for moving the clamp longitudinally of the axis of winding while said clamp is clamped upon the cut thread, thereby to carry the thread to a position adjacent to said center.

40. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative movement between the winding units and the tending mechanism to bring the tending mechanism into cooperative relation to the winding units successively, the several winding units each including a center for rotating the bobbin during winding, a thread guide, and means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, the tending mechanism including means for leading the thread extending to the wound bobbin back toward the base of the bobbin, and the machine including means for rotating the said center of the winding unit during such leading of the thread to rotate the bobbin and wind the thread in the form of an open spiral on the exterior of the bobbin.

41. A multiple unit winding machine including a plurality of winding units adapted to travel in a procession, a non-traveling winding unit tending mechanism past which the winding units travel, the several winding units each including a center for rotating the bobbin during winding, a thread guide, and means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, the tending mechanism including means for leading the threads extending to the bobbins of the successive traveling units back toward the base of its bobbin, and the machine including means for rotating the said centers of the traveling units during such leading of the thread, to rotate the bobbins and wind the thread in the form of an open spiral on the exterior of the bobbin.

42. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative movement between the winding units and the tending mechanism to bring the tending mechanism into cooperative relation to the winding units successively, the several winding units each including a center for rotating the bobbin during winding, a thread guide, and means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, the tending mechanism including means for moving the thread guide back toward the base of the bobbin, and the machine including means for rotating the

said center of the winding unit during such back movement of its thread guide, to wind the thread in the form of an open spiral on the exterior of the bobbin.

43. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative movement between the winding units and the tending mechanism to bring the tending mechanism into cooperative relation to the winding units successively, the several winding units each including a center for rotating the bobbin during winding, a thread guide, and means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, the tending mechanism including means for leading the thread extending to the wound bobbin back toward the base of the bobbin, the tending mechanism including a friction element, and the several winding units including rotatable means engageable with and rotatable by said friction element for rotating the center of the winding unit during such leading of the thread to rotate the bobbins and wind the thread in the form of an open spiral on the exterior of the bobbin.

44. A multiple unit winding machine including a plurality of winding units and winding unit tending mechanism, with relative movement between the winding units and the tending mechanism to bring the tending mechanism into cooperative relation to the winding units successively, the several winding units each including a center for rotating the bobbin during winding, a shaft for rotating the center and a motor connected to drive the said shaft, a thread guide, and means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, the tending mechanism including means for leading the thread extending to the wound bobbin back toward the base of the bobbin, the tending mechanism including a friction element, and the several winding units each including a wheel on said shaft and adapted to engage said friction element to rotate said center of the unit.

45. An automatic winding machine including means for holding a rotating bobbin, a reciprocable traverse rod, a thread guide movable by the traverse rod, means for progressively advancing the thread guide along the traverse rod toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, said advancing means including a bobbin-feeler mechanism movable with the thread guide and an abutment not partaking of such advance of the thread guide and adapted to be engaged by the feeler mechanism to advance the feeler mechanism and thread guide along the traverse rod, means for moving said abutment out of position to engage the feeler mechanism, and means operating after such movement of the abutment to move the thread guide and feeler mechanism from a position adjacent to the outermost conical layer of the bobbin toward the base of the bobbin.

46. An automatic winding machine including means for holding a rotating bobbin, a reciprocable traverse rod, a thread guide movable by the traverse rod, means for progressively advancing the thread guide along the traverse rod toward the tip of the bobbin, so as to distribute

the thread on the bobbin in nested conical layers, said advancing means including a bobbin-feeler mechanism movable with the thread guide, the bobbin-feeler mechanism including a pawl portion, and a ratchet bar not partaking of such advance of the thread guide and adapted to be engaged by the pawl portion of the feeler mechanism to advance the feeler mechanism and thread guide along the traverse rod, means for moving the ratchet bar out of position to engage said pawl portion, and means operating after such movement of the ratchet bar to move the thread guide and feeler mechanism from a position adjacent to the outermost conical layer on the bobbin toward the base of the bobbin.

47. An automatic winding machine including means for rotating a winding bobbin, a reciprocable traverse rod, a thread guide device having frictional engagement with the traverse rod, an abutment engageable with the thread guide device to limit the movement of the thread guide device toward the base of the bobbin and thereby advance the thread guide device along the traverse rod, means for moving said abutment out of position to engage the thread guide device, and means operating after such movement of the abutment to move the thread guide device toward the base of the bobbin.

48. An automatic winding machine comprising means for holding a rotatable winding bobbin, a thread guide, means for imparting to the thread guide a stroke of traverse of less length than the finished mass of wound thread on the bobbin, means for causing a progressive shifting of the stroke of traverse during winding the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a thread positioning member adapted to engage the run of thread extending from the thread guide to the mass of wound thread on the bobbin when the wound bobbin is held in winding position by said holding means, means acting after completion of said progressive shifting of the stroke of traverse to move the thread guide to a predetermined place to bring said run of thread into position to be engaged by said thread positioning member, and means for subsequently discharging the wound bobbin from said holding means.

49. An automatic winding machine comprising means for holding a rotatable winding bobbin, a thread guide, means for imparting to the thread guide a stroke of traverse of less length than the finished mass of wound thread on the bobbin, means for causing a progressive shifting of the stroke of traverse during winding the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a thread clamp adapted to engage the run of thread extending from the thread guide to the mass of wound thread on the bobbin when the wound bobbin is held in winding position by said holding means, means acting after completion of said progressive shifting of the stroke of traverse to move the thread guide to a predetermined place to bring said run of thread into position to be engaged by said thread clamp, means for causing said clamp to clamp the thread while the wound bobbin is held in winding position by said holding means, means for discharging the wound bobbin from said holding means, and means for moving said thread clamp to carry said run of thread into position to be associated with a fresh bobbin.

50. An automatic winding machine comprising means for holding a rotatable winding bobbin, a thread guide, means for imparting to the thread

guide a stroke of traverse of less length than the finished mass of wound thread on the bobbin, means for causing a progressive shifting of the stroke of traverse during winding the bobbin, so as to distribute the thread on the bobbin in nested conical layers, a combined clamp and cutter adapted to engage the run of thread extending from the thread guide to the mass of wound thread on the bobbin when the wound bobbin is held in winding position by said holding means, means acting after completion of said progressive shifting of the stroke of traverse to move the thread guide to a predetermined place to bring said run of thread into position to be engaged by said combined clamp and cutter, means for causing said combined clamp and cutter to clamp and cut the thread while the wound bobbin is held in winding position by said holding means, means for discharging the wound bobbin from said holding means, and means for moving said combined clamp and cutter to carry said run of thread into position to be associated with a fresh bobbin.

51. A multiple unit automatic winding machine comprising a plurality of winding units each including a thread guide and bobbin holding means, means for supplying fresh bobbins to the bobbin holding means of the several winding units in succession, a thread clamp acting on the threads of the several winding units in succession and movable to carry the thread into position to be associated with the fresh bobbin, and means acting on the thread guides of the several winding units in succession to carry the thread guide to a predetermined place for engagement of the thread by said thread clamp.

52. In an automatic winding machine the combination of a thread positioning member, comprising elements adapted to receive a thread therebetween and close upon each other to clamp and cut said thread, means for moving said thread positioning member through a path such as to carry said clamped and cut thread into position for association with a bobbin to be wound, and means whereby the initial portion of such movement of said thread positioning member closes said elements so as to clamp and cut the thread.

53. In an automatic winding machine the combination of a thread positioning member, comprising fixed blades and a movable blade adapted to cooperate therewith to clamp and cut a thread, means for moving said thread positioning member through a path such as to carry said clamped and cut thread into position for association with a bobbin to be wound, and means for closing said movable blade upon the other blades during the initial portion of such movement of the thread positioning member.

54. In an automatic winding machine the combination of a thread positioning member, comprising elements adapted to receive a thread therebetween and close upon each other to clamp and cut said thread, means for moving said thread positioning member through a path such as to carry said thread into position for association with a bobbin to be wound, and cam and cam-follower mechanism arranged to close said elements upon each other during the initial portion of such movement of the thread positioning member.

55. In an automatic winding machine the combination of a thread positioning member, comprising elements adapted to receive a thread therebetween and close upon each other to clamp

and cut said thread, means for moving said thread positioning member through a path such as to carry said thread into position for association with a bobbin to be wound, and a connection between one of said elements and a relatively stationary part of the machine adapted to move said element to its closed position during the initial portion of such movement of the thread positioning member.

56. In an automatic winding machine the combination of a thread positioning member, comprising elements adapted to receive a thread therebetween and close upon each other to clamp and cut said thread, means for moving said thread positioning member in a direction generally parallel to the axis of winding, and means swinging said thread positioning member through a path transverse to the axis of winding.

57. In an automatic winding machine the combination of a thread positioning member, comprising elements adapted to receive a thread therebetween and close upon each other to clamp and cut said thread, means for moving said thread positioning member in a direction generally parallel to the axis of winding, and means responsive to such movement of the thread positioning member for swinging said thread positioning member through a path transverse to the axis of winding.

58. In an automatic winding machine the combination of a thread positioning member, comprising elements adapted to receive a thread therebetween and close upon each other to clamp and cut said thread, means for moving said thread positioning member in a direction generally parallel to the axis of winding, and a cam and cam-follower mechanism effective during such movement for swinging said thread positioning member through a path transverse to the axis of winding.

59. A multiple unit winding machine including a plurality of thread winding units each adapted to carry a supply of thread to be wound and means for rotatably holding a bobbin in winding position to receive thread from said supply, winding unit tending mechanism associated with the several winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, the machine including means for holding the threads of the winding units clamped during the removal of the wound bobbin from the bobbin-holding means and during the placing of a fresh bobbin in said bobbin-holding means.

60. A multiple unit winding machine including a plurality of thread winding units each adapted to carry a supply of thread to be wound and means for rotatably holding a bobbin in winding position to receive thread from said supply, winding unit tending mechanism associated with the several winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, the machine including a clamp adapted to engage the thread of the winding unit being tended by said tending mechanism, and means actuating the clamp to hold said thread clamped during the removal of the wound bobbin from the bobbin-holding means and during the placing of a fresh bobbin in said bobbin-holding means.

61. A multiple unit winding machine including a plurality of thread winding units each adapted to carry a supply of thread to be wound and means for rotatably holding a bobbin in winding position to receive thread from said supply, winding unit tending mechanism associated with

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the several winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, the machine including a combined clamp and cutter adapted to engage the thread of the winding unit being tended by said tending mechanism, and means actuating the clamp and cutter to sever the thread, and to hold the end of thread attached to the supply clamped during the removal of the wound bobbin from the bobbin-holding means and during the placing of a fresh bobbin in said bobbin-holding means.

62. A multiple unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide, and means for progressively advancing the zone of traverse of the thread guide along the bobbin away from the base and toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, winding unit tending mechanism associated with the winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, and the machine including means for shifting the thread guides of the several units from adjacent to the conical nose of the body of thread on the bobbin to the region of the base of the bobbin while said bobbin is held by said holding means preparatory to replacement of said bobbin by said tending mechanism.

63. A multiple unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide, and means for progressively advancing the zone of traverse of the thread guide along the bobbin away from the base and toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, said zone-advancing means including a feeler adapted to cooperate with the progressively advancing conical nose of the body of thread on the bobbin, winding unit tending mechanism associated with the winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, and the machine including means for shifting the feelers and thread guides of the several units from adjacent to the conical nose of the body of thread on the bobbin to the region of the base of the bobbin while said bobbin is held by said holding means preparatory to replacement of said bobbin by said tending mechanism.

64. A multiple unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide, and means for progressively advancing the zone of traverse of the thread guide along the bobbin away from the base and toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers,

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said zone-advancing means including a feeler adapted to cooperate with the progressively advancing conical nose of the body of thread on the bobbin, winding unit tending mechanism associated with the winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, and the machine including means for shifting the feelers and thread guides of the several units from adjacent to the conical nose of the body of thread on the bobbin to the region of the base of the bobbin while said bobbin is held by said holding means preparatory to replacement of said bobbin by said tending mechanism, the said feeler of each unit being adapted to move outwardly away from the axis of the bobbin to at least the largest diameter portion of the body of thread wound on the bobbin.

65. A multiple unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide, and means for progressively advancing the zone of traverse of the thread guide along the bobbin away from the base and toward the tip of the bobbin, so as to distribute the thread on the bobbin in nested conical layers, said zone-advancing means including a feeler adapted to cooperate with the progressively advancing conical nose of the body of thread on the bobbin, and including means normally restraining said feeler against movement from the zone of the last conical layer of wound yarn toward the base of the bobbin, winding unit tending mechanism associated with the winding units successively and adapted to replace a wound bobbin of a winding unit with a fresh bobbin, and the machine including means for disabling said means which restrain the feelers of the several winding units, and means for shifting the thread guides of the several units from adjacent to the conical nose of the body of thread on the bobbin to the region of the base of the bobbin while said bobbin is held by said holding means preparatory to replacement of said bobbin by said tending mechanism.

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