Aug. 26, 1947. E. J. ABBOTT ET AL. 2,426,168

WINDING MACHINE

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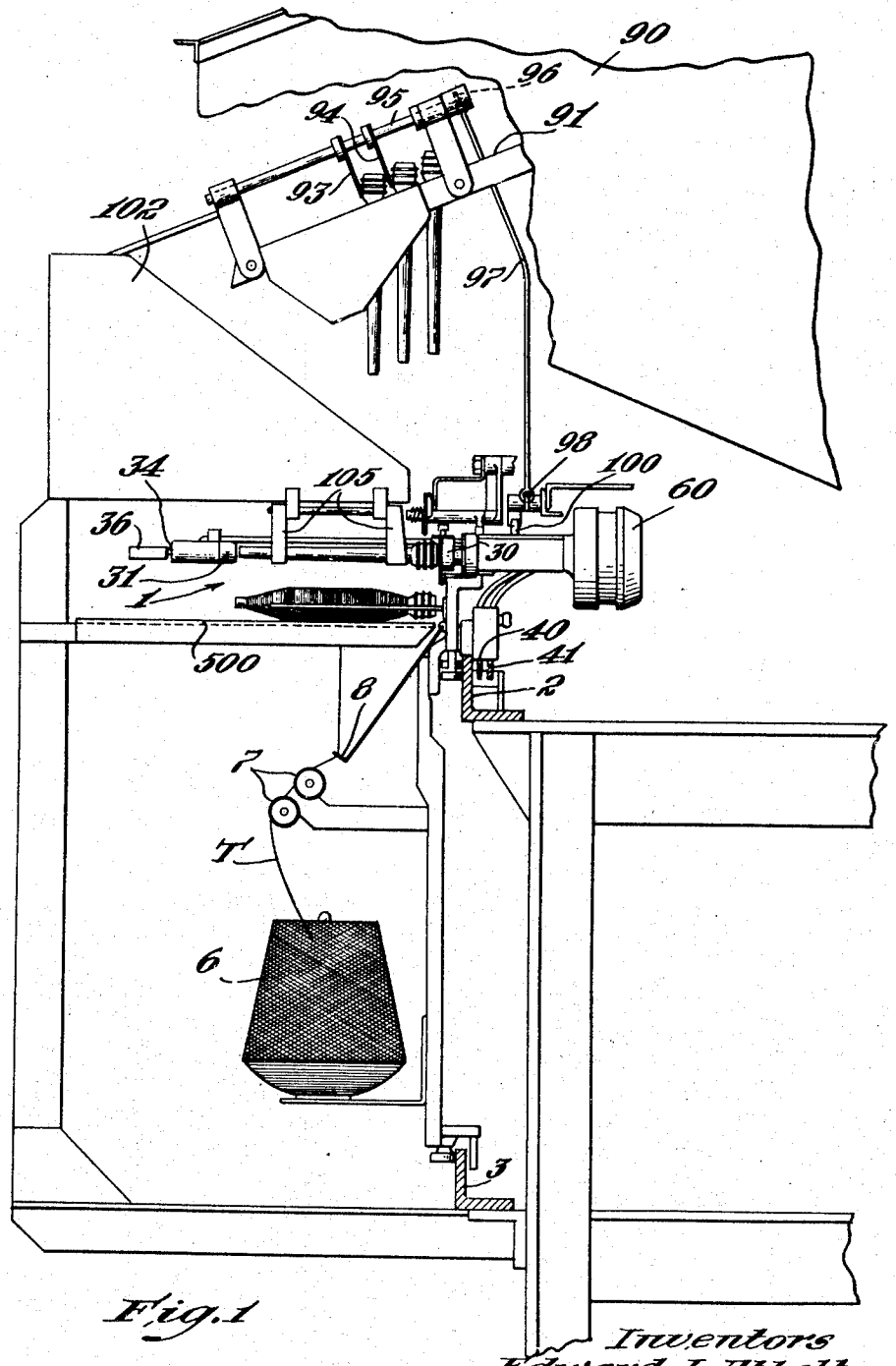


Fig. 1

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Aug. 26, 1947. E. J. ABBOTT ET AL 2,426,168

WINDING MACHINE

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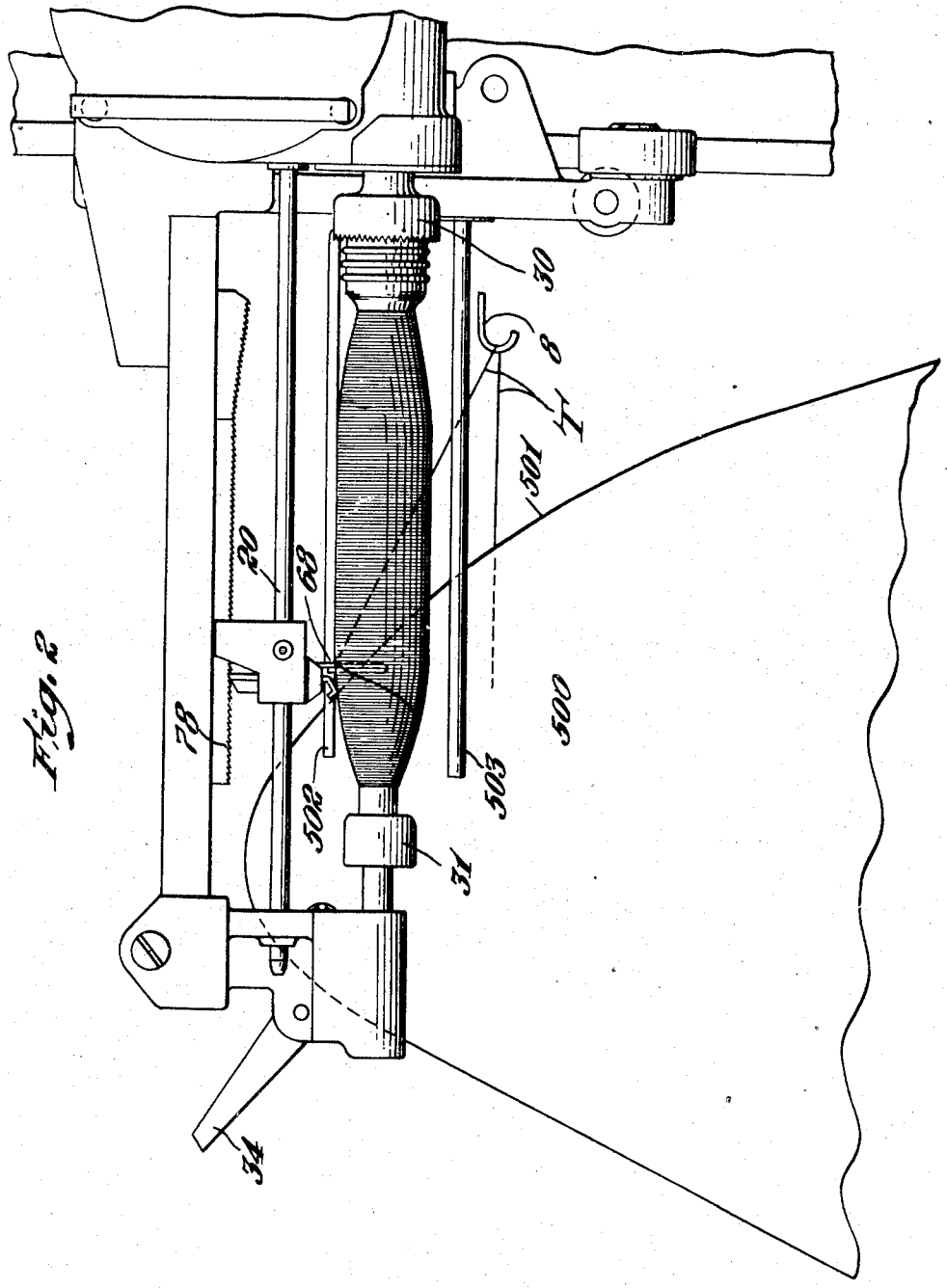


Fig. 2

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Aug. 26, 1947. E. J. ABBOTT ET AL 2,426,168

WINDING MACHINE

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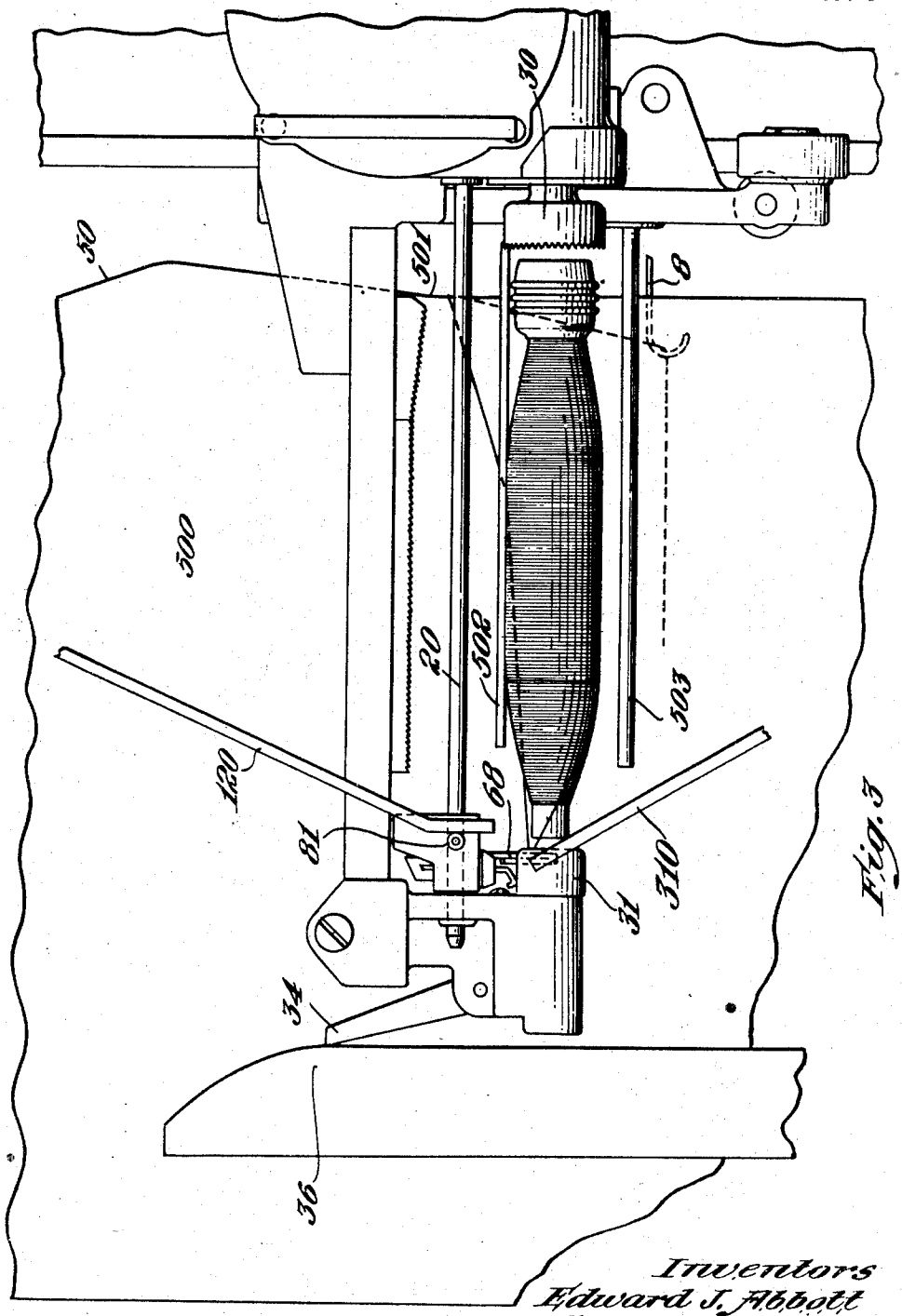


Fig. 3

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WINDING MACHINE

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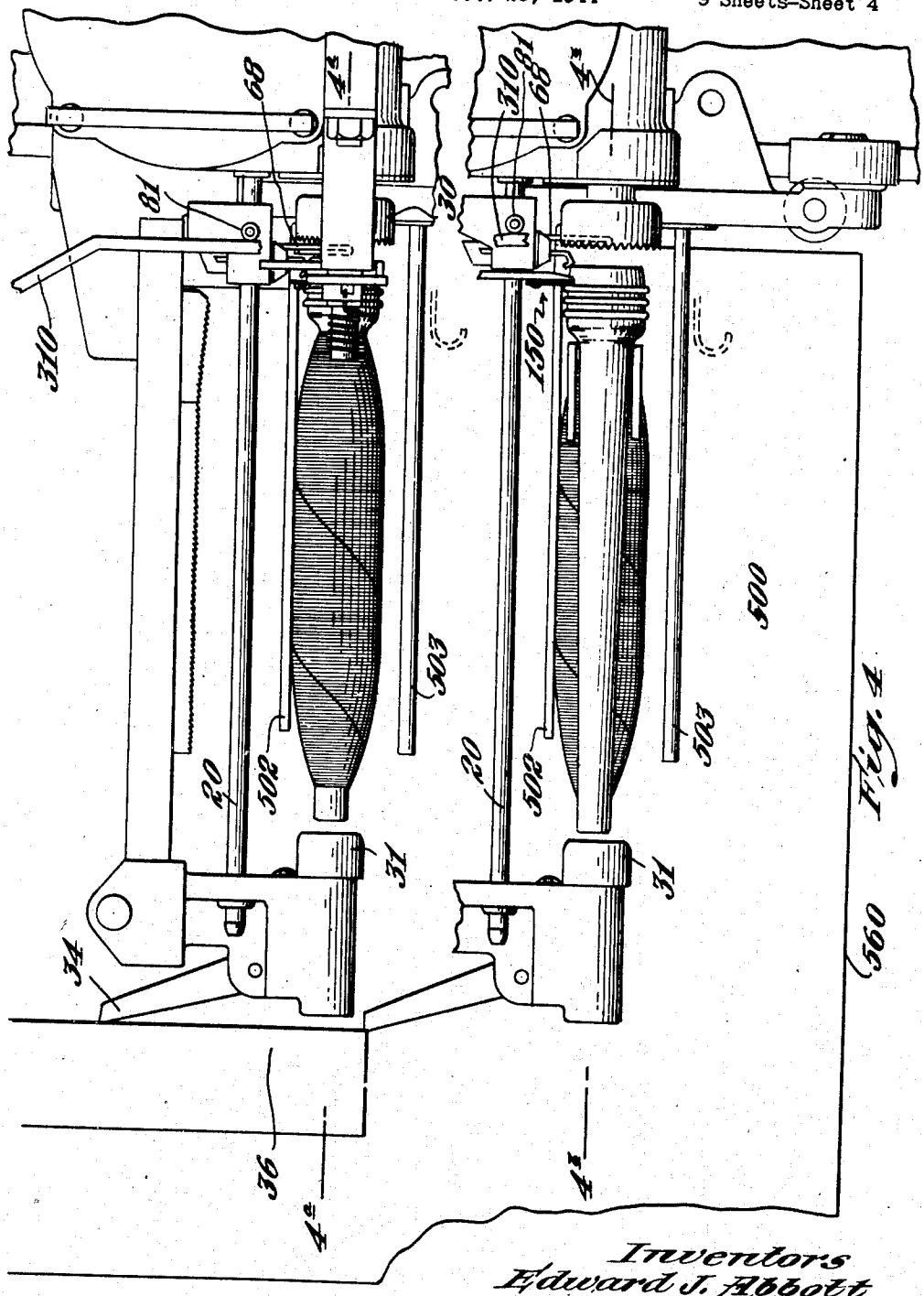


Fig. 4.

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Aug. 26, 1947. E. J. ABBOTT ET AL 2,426,168

WINDING MACHINE

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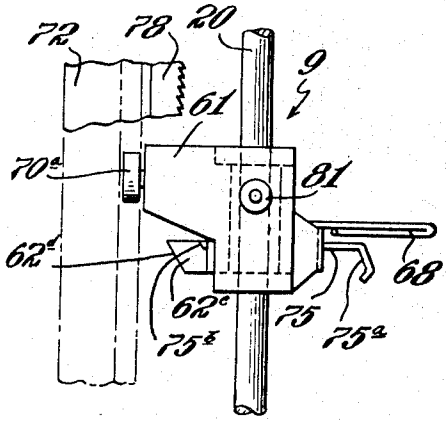


Fig. 7

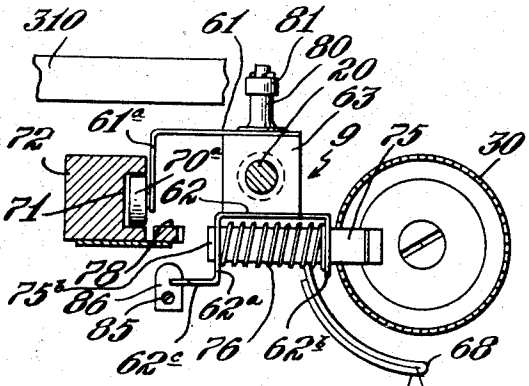
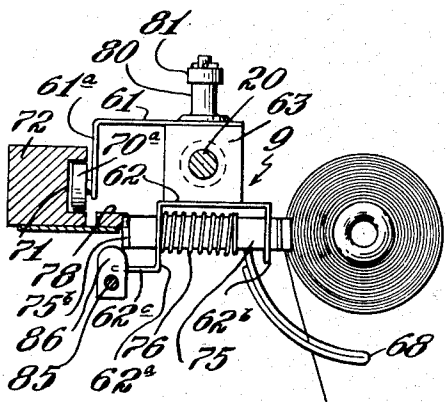
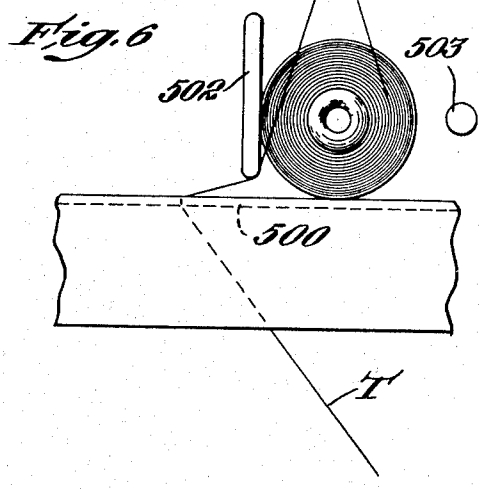


Fig. 6





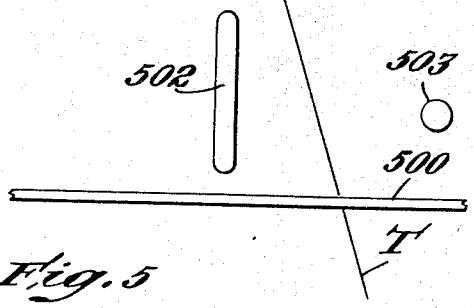


Fig. 5

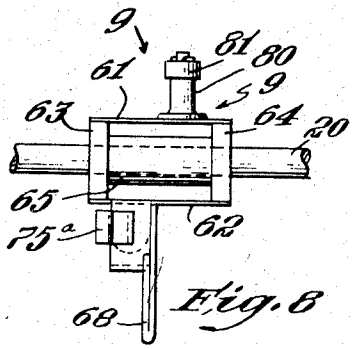


Fig. 8

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WINDING MACHINE

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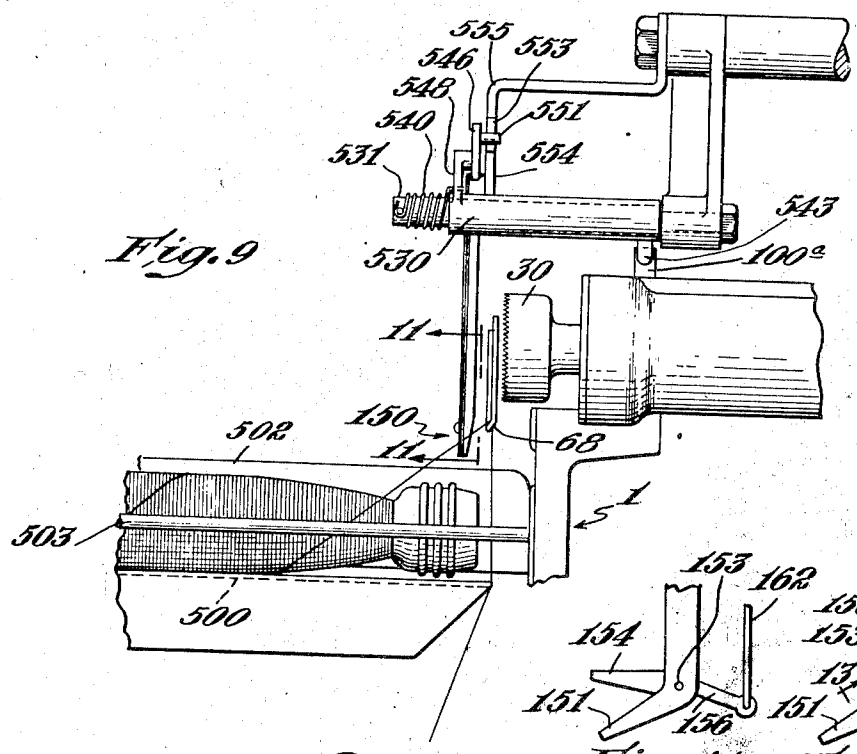


Fig. 9

Fig. 11 Fig. 12

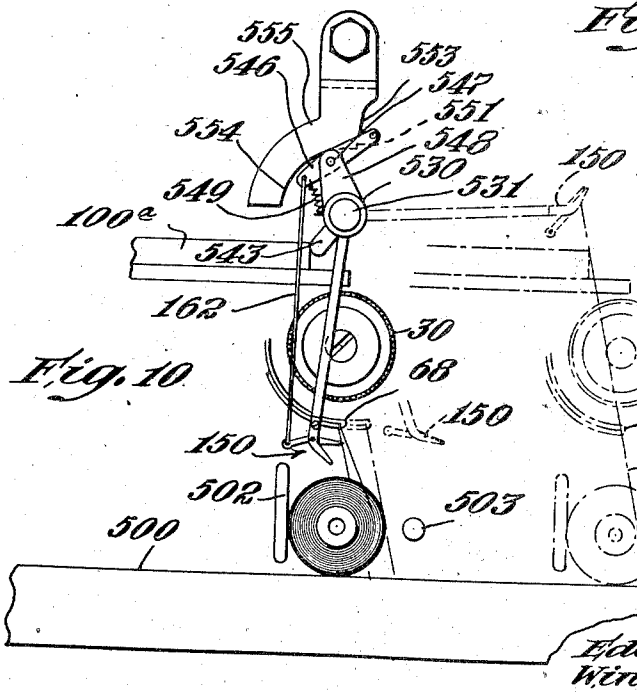


Fig. 10



Fig. 13

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WINDING MACHINE

Filed Oct. 28, 1944 9 Sheets-Sheet 7

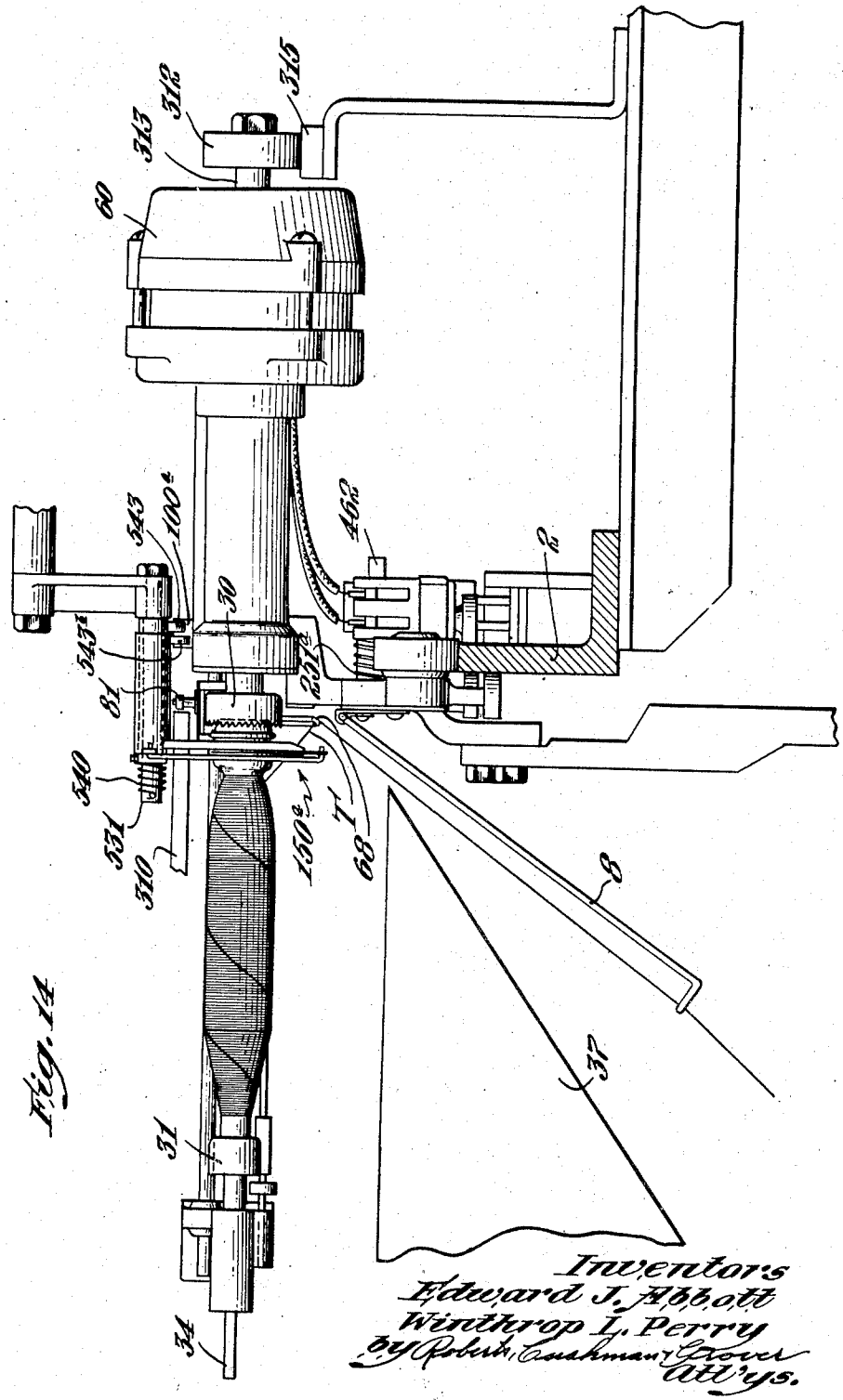


Fig. 14

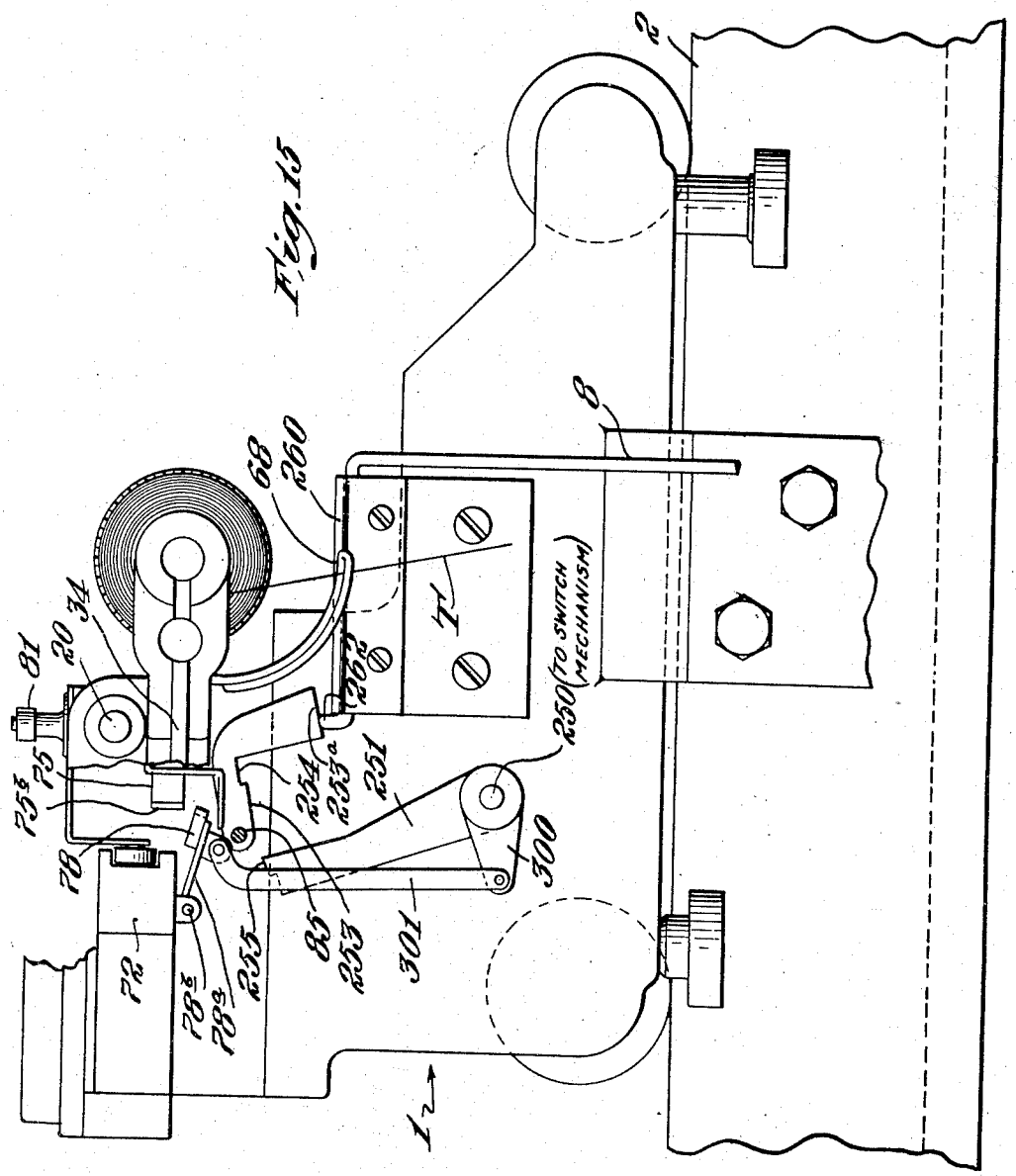
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WINDING MACHINE

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Fig. 15



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WINDING MACHINE

Filed Oct. 28, 1944 9 Sheets-Sheet 9

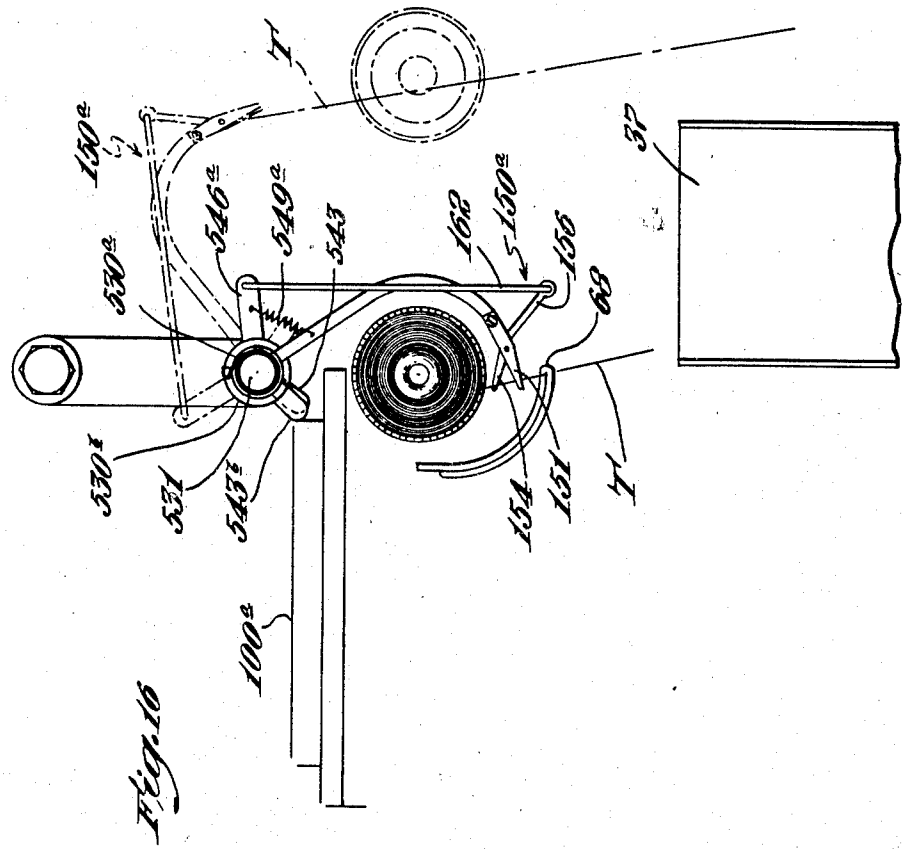


Fig. 16

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Patented Aug. 26, 1947

2,426,168

UNITED STATES PATENT OFFICE

2,426,168

WINDING MACHINE

Edward J. Abbott and Winthrop L. Perry, Wilton, N. H., assignors to Abbott Machine Company, Wilton, N. H., a corporation of New Hampshire

Application October 28, 1944, Serial No. 560,737

41 Claims. (Cl. 242—32)

1

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 provide a more direct path for a thread which passes upwardly from a supply package to the winding bobbin, to improve the thread guide mechanism and cause it to run more easily, to provide for a more positive control of the thread during the association of the thread with the fresh bobbin, and to secure these advantageous features in mechanism which will operate automatically to wind the bobbin, produce an open spiral of thread on the exterior of the bobbin extending from the last conical layer back toward the base of the bobbin, substitute a fresh bobbin for the previously wound bobbin and begin winding the thread on the fresh bobbin.

A preferred form of the invention herein illustrated involves a winding unit tending mechanism to tend a plurality of winding units in succession, but 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 only on 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 one of the winding units of the machine and showing mechanism for supplying fresh bobbins to the winding units in succession and mechanism for associating the thread with a fresh bobbin;

Fig. 2 is a diagrammatic plan view of a portion of the winding machine, showing a traveling winding unit at a position at which the last conical layer of thread on its bobbin has been wound, the winding stopped, and the thread extending upwardly to the thread guide about to encounter an inclined edge of a thread plow plate adapted to move this portion of the thread toward the center for holding the base end of a bobbin;

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Fig. 3 is a diagrammatic plan view of a portion of the machine next following that of Fig. 2, showing a winding unit in a position in which its thread guide has been shifted outwardly beyond the tip end of the bobbin, the bobbin has been discharged from between the bobbin-holding centers of the unit and rests on the surface of the thread plow plate, and the thread which extends upwardly to the thread guide has been plowed over nearly to the outer face of the center for holding the base end of a bobbin;

Fig. 4 is a diagrammatic plan view of a portion of the machine a little farther along the machine than Fig. 3, showing two positions of a winding unit, at which the axis of the centers of the winding unit has reached respectively the lines 4^a—4^a and 4^b—4^b. At the position 4^a—4^a the thread guide of the winding unit has already been shifted to a position adjacent to the center for holding the base end of the bobbin and lies between this center and mechanism for cutting and clamping the thread. In the position 4^b—4^b the thread guide has been shifted still farther to a position beyond the plane of the outer face of the center, and the cutting and clamping mechanism has picked up the thread extending from the thread guide to the bobbin and has raised this thread upwardly to a position above the center. At the position 4^b—4^b the centers of the winding unit are about to receive a fresh bobbin between them, and force the portion of thread that has been raised by the cutting and clamping mechanism against the center for holding the base end of the bobbin;

Fig. 5 is a diagrammatic view in the nature of a vertical section showing portions of the winding machine and of a winding unit in the position of Fig. 2;

Fig. 6 is a diagrammatic view in the nature of a vertical section showing portions of the winding machine and of a winding unit in the position of Fig. 3;

Fig. 7 is a fragmentary plan view of the thread guide assembly and certain of its associated parts in the position of Figs. 3 and 6;

Fig. 8 is a fragmentary right side elevation of the thread guide assembly of Fig. 7;

Fig. 9 is a diagrammatic elevation taken from the right side of Fig. 4 showing portions of the winding unit and the clamping and cutting mechanism in the position 4^a—4^a of Fig. 4;

Fig. 10 is a diagrammatic view in the nature of a vertical section similar to Fig. 6, showing

portions of the winding unit and the clamping and cutting mechanism in full lines in their position 4a—4a of Fig. 4, and in broken lines in their position 4b—4b of Fig. 4;

Fig. 11 is a fragmentary view of the thread clamping and cutting bill, this view being taken on the line 11—11 of Fig. 9 and showing the bill open;

Fig. 12 is a view similar to Fig. 11 showing the bill closed;

Fig. 13 is a fragmentary sectional view taken on the line 13—13 of Fig. 12 and showing also the clamped end of thread and the cut-off end of thread;

Fig. 14 is a fragmentary right side elevation of a winding unit and parts of the winding-unit tending mechanism of a modified form of the invention, showing a portion of the track of the machine in cross-section and the bobbin-supplying mechanism being omitted for clarity of illustration;

Fig. 15 is a diagrammatic view in the nature of a front elevation of the winding unit of Fig. 14 at a position at which it has a stopped winding, and before reaching the winding-unit tending mechanism; and

Fig. 16 is a diagrammatic view in the nature of a vertical section of the winding unit and winding-unit tending mechanism of Fig. 14, showing portions of the winding unit, the thread and the cutting and clamping mechanism in full lines at the position where the thread is about to be engaged by the cutting and clamping mechanism, and in broken lines at the position corresponding to the position of 4b—4b of Fig. 4 wherein the centers of the winding unit are about to receive a fresh bobbin between them and force the portion of thread that has been raised by the cutting and clamping mechanism against the center for holding the base end of the bobbin.

As illustrated in the drawings, the invention is shown as embodied in traveling multiple unit filling bobbin winding machines 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. In addition, the machines illustrated in the drawings include some of the features described and claimed in another application of Edward J. Abbott and Winthrop L. Perry, for Winding machine, Serial No. 560,736, filed on the same date as this application, and for convenience numerous of the corresponding parts of the machines of this and said other application are designated by the same or similar reference characters.

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 (not shown herein, but which may be the chain 4 shown in Fig. 9 of the other application of Edward J. Abbott and Winthrop L. Perry for Winding machine, filed on the same date as this application, Serial No. 560,736), through a closed path having straight and semicircular portions in the general manner described in the above reissue patent and applications.

In each winding unit the thread T from a supply package 6 carried near the bottom of the unit passes up through a suitable tension device 7, under the pivoted wire bail 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 8, inclusive.

In the above reissue patent and applications, the thread after passing upwardly to the thread guide, passes over a portion of the thread guide and thence downwardly onto the winding bobbin. In the preferred forms of machines shown in this application the thread guide is so disposed with reference to the thread running from the supply package to the bobbin that, as viewed in a plane transverse to the axis of winding (such as in Fig. 5), the thread can pass approximately in a straight line to and through the thread guide and thence to the bobbin. The thread guide thus controls only the axial or back and forth movement of the thread running to the bobbin. This is advantageous in lessening the frictional effect of the thread guide on the thread, in reducing the pull of the thread on the thread guide assembly, and in causing the thread guide assembly to run more easily, especially at high speeds. Preferably the thread guide is disposed below the bobbin, the thread supply also being below the bobbin, so that the thread runs upwardly to the thread guide, upwardly through the thread guide and thence further upwardly to the 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 (Figs. 3 and 4) is located at the place where bobbins are changed, to hold the lever 34 inwardly and thus hold the outer center 31 retracted to release the full bobbin 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 8, 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. 2) up through a thread guide eye 68 shown as formed of a bent wire extending beneath the bobbin from the lower plate 62 of the thread guide assembly. From the thread guide eye 68 the thread runs further upwardly onto the winding bobbin.

The thread passes through a slot or passage defined by the two parallel portions of the bent wire which constitutes the thread guide 68, and this slot is preferably of sufficient length so that in running from the thread detector 8 to either the large diameter portion or the small diameter portion of the winding there is, as viewed in the plane of Fig. 5, an approximately straight path for the thread to and through the thread guide and thence to the bobbin. The thread, of course, is necessarily deflected by the thread guide as viewed in planes such as there is of Figs. 1 and 3, due to the winding of different axial portions of the winding package as the thread guide reciprocates.

The upper plate 61 of the thread guide assembly is provided with a downturned portion 61^a (Fig. 5) carrying a roller 70^a extending loosely into a recess 71 in a horizontal bar 72 which constitutes a part of the frame of the winding unit.

The lower plate 62 of the thread guide assembly is provided with downturned portions 62^a, 62^b which are slotted to receive a slidable feeler member 75. The feeler member is bent at its right end (Fig. 7) 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. 7, 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, which may if desired be constructed as described more fully in said other application of Edward J. Abbott and Winthrop L. Perry, Serial No. 560,736, filed on the same date as this application and may include the features described in connection with Fig. 15 of this application, includes a rotatable rod 85 carrying an upstanding finger 86, normally in the position shown in Fig. 5. 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 on 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 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.

A short distance below the level at which the thread guide eye 68 operates, a stationary horizontal plate 500 extends inwardly under the path of the bobbins of the winding units at the winding unit tending mechanism. Fig. 2 shows the end of the plate 500 which is first encountered by the traveling winding units and shows the inner cam-shaped edge 501 of this plate about to engage the portion of thread extending from the detector wire 8 to the thread guide eye 68. This inner edge 501 is shaped to force the thread over in the direction of the base center 30 while at the same time causing the portion of thread riding along edge 501 to lag somewhat behind its former position in the winding unit (Fig. 3).

While the thread is thus being forced inwardly by edge 501, a stationary cam 120 (Fig. 3) 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 beyond the wound bobbin at the position shown in Fig. 3. It will be understood that the thread guide assembly will normally have tripped its stop mechanism 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 eye will accordingly stop in the zone of such last conical layer. Wherever stopped, the thread guide eye is moved axially of the bobbin to the tip end thereof and preferably somewhat beyond the tip end thereof (as shown in Fig. 3) by the action of the stationary cam **120** upon the roller **81**.

As a result of the combined action on the cam edge **501** and the outward motion of the thread guide eye described above, both the thread and thread guide eye are removed from interfering with downward movement of the wound bobbin, and when as in Fig. 3 the outer center **31** is retracted, the wound bobbin is free to drop onto the plate **500**.

The wound bobbin on the plate **500** is loosely confined between an arm **502** and rod **503** that extend out from the head of the winding unit, and is thus caused to roll along the plate with the winding unit. The thread from the thread guide is therefore wound slowly on the rolling bobbin.

With the bobbin displaced from its winding position, the thread guide assembly is now capable of being pushed rearwardly without its feeler **75** being forced into locked engagement with the ratchet bar **78**.

As the bobbin thus rolls along the plate, the roller **81** on the thread guide assembly encounters a stationary cam **310** (Figs. 3 and 4) and the thread guide assembly is thereby slid inwardly from the position of Fig. 3 to that of the line 4^b—4^b of Fig. 4 wherein it lies adjacent to the base center **30** of the winding unit. This inward movement of the thread guide assembly and slow rotation of the bobbin wind the thread onto the outer surface of the bobbin in the form of an open spiral. The thread extending from the thread guide eye **68** to the wound bobbin is also brought into position to be received by the thread clamping and positioning mechanism now to be described.

While various forms of mechanism for positioning the thread for association with the new bobbin might be employed, it is preferred to employ mechanism employing certain of the features of such mechanism described and claimed in the said other application of Edward J. Abbott and Winthrop L. Perry, Serial No. 560,736, filed on the same date as this application. More especially the thread positioning mechanism shown in Figs. 9 to 13 includes a combined clamp and cutter in the nature of a bill **150** adapted to cut and clamp the thread and move the clamped thread to the opposite side of the bobbin-holding center from the thread guide eye **68**.

The bill **150** is mounted on a sleeve **530** (Figs. 9 and 10) which turns on a stationary shaft **531**, so as to move from the position of Fig. 9 and full line position of Fig. 10 to the upper broken line position of Fig. 10.

As shown in more detail in Figs. 11 to 13, the bill has at its outer end a fixed blade **151** having 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 position of Fig. 9 and rolling of the bobbin along the plate **500** 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.

The bill **150** is urged toward its bottom position shown in full lines in Fig. 10 by a spiral spring **540** (Fig. 9) which is connected to the rotatable sleeve **530** and to the stationary shaft **531**. The sleeve **530** is provided with a crank arm **543** adapted to engage and be turned by each one of bars 100^a that project upwardly from the respective traveling winding units, thus to raise the bill to the upper broken line position of Fig. 10 each time a winding unit reaches the bill.

The extension **156** of the pivoted blade **154** of the bill is connected to a lever **546** which is pivoted at **547** to an arm **548** on the sleeve **530**. A coil spring **549** between the lever **546** and sleeve **530** acts on these parts to urge the pivoted blade of the bill to its open position shown in full lines in Fig. 10.

Shortly after starting its upward swing, the bill receives between its blades the portion of the thread extending from the thread guide eye **68** to the wound bobbin. Then the bill is closed by the time it reaches the lower broken line position of Fig. 10, cutting off the end of thread leading to the wound bobbin and holding clamped the end of thread extending to the thread guide, the bill remaining closed during the remainder of its upward swing.

For controlling the closing of the blade, the lever **547** is provided with a rearwardly extending pin **551** adapted to be acted on by a cam surface **553** and a subsequent holding surface **554** on a stationary bracket **555**.

When the winding unit center **30** and thread guide eye **68** reach their broken line-positions of Fig. 10, the thread between the thread guide eye **68** and bill **150** is thus held across the center **30** as shown in Fig. 10. At this stage the winding unit has reached the fresh bobbin which is held in the position 4^b—4^b of Fig. 4 by the magazine. The outer center **31** then closes upon this fresh bobbin, forcing its base end and the thread to enter the center **30** so that the thread is thus clamped between the bobbin and the center. The thread is thereby effectively secured to the fresh bobbin, for winding thereon, the thread end pulls out from between the blades of the bill, and winding on the unit is started by the automatic starting mechanism.

The full bobbin, cut off by the bill, rolls along with the unit until it reaches the edge **560** of the plate **500**, whereupon it drops onto any suitable slide or other receptacle.

As will be evident, the bill returns to its lower broken line position of Fig. 10 and opens to receive the thread of the next winding unit.

The modified form of mechanism shown in Figs. 14 to 16 includes many parts which are the same as or similar to those shown in the preceding figures, and such parts are designated by the same or similar reference characters in the two forms of the invention and their descriptions will not be repeated.

One feature of the mechanism of Figs. 14 to 16 is movement of the thread guide, which is below the winding bobbin, rearwardly sufficiently to prevent it from interfering with the subsequent fall of the finished bobbin. Another feature is the winding of the open spiral of thread on the exterior of the wound bobbin, through the cooperation of the thread guide located below the bobbin, while the bobbin is still held in winding position.

In the machine of Figs. 14 to 16, the arm **502** and rod **503** on the winding unit and the stationary plate **500**, employed in the mechanism of Figs. 1 to 13 to roll the wound bobbin during rearward movement of the thread guide, may be omitted.

In connection with the machine of Figs. 14 to 16, the winding-stopping and starting mechanism, previously briefly mentioned in connection with the machine of Figs. 1 to 13, will be described in more detail. Stopping and starting of the winding on each unit is accomplished by 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. 15) and being urged in a counterclockwise direction in Fig. 15 by a coil spring **251a** (Fig. 14). 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. 15. A boss **462** on the switch mechanism of the unit (Fig. 14) 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. 16. Rod **85** (referred to previously in connection with Fig. 5) 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. 15, 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. 15 in either of two ways.

The thread guide assembly may reach the projection **86** on rod **85** and the cam surface **62d** (Fig 7) tilt the projection **86**, thereby turning the rod **85** counterclockwise 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 **253a** of latch **253**. Thread detector **8** is normally held up 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. 14 to 16, 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. 5, 6 and 7, is mounted as shown in Fig. 15 on a plate **78a** hinged at **78b** 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 **75b** of the feeler member of the thread guide assembly, as shown in Fig. 15. When winding begins, the ratchet bar **78** resumes its active position, similar to that shown in Fig. 5.

A stationary cam **310**, similar to the one described in connection with Figs. 3 and 4, engages the upstanding roller **81** of the thread guide assembly and plows the thread guide assembly from its outermost position over to its rearmost position where the thread guide eye **68** lies beneath the inner bobbin-holding center at or even somewhat beyond the base end of the bobbin so as to clear a path for the bobbin to be dropped downwardly, in front of the thread guide eye, out from between the centers.

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 in the direction 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 shown in Fig. 14. 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 Fig. 14, 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 **150a**. Bill **150a** is similar to bill **150** of Figs. 1 to 13 but faces to the left, as shown in Fig. 16, instead of to the right as the bill **150** of Fig. 10, and is curved as shown

in Fig. 16 so as to clear a fully wound bobbin that is held between the centers of the winding unit. Moreover, the blades of the bill are located so that in the thread-receiving position shown in full lines in Fig. 16, the blades are above the lower portion of the thread guide eye 63 so as to receive the thread extending therefrom to the bobbin.

Bill 150a is mounted to turn with an inner sleeve 530a which turns on a stationary shaft 531, the inner sleeve and bill being yieldingly urged to the full line position of Fig. 16 by the spiral spring 540 (Fig. 14). Inner sleeve 530a is provided with a crank arm 543 adapted to engage and be turned by the bars 100a on the respective winding units, in the manner of the mechanism of Figs. 1 to 13.

An outer sleeve 530b rotatable on the inner sleeve 530a carries a crank arm 546a fast thereon and connected by a link 162 to the extension 156 of the pivoted blade 154. These parts are yieldingly urged to the open-bill position of Fig. 16 by a coil spring 549a. In this position, a further crank arm 543b fast on the outer sleeve 530b is located somewhat more to the left (Fig. 16) than the crank arm 543, and likewise in position to engage and be turned by the bars 100a of the winding units. Thus, when the bar 100a of a winding unit first encounters the bill-operating mechanism, the crank arm 543b, outer sleeve 530b, arm 546a, link 162 and blade extension 156 are first moved to close the pivoted blade 154, cutting and clamping the thread. The spring 549a between arm 546a and the bill offers less resistance than the coil spring between the bill-carrying inner sleeve 530a and the fixed shaft 531, so as to permit this closure of the bill before rotation of the bill about the fixed shaft. Thereupon, with the bill closed, the bar 100a engages and turns the crank arm 543, inner sleeve 530a and bill, to bring the bill to the broken line position of Fig. 16. In this position the thread is in position to line across the center 30 of the winding unit in its broken line position of Fig. 16. It will be noticed that the first part of the movement of the bill from its full line position of Fig. 16 removes the bill from beneath the full bobbin, thus avoiding interference between the bill and the bobbin as the bobbin is then dropped out from between its centers 30 and 31.

A stationary abutment 36, similar to the one previously described in connection with Figs. 1 to 13, but shorter in length, is located to press the lever 34 of the unit inwardly to retract the outer center 31 as the bobbin passes over a stationary inclined chute 37, thus dropping the bobbin into this chute. The stationary abutment 36 terminates at a point such that the outer center 31 closes upon a fresh bobbin in the magazine at the broken line position of the center 30 in Fig. 16, forcing the base end of the bobbin and the thread into the center and thus securing the thread to the fresh bobbin for winding thereon. The thread end then pulls out from between the blades of the bill, and the bill returns to its full line position of Fig. 16.

The mechanism of this invention can be simplified by eliminating the feeler 75 and the cooperating ratchet bar 78 and causing the progression of the zone of traverse of the thread guide toward the tip of the bobbin by a cam-like abutment extending around the machine as disclosed in the application Serial No. 488,872 of Edward J. Abbott and Winthrop L. Perry, filed May 28, 1943. Such abutment may for example take the form of the pair of flanges indicated at 600 and 601 in said application Serial No. 488,872, now Patent No. 2,362,455, the roller 81 of the thread guide assembly herein shown moving back and forth between these flanges, 600 and 601, which are spaced apart a distance such that travel of the roller 81 of the thread guide assembly from one such flange to the other will produce the desired length of stroke of the thread guide assembly.

In particular such simplification and use of the aforesaid abutment is advantageous in conjunction with the mechanism of 14, 15, and 16 of this application in providing a simple construction permitting the winding of the open spiral of thread on the exterior of the bobbin while the bobbin is still retained by the bobbin holding centers of the winding unit.

We claim:

1. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide having during winding a path of movement located on the same side of the bobbin from which the thread runs in approaching the thread guide, means for discharging the bobbin from said holding means, means for supplying a fresh bobbin to said holding means, a clamp engageable with a portion of the thread extending from the thread guide to the wound bobbin, and means for moving the clamp and clamped thread from the side of said holding means at which the thread guide has its said path of movement to another generally opposite side of said holding means.

2. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide having during winding a path of movement located on the same side of the bobbin from which the thread runs in approaching the thread guide, means for discharging the bobbin from said holding means, means for supplying a fresh bobbin to said holding means, a combined clamp and cutter engageable with a portion of the thread extending from the thread guide to the wound bobbin, and means for moving the combined clamp and cutter and clamped thread from the side of said holding means at which the thread guide has its said path of movement to another generally opposite side of said holding means.

3. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide located below the winding bobbin to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, means for discharging the wound bobbin from said holding means, means for supplying a fresh bobbin to said holding means, and means for moving from below said holding means upwardly to said holding means a portion of thread that has passed the thread guide, for engagement of said thread with the fresh bobbin.

4. An automatic winding machine comprising means including a center for rotatably holding a winding bobbin, a thread guide located below the winding bobbin to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, means for discharging the wound bobbin from said center, means for supplying a fresh bobbin to said center, and means for moving from below said center upwardly to said center a portion of thread that has passed the thread guide, for engagement

of the thread between said center and said fresh bobbin.

5. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide located to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, means for discharging the wound bobbin from said holding means, means for supplying a fresh bobbin to said holding means, and a clamp engageable with a portion of the thread extending from the thread guide to the wound bobbin, and means for moving the clamp and clamped thread from below said holding means to above said holding means.

6. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide located to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, means for discharging the wound bobbin from said holding means, means for supplying a fresh bobbin to said holding means, and a combined clamp and cutter engageable with a portion of the thread extending from the thread guide to the wound bobbin, and means for moving the combined clamp and cutter and clamped thread from below said holding means to above said holding means.

7. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide located below the winding bobbin to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, 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, means for supplying a fresh bobbin to said holding means, and means for moving from below said holding means upwardly to said holding means a portion of thread that has passed the thread guide, for engagement of said thread with the fresh bobbin.

8. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for holding the base end of the bobbin, a thread guide located to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, 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 for shifting the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the winding of the last said conical layer of thread, means acting while the thread guide is beyond said end of the bobbin for discharging said bobbin from said center downwardly, means for supplying a fresh bobbin to said center, and means for holding the thread for engagement between said fresh bobbin and said center including means for positioning above and adjacent to said center a portion of thread that has passed the thread guide and means for shifting said thread guide to a position adjacent to said center.

9. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for holding the base end of the bobbin, a thread guide located to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, 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 for discharging the bobbin from said center after the winding of the last conical layer, means for supplying a fresh bobbin to said center, and means for holding the thread for engagement between said fresh bobbin and said center including a clamp engageable with a portion of the thread extending from the thread guide to the wound bobbin and means for moving the clamp and clamped thread from below said center to above said center.

10. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for automatically moving the thread-guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the completion of winding of a body of thread on the bobbin, and means for discharging said bobbin from said holding means downwardly through said path of movement of the thread guide.

11. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for automatically moving the thread-guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the completion of winding of a body of thread on the bobbin, and means for discharging said bobbin from said holding means downwardly through said path of movement of the thread guide, the machine including means engageable with a portion of the thread extending from the thread guide to the bobbin for carrying the thread into position for association with a fresh bobbin.

12. An automatic winding machine comprising means including a center for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for automatically moving the thread-guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the completion of winding of a body of thread on the bobbin, and means for discharging said bobbin from said holding means downwardly through said path of movement of the thread guide, the machine including a clamp engageable with a portion of the thread extending from the thread guide to the bobbin and means for moving the clamp and clamped thread from below said center to above said center.

13. An automatic winding machine comprising means including a center for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for automatically moving the thread-guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the completion of winding of a body of thread on the bobbin, and means for discharging said bobbin from said holding means downwardly through said path of movement of the thread guide, the machine including a combined clamp and cutter engageable with a portion of the thread extending from the thread guide to the bobbin and means for moving the clamp and

cutter and clamped thread from below said center to above said center.

14. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, 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, means for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the winding of the last sad conical layer of thread, and means for discharging said bobbin from said center downwardly through said path of movement of the thread guide.

15. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, 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, means for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the winding of the last said conical layer of thread, and means for discharging said bobbin from said center downwardly through said path of movement of the thread guide, the machine including means engageable with a portion of the thread extending from the thread guide to the bobbin for carrying the thread into position for association with a fresh bobbin.

16. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, 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, means for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the winding of the last said conical layer of thread, and means for discharging said bobbin from said center downwardly through said path of movement of the thread guide, the machine including a clamp engageable with a portion of the thread extending from the thread guide to the bobbin and means for moving the clamp and clamped thread from below said center to above said center.

17. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, 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, means for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the winding of the last said conical layer of thread, and means for discharging said bobbin from said center downwardly through said path of movement of the thread guide, the machine including a combined clamp and cutter engageable with a portion of the thread extending from the thread guide to the bobbin and means for moving the clamp and cutter and clamped thread from below said center to above said center.

18. A traveling winding unit for an automatic winding machine, including centers for rotatably holding a winding bobbin, said centers being adapted to open to discharge the bobbin downwardly, and means for mounting the thread guide for movement beneath said winding bobbin during winding and also for movement out of its winding position to permit the discharged bobbin to pass through the path of movement of the thread guide.

19. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for automatically removing the thread guide from beneath the bobbin, and means for dropping the bobbin downwardly from said holding means.

20. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, 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, means for automatically removing the thread guide from beneath the bobbin after the winding of the last conical layer of thread, and means for dropping the bobbin downwardly from said center.

21. A multiple-unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, each winding unit including a thread guide movable in a path extending beneath its winding bobbin, and the machine including mechanism acting on the threads of the several units in succession to hold a portion of the thread above the level of the bobbin-holding means of the unit.

22. A multiple-unit winding machine including a plurality of winding units each including a center for rotatably holding a winding bobbin, each winding unit including a thread guide movable in a path extending beneath its winding bobbin, and the machine including mechanism acting on the threads of the several units in succession to hold a portion of the thread above and adjacent to the said center of the unit.

23. A multiple-unit winding machine including a plurality of winding units each including a center for rotatably holding a winding bobbin, each winding unit including a thread guide movable in a path extending beneath its winding bobbin, and the machine including means for supplying fresh bobbins to the centers of said winding units, thread-positioning means adapted to engage the threads of the several units in succession between the thread guide and wound bobbin of the unit and carry the thread upwardly into position for engagement between the center and the fresh bobbin.

24. A multiple-unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide movable in a path extending

beneath its winding bobbin, the machine including means for imparting to each 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, means acting successively on the several units to discharge the wound bobbin from said holding means, and means for shifting each thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end preparatory to such discharge of the bobbin.

25. A multiple-unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide movable in a path extending beneath its winding bobbin, the machine including means for imparting to each 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, means acting successively on the several units to discharge the wound bobbin from said holding means, means for shifting each thread guide in the direction of the tip end of the bobbin at least as far as to adjacent to said end preparatory to such discharge of the bobbin, means for rotating each bobbin following such discharge, and means acting to lead each thread back toward the base of the bobbin during such rotation following discharge of the bobbin, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin.

26. A multiple-unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin, a thread guide movable in a path extending beneath its winding bobbin, the machine including means for imparting to each 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, means acting successively on the several units to discharge the wound bobbin from said holding means, means for shifting each thread guide in the direction of the tip end of the bobbin at least as far as to adjacent to said end preparatory to such discharge of the bobbin, means for rotating each bobbin following such discharge, and means for shifting each thread guide toward the base end of the bobbin during such rotation, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin.

27. A multiple-unit winding machine including a plurality of winding units and means for moving said units in a procession around the machine, each winding unit including a thread guide movable in a path extending beneath its winding bobbin, the machine including means for imparting to each 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, means for discharging each bobbin from its holding means downwardly through the path of its thread guide, a support along which said discharged bobbins roll with their respective winding units, and means for leading the threads extending to the rolling bobbins toward the base end of such bobbin, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin.

28. A multiple-unit winding machine including a plurality of winding units and means for moving said units in a procession around the machine, each winding unit including a thread guide movable in a path extending beneath its winding bobbin, the machine including means for imparting to each 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, means for discharging each bobbin from its holding means downwardly through the path of its thread guide, a support along which said discharged bobbins roll with their respective winding units, and means for shifting each thread guide toward the base end of its discharged bobbin as such bobbin rolls, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin.

29. A traveling winding unit for an automatic winding machine including centers for rotatably holding a winding bobbin, a thread guide having a path of movement beneath said winding bobbin, said centers being adapted to open to discharge the bobbin downwardly, and the thread guide being movable out of its winding position to permit the discharged bobbin to pass through the path of movement of the thread guide, and means below the path of movement of the thread guide for constraining the discharged bobbin to rolling movement with the winding unit.

30. 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 in succession, the winding units including means for holding winding bobbins with their axes transverse to the direction of such relative movement, and the tending mechanism including a movable thread clamp adapted to engage the thread of a winding unit and thereupon having one component of motion upwardly from beneath the bobbin-holding means to above the bobbin-holding means of the winding unit, and another component of motion in the direction of the relative motion of the winding unit with respect to the tending mechanism.

31. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide located below the winding bobbin to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, 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 lead the thread back toward the base of the bobbin, means for rotating the bobbin during such leading of the thread back, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin, means for supplying a fresh bobbin to said holding means, and means for moving from below said holding means upwardly to said holding means a portion of the thread that has passed the thread guide, for engagement of said thread with the fresh bobbin.

32. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide located below the winding bobbin to cause the thread to approach the winding bobbin by running upwardly from beneath the bobbin onto the bobbin, 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 lead the thread back toward the base of the bobbin, means for rotating the bobbin during such leading of the thread back, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin, means for supplying a fresh bobbin to said holding means, and thread-positioning means engageable with a portion of the thread extending from the thread guide to the bobbin and movable from below said holding means upwardly to said holding means, for engagement of said thread with the fresh bobbin.

33. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement located below the bobbin, 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 for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end after the completion of winding of a body of thread on the bobbin, means for discharging said bobbin from said holding means downwardly through said path of movement of the thread guide, means for leading the thread back toward the base of the bobbin, means for rotating the bobbin during such leading of the thread back, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin, means for supplying a fresh bobbin to said holding means, and means for positioning above said holding means a portion of the thread that has passed the thread guide, for engagement of said thread with the fresh bobbin.

34. 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 lead the thread back toward the base of the bobbin, means for applying a rolling action to the bobbin during such leading of the thread back, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin, a thread clamp located to receive the thread extending from the thread guide to said spiral on the bobbin, means for severing the thread extending from the clamp to the bobbin, and means for moving said clamp 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 lead the thread back toward the base of the bobbin, means for applying a rolling action to the bobbin during such leading of the thread back, thereby to wind the thread in the form of an open spiral on the exterior of the 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, said combined clamp and cutter being located to receive the thread extending to said spiral adjacent to the base portion of wound thread on the bobbin, and means for moving said combined clamp and cutter to carry the thread clamped thereby into position to be associated with a fresh bobbin.

36. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide movable beneath the bobbin, 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 for discharging the bobbin downwardly from its holding means to a position below the path of the thread guide, means acting after such discharge of the bobbin to move the thread guide back above the bobbin toward the position of winding of the base portion of thread of the bobbin, means for applying a rolling action to the discharged 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 discharged bobbin, means for severing the thread extending from the clamp to the bobbin, and means for moving said clamp to carry the thread into position to be associated with a fresh bobbin.

37. An automatic winding machine comprising means for rotatably holding a winding bobbin, a thread guide movable lengthwise of the bobbin during the winding along a path of movement extending beneath the bobbin, means for imparting to the thread guide a progressive advance of its zone of traverse 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, means for automatically moving the thread guide in the direction of the base end of the bobbin at least as far as to adjacent to said end after the winding of the last said conical layer of thread, and means for discharging said bobbin downwardly through said path of movement of the thread guide.

38. An automatic winding machine comprising means for rotatably holding a winding bobbin, said holding means including a center for the base of the bobbin, a thread guide movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for imparting to the thread guide a progressive advance of its zone of traverse 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, means for stopping said progressive advance of the zone of traverse of the thread guide, means for automatically moving the thread guide adjacent to said center for the base of the bobbin while said bobbin is held by said center, means for discharging said bobbin downwardly through said path of movement of the thread guide, and means for moving upwardly to said center a portion of thread that has passed the thread guide, for engagement of the thread with said center.

39. 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 movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for imparting to the thread guide a pro-

gressive advance of its zone of traverse along the bobbin so as to distribute the thread in nested conical layers, means for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end, 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 while the bobbin is held by said center, and means for thereafter discharging the bobbin from said center downwardly through said path of movement of the thread guide.

40. 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 movable lengthwise of the bobbin during winding along a path of movement extending beneath the bobbin, means for imparting to the thread guide a progressive advance of its zone of traverse along the bobbin so as to distribute the thread in nested conical layers, means for automatically moving the thread guide in the direction of an end of the bobbin at least as far as to adjacent to said end, a combined clamp and cutter, means for operating said combined clamp and cutter to clamp the thread at a place between the wound bobbin and the thread guide and cut the thread extending to the bobbin while the bobbin is held by said center, and means for thereafter discharging the bobbin from said center downwardly through said path of movement of the thread guide.

41. A multiple-unit winding machine including a plurality of winding units each including means for rotatably holding a winding bobbin and a thread guide movable in a path extending beneath said winding bobbin, the machine including means for imparting to each 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, means acting successively on the several units to discharge the wound bobbin from said holding means, means for shifting each thread guide in the direction of the base end of the bobbin at least as far as to adjacent to said end preparatory to such discharge of the bobbin, and means for rotating each bobbin during such shift of the thread guide, thereby to wind the thread in the form of an open spiral on the exterior of the bobbin.

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