

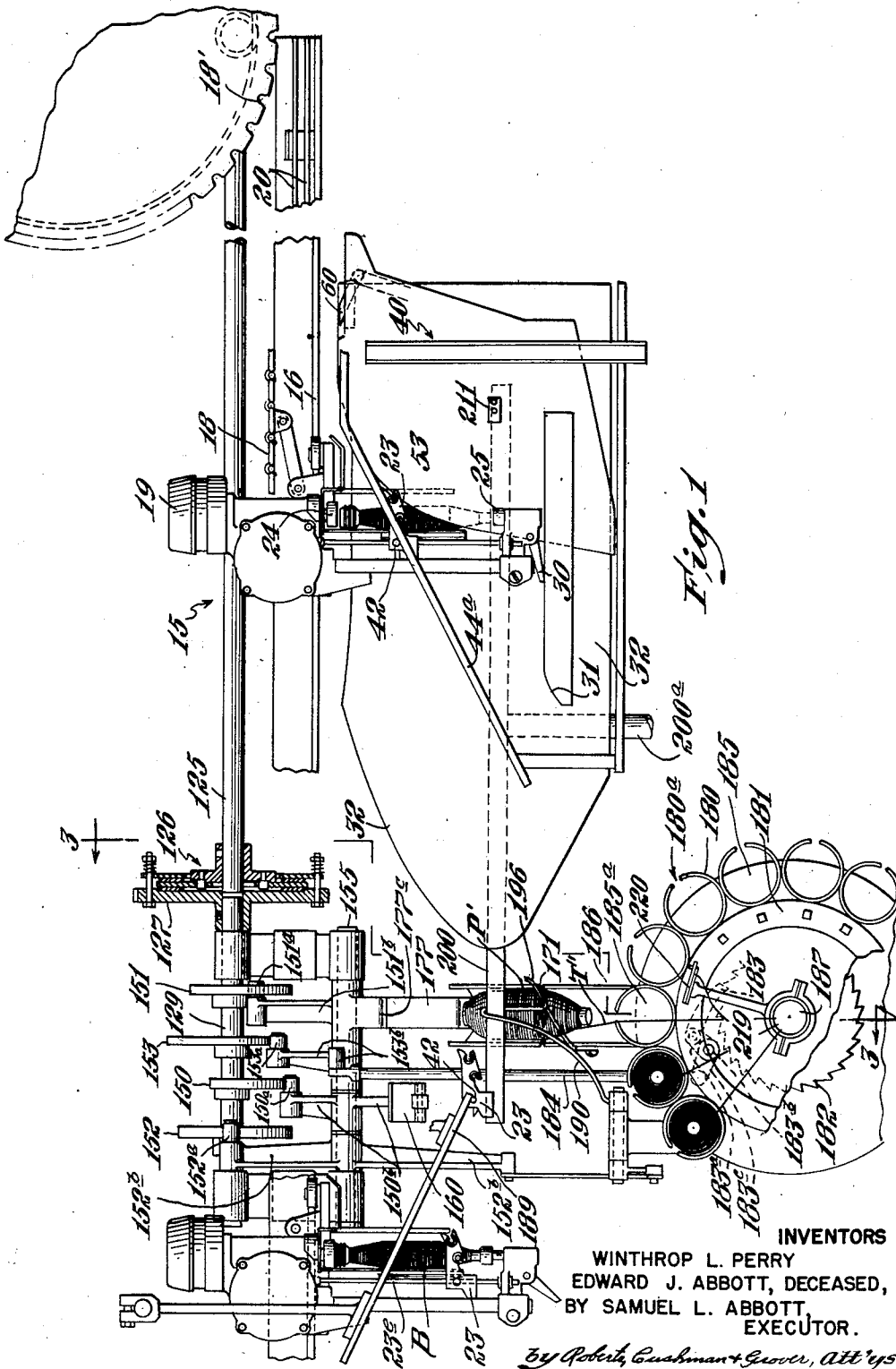
Nov. 17, 1953

W. L. PERRY ET AL
WINDING MACHINE

2,659,538

Filed Nov. 29, 1949

10 Sheets-Sheet 1



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Filed Nov. 29, 1949

10 Sheets-Sheet 2



by *Roberts, Cushman & Grover*
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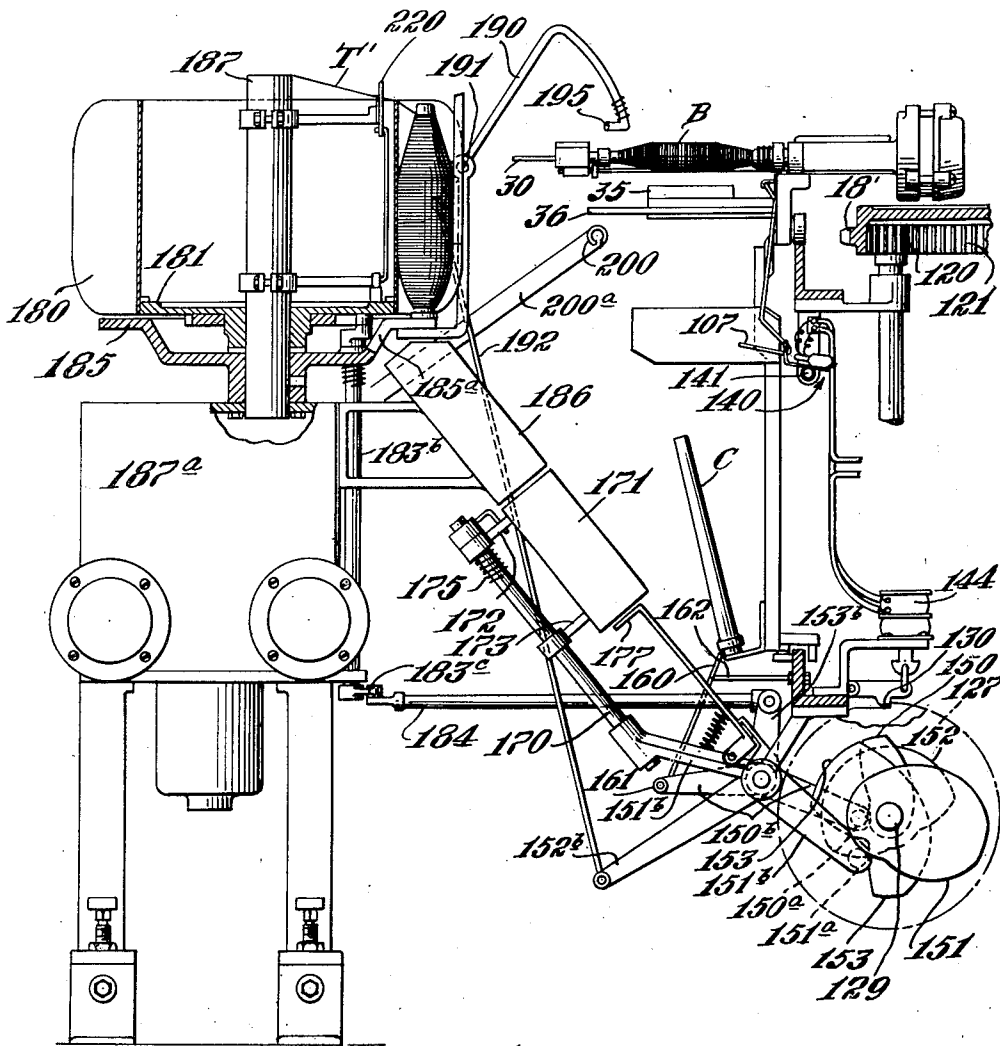
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10 Sheets-Sheet 3



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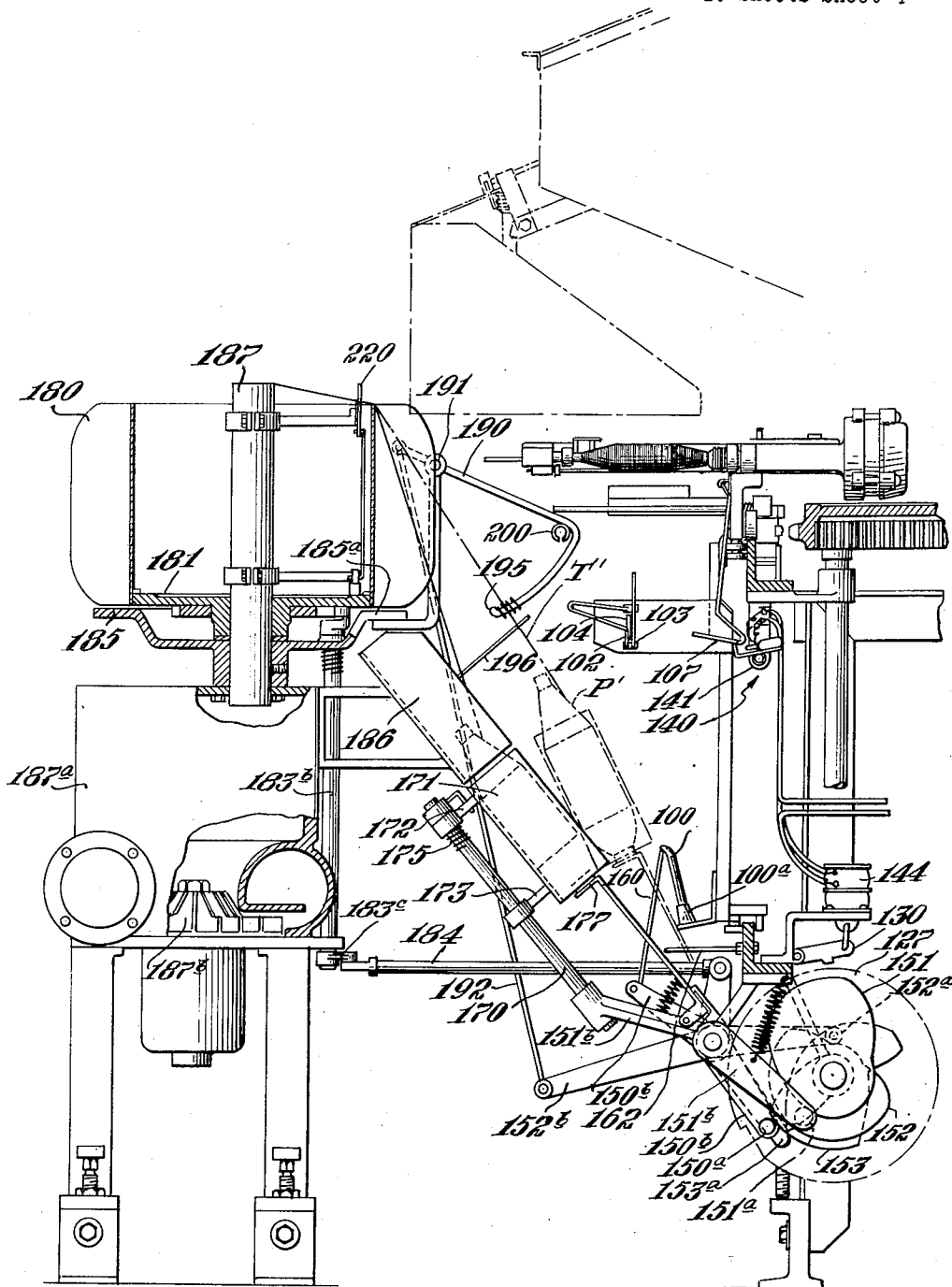


Fig. 4

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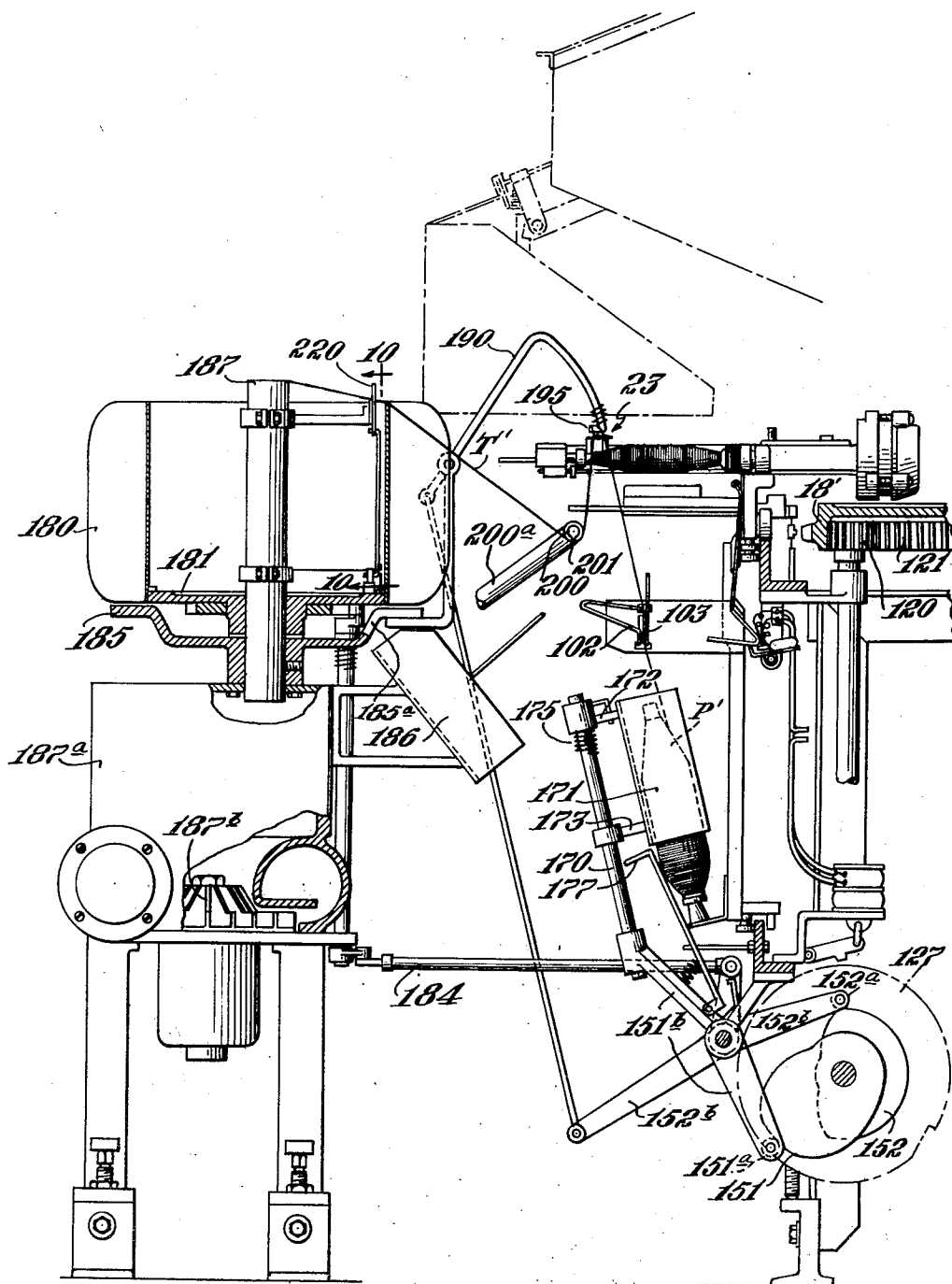


Fig. 5

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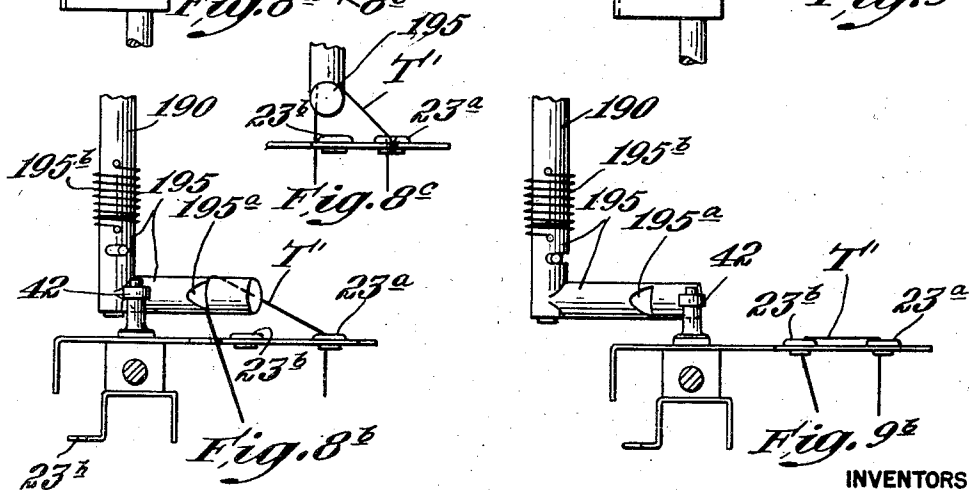
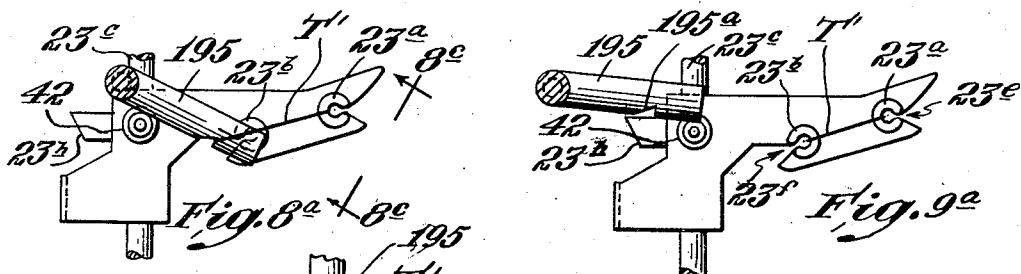
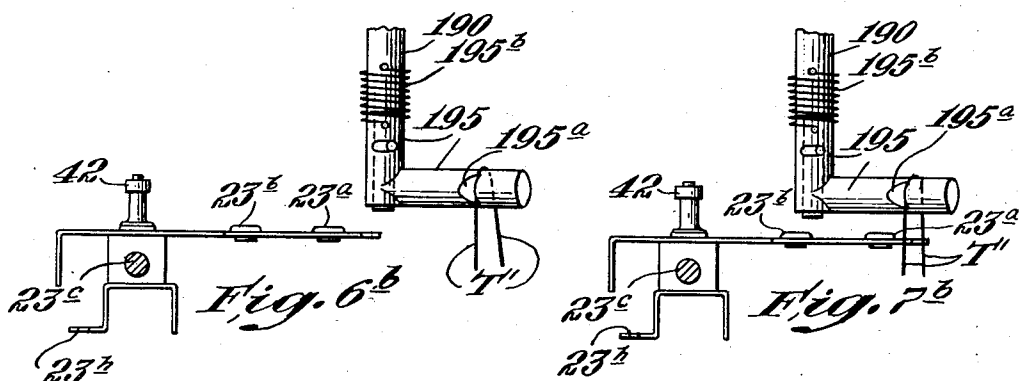
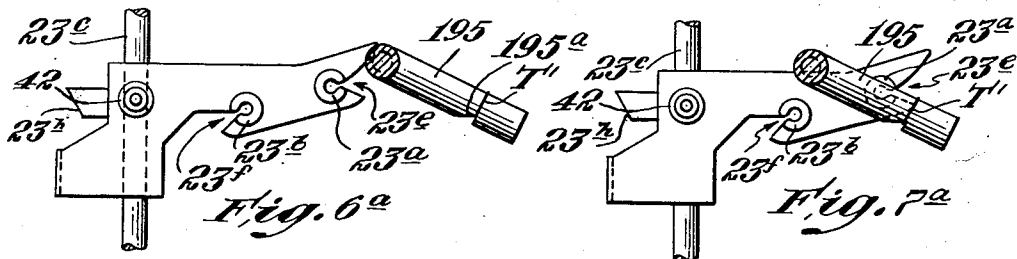
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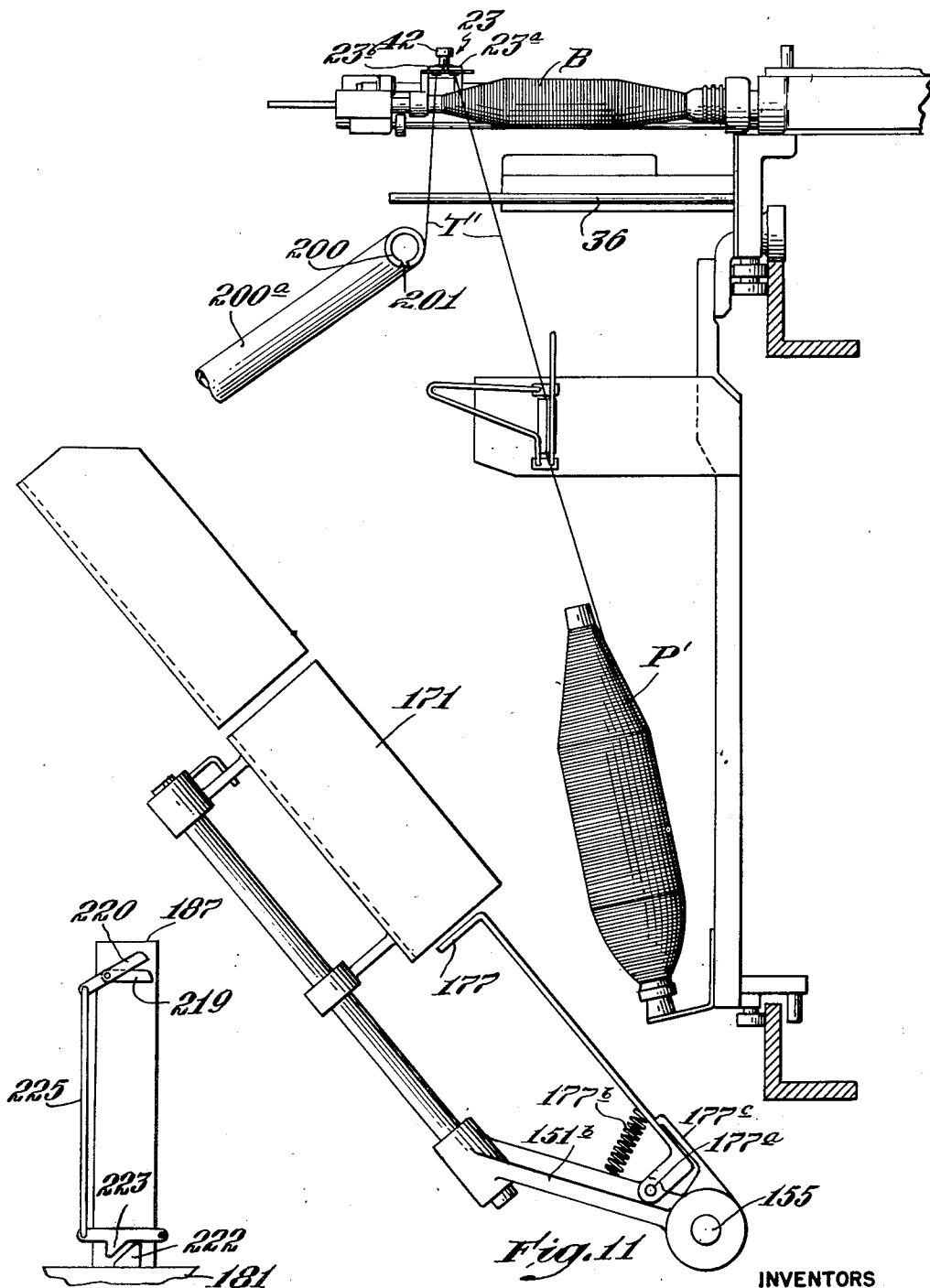


Fig. 10

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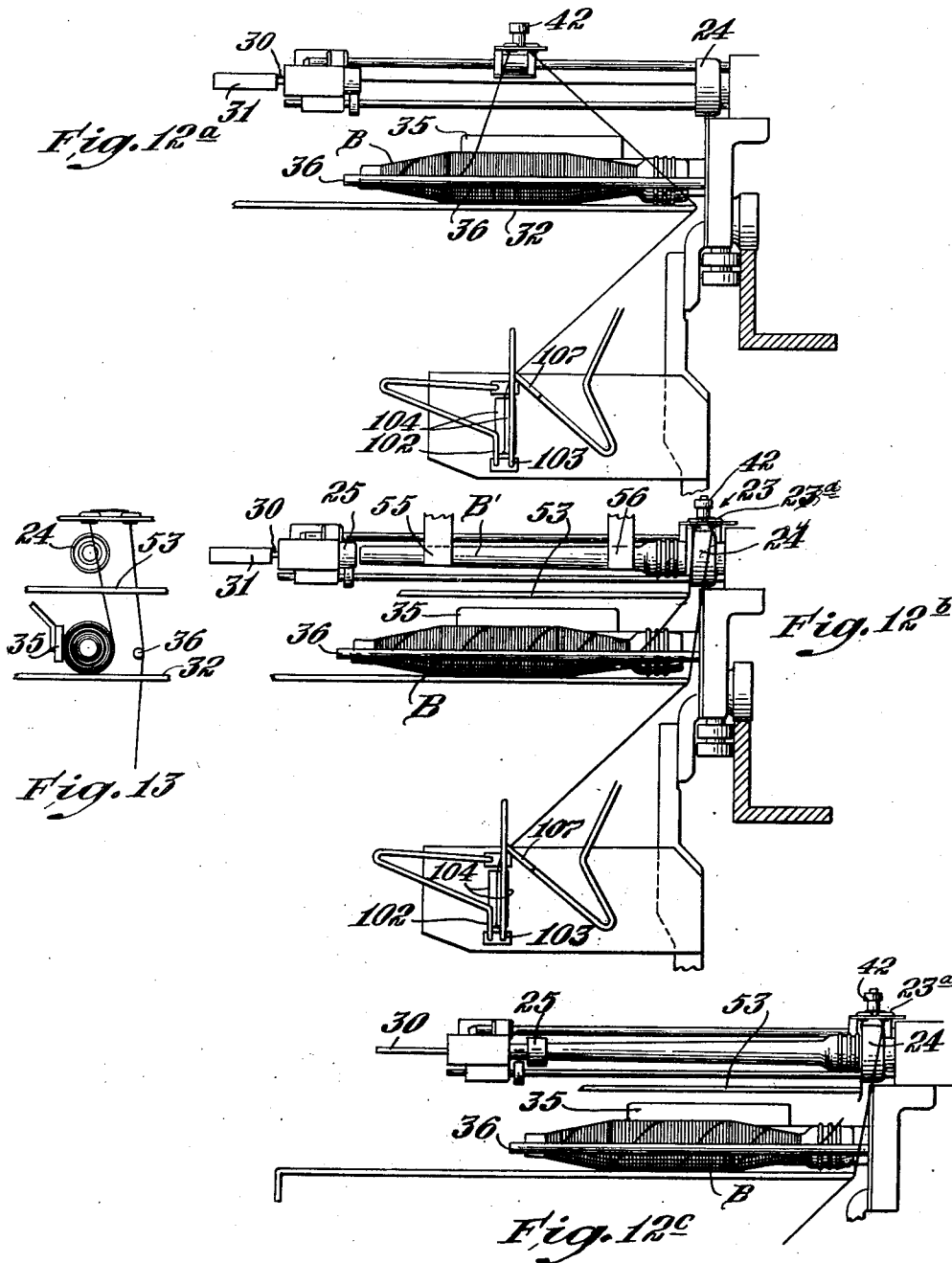
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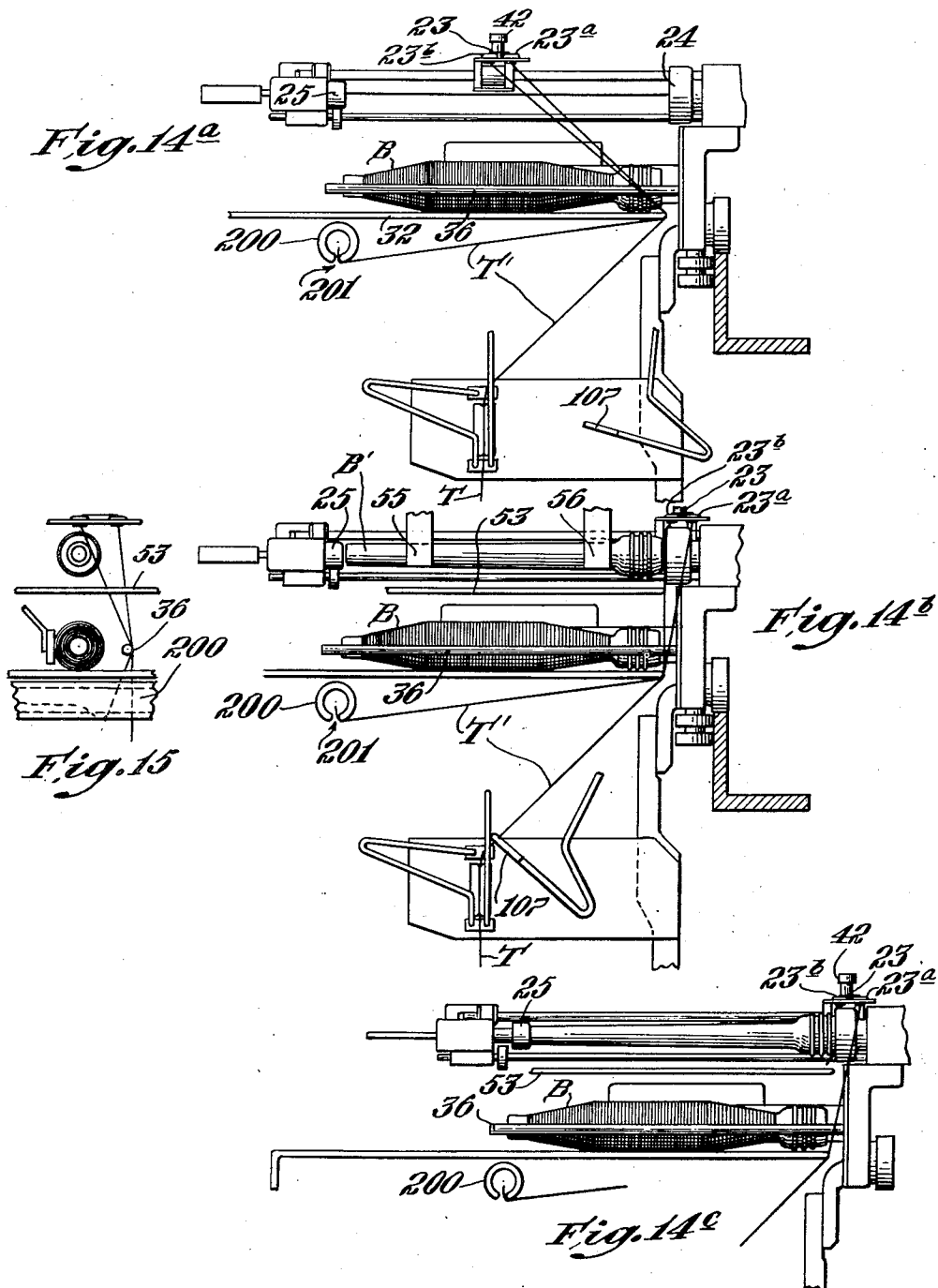
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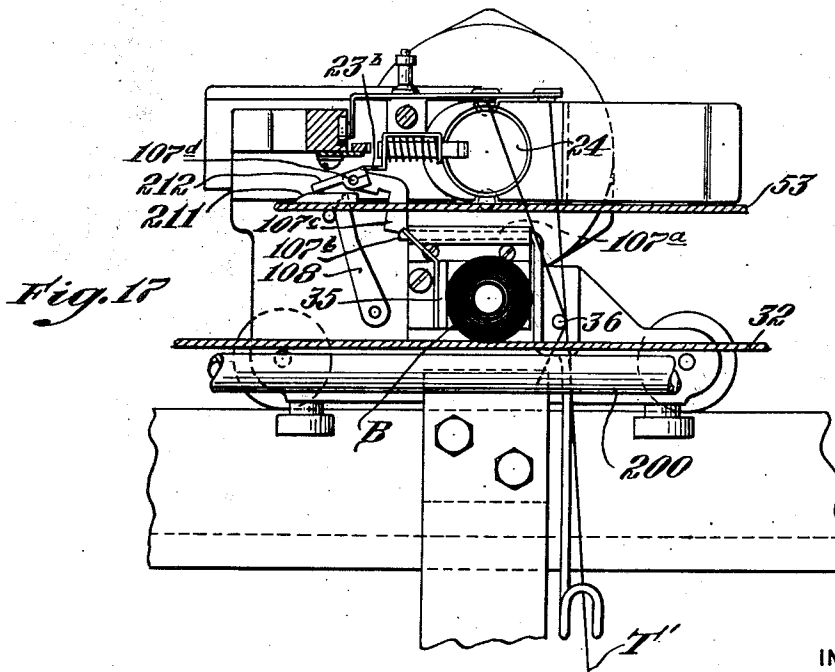
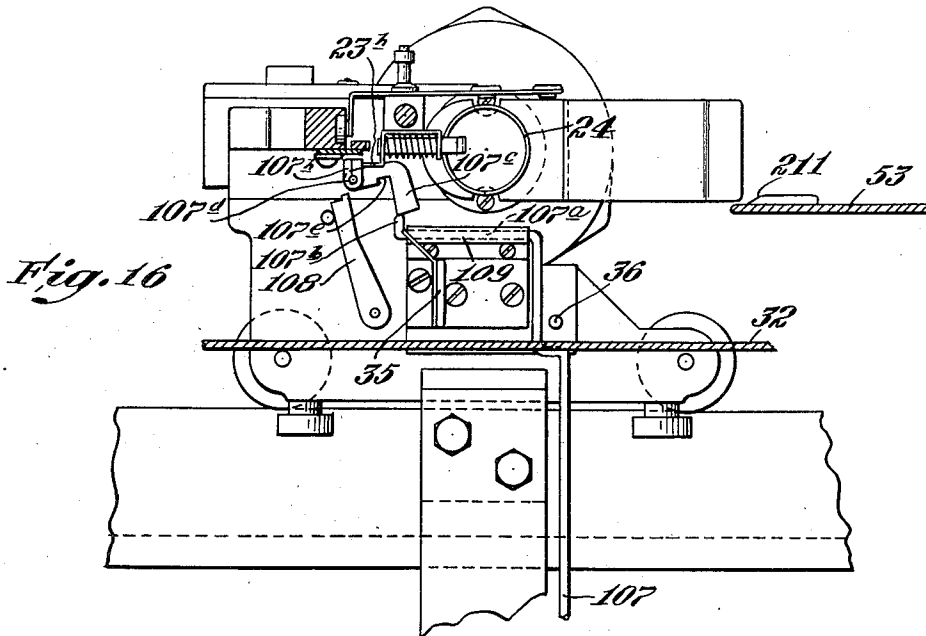
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UNITED STATES PATENT OFFICE

2,659,538

WINDING MACHINE

Winthrop L. Perry, Wilton, N. H., and Edward J. Abbott, deceased, late of Wilton, N. H., by Samuel L. Abbott, executor, Wilton, N. H., assignors, by mesne assignments, to Abbott Worsted Mills, Incorporated, Wilton, N. H., a corporation of New Hampshire

Application November 29, 1949, Serial No. 129,898

65 Claims. (Cl. 242—35.6)

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This invention relates to automatic winding machines and preferably is applied to automatic winding machines of the type having a plurality of winding units each adapted to wind thread from a supply onto a winding bobbin, and having the automatic tending mechanism of the machine constructed to operate upon the several winding units in succession, as by travel of the winding units past the tending mechanism, the tending mechanism acting automatically to replace a wound bobbin in a winding unit with a new bare bobbin for winding thereon.

A principal object of the invention is to provide, more especially upon exhaustion of the old supply thread of a winding unit, for automatically attaching a new thread from a different supply to the new bare bobbin next to be wound.

As illustrated herein the invention includes provision for automatically delivering new supplies of threads to the winding units, for automatically placing the thread in the thread guide of the winding unit and for automatically positioning the new thread for engagement with a new bare bobbin for winding thereon. Further objects of the invention are to provide for performing these automatic operations without complicating the operation of the replacement of wound bobbins with new bare bobbins, and in such manner as to reduce the effort and attention required of the operator of the machine.

Further objects and advantageous features of the invention will be apparent from this specification and its accompanying drawings wherein the invention is explained by description of a preferred example thereof.

In the accompanying drawings:

Fig. 1 is a diagrammatic view mainly in plan showing a portion of the track of a traveling unit automatic filling winder, two positions of one of the traveling winding units, automatic mechanism for selectively supplying new supply packages to the winding units, and mechanism for automatically changing the bobbins wound by the winding units;

Fig. 2 is a right-hand elevation of one of the winding units approaching the apparatus of Fig. 1 in the condition in which the winding unit has finished winding a fully wound bobbin, with the thread from the supply package neither broken nor exhausted;

Fig. 3 is a right-hand elevation, partly in vertical section and partly broken away and with some parts omitted, taken mainly on the line 3—3 of Fig. 1 showing a winding unit having entered the apparatus shown in Fig. 1 with its thread supply exhausted;

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Figs. 4 and 5 are views similar to Fig. 3 showing subsequent stages of operation of the supply package delivering and other mechanism;

Figs. 6^a to 9^b inclusive are diagrammatic views showing the operation of insertion of a thread of a new supply package into the thread eyes of the thread guide assembly of the winding unit, Figs. 6^a, 7^a, 8^a and 9^a being plan views, Figs. 6^b, 7^b, 8^b and 9^b being corresponding front elevations, and Fig. 8^c being a fragmentary elevation on the line 8^c—8^c of Fig. 8^a;

Fig. 10 is a detail, in elevation, taken on the line 10—10 of Fig. 5 showing mechanism for cutting off the previously held end of thread of a newly delivered supply package;

Fig. 11 is a view similar to Fig. 4 at a subsequent stage in the operation of the mechanism, showing certain parts as restored to inactive position and the held end of thread having been cut off;

Figs. 12^a, 12^b and 12^c are diagrams, viewing the winding unit in right elevation showing successive stages in the changing of the winding bobbin in the event the supply thread has not broken or exhausted and the supply has not been changed;

Fig. 13 is a diagram in the nature of a front elevation, corresponding to the position of the winding unit in Fig. 12^b;

Figs. 14^a, 14^b and 14^c are diagrams, viewing the winding unit in right elevation showing successive stages in the changing of the winding bobbin in the event the supply has been changed;

Fig. 15 is a diagram in the nature of a front elevation, corresponding to the position of Fig. 14^b;

Fig. 16 is a fragmentary view showing portions of the head of a winding unit, particularly portions of the detector wire and winding stop mechanism; and

Fig. 17 is a fragmentary view of the winding unit of Fig. 16, farther advanced through the tending mechanism, showing the resetting of the detector wire, into engagement with the thread of a new supply package.

The winding machine to which the invention is shown as applied includes a plurality of winding units such as indicated at 15 in Fig. 1, movable by means of a chain 13 in a closed path around the machine upon tracks consisting of upper and lower rails, the upper such rail 16 being shown in Figs. 1 and 2.

Each winding unit may be individually driven by its own electric motor 19, such motor deriving its current through the frame of the machine and through suitable brushes contacting with stationary conductor bars 20, so as to wind a thread

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package on an individual bobbin B as the winding unit travels around the machine. As shown in Fig. 1, the conductor bars 20 are interrupted in the region where winding is suspended, following completion of winding a bobbin and before and during the changing of the bobbin by the winding unit tending mechanism.

Each winding unit is shown as provided near its lower end with a holder in the form of a peg 109 having a conical base portion 100^a (Fig. 4) for reception of any suitable supply package, such as a spinning package P having a core C (Fig. 2) from which the thread passes upwardly, between self-threading thread guides 102 and 103, between tension disks 104, 104 and beneath the outer hooked end of a swinging thread detector wire 107 to a traversing thread guide assembly 23.

The detector wire 107 may if desired control the motor 19 on the individual winding unit in known manner, so as to stop the motor in the event of exhaustion of the thread. The detector wire 107 is thus shown as having an upper horizontal portion 107^a mounted in a bearing 109 (Fig. 16) and a rearwardly extending crank portion 107^b engaging the lower surface of a knock-off finger or latch member 107^c which is fast on a partially rotatable knock-off rod 107^d. In normal winding a notch 107^e in the latch member 107^c engages and hold to the right the upper end of a brush controlling lever 103 corresponding to the arm 251 of Fig. 15 of United States Patent No. 2,426,168 to maintain the brushes of the winding unit in contact with the stationary conductor bars 20, for instance through brush-controlling mechanism such as is shown as controlled by the arm indicated at 463 in Figs. 16 and 17 of United States Patent No. 2,377,367.

As employed in the present invention, the detector wire 107 has for its main function to initiate actuation of the package-supply mechanism, to supply a new package to the winding unit in the event of breakage or exhaustion of the old supply of thread. In the present application the detector wire 107 is broken away in some of the views for simplicity of illustration, but is shown in Fig. 2 in its raised position in engagement with thread of an old supply package that has not exhausted or broken, and is shown for instance in Figs. 3 and 4 in its lowered position to which it drops in the event of failure of supply thread.

At the thread guide assembly 23 the thread T passes through an outer thread guide eye 23^a and thence over and down through an inner thread guide eye 23^b onto the winding bobbin B. As shown in Fig. 6^a the guide eyes 23^a and 23^b communicate with flaring throats 23^c and 23^d respectively to facilitate reception of a new thread as subsequently described.

The bobbin B is held between inner and outer chucks or rotatable hollow centers 24 and 25, the inner center 24 being rotated by the motor 19 to rotate the bobbin.

The thread guide assembly 23 is preferably frictionally mounted for sliding movement upon a traverse rod 23^e (Figs. 6^a and 6^b) which is reciprocated with a short stroke of traverse by suitable traverse cam and linkage connections from the motor 19. During the winding of the bobbin the thread guide assembly 23 is progressively advanced along the rod 23^e, from the base of the bobbin toward the tip, for instance by feeler mechanism such as disclosed in United States Patent No. 2,377,367 or by stationary guide mechanism which reacts on the thread

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guide assembly of the traveling winding unit as disclosed in United States Patent No. 2,362,455. In either case the progressive shifting of the zone of traverse of the thread guide assembly 23 from near the base of the bobbin to near the tip of the bobbin provides the filling type of winding on the bobbin.

Upon completion of a wound bobbin by the winding unit, or upon breakage or exhaustion of the thread, the individual motor 19 of the winding unit is deenergized by breaking the circuit to the motor, for instance by allowing the brush-controlling mechanism to lift the unit's brushes from the conductor bars 20. For example the thread guide assembly 23 may have a cam portion provided with an inclined edge 23^a (Fig. 6^a) facing toward the observer in Fig. 16 and shaped to engage a dog 107^b fast on the knock-off rod 107^d near the tip of the bobbin, to tilt the dog and knock-off rod counterclockwise and so raise the latch 107^c and release it from the brush-controlling arm 103, allowing this arm to swing to the position of Fig. 16 and allowing the brushes to rise from the conductor bars 20. If the supply of thread on a winding unit exhausts or breaks before completion of the wound bobbin, dropping of the detector wire 107 will cause the rearwardly extending crank portion 107^b to raise the latch 107^c, with similar raising of the brushes. In addition since the conductor bars 20 are interrupted a suitable distance in advance of the tending mechanism, it is assured that the motor of each winding unit will always have had time to stop before the winding unit reaches the tending mechanism.

Thus each winding unit enters from the left of Fig. 1 in an inactive condition but still holding the wound bobbin in winding position between the centers 24 and 25.

The machine of the invention is best utilized by using as its supply packages bobbins of thread which contain an even multiple or slightly less than an even multiple of the amount of thread which can readily be held by the individual filling bobbins, for example 2, 3 or 4 times.

Thus in a large proportion of passages of a winding unit through the illustrated mechanism the supply package P will not be exhausted but will contain enough thread for the winding of one or more further filling bobbins B, as in the case of the particular winding unit shown in Fig. 2. The thread supply neither being exhausted nor broken, the detector wire 107 will not have dropped to detecting position as in the case of an exhausted supply. In this situation of Fig. 2 the winding unit passes through the package supplying mechanism without the latter being actuated, and then passes through bobbin-changing mechanism which may be of known construction where a new bare bobbin B' is substituted for the fully wound bobbin B, for further winding from the previous supply package P.

The outer chuck or center 25 of each unit is retractable to discharge the wound bobbin B from winding position by means of a crank arm 30 on the winding unit and a stationary abutment 31 shown in Fig. 1. Upon the crank arm 30 encountering the abutment 31, the wound bobbin will drop from the chucks or centers a short distance onto a lower horizontal stationary plow plate 32 which extends along the path of travel of the winding units 15, underneath their head portions. The wound bobbin is rolled along on this plate 32 by being held between a

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generally vertical plate 35 and a rod 36 (Figs. 2 and 12^a) both of which extend from and move along with the winding unit, and upon reaching the right end of plate 32 the wound bobbin may roll off into a receptacle or into any desired bobbin-arranging mechanism.

Following discharge of the wound bobbin B from winding position, the thread guide assembly 23 is shifted to a position above the inner or base chuck 24 by engagement of an upstanding roller 42 of its thread guide assembly with an inclined stationary guide element 44^a (Fig. 1).

The lower plate 32 has meanwhile acted as a cam surface to plow over to the region of the base chuck 24 that run of thread which extends from the supply package P to the thread guide assembly. As the bobbin rolls along the plate 32 and the thread guide assembly shifts toward the base chuck, the rotation of the rolling bobbin winds the thread on its outer surface in the form of an open spiral, as shown in Figs. 12^a and 12^b. In the last portion of movement of the thread guide assembly toward the base chuck, an upper plow plate 53 engages the thread between the thread guide and discharged bobbin and acts in conjunction with the thread guide to position this thread across the face of the inner chuck 24 as shown in Figs. 12^b and 13.

With the thread so positioned the winding unit reaches empty bobbin-feeding mechanism indicated diagrammatically in Fig. 1 at 49 and which may be that of Fig. 21 of said Patent No. 2,377,367, at which an empty bobbin B' is held by swingable fingers 53 and 55 (Fig. 12^b), whereupon the outer chuck 25 closes upon this empty bobbin B' as shown in Fig. 12^c and withdraws it from the bobbin-feeding mechanism. The thread extending past the thread guide is forced into the hollow inner chuck 24 by the base of the new bobbin and clamped between the bobbin and chuck. The thread extending from the inner chuck 24 to the discharged fully wound bobbin B enters in between the blades of a cutter immediately below and at the inner edge of upper plow plate 53, the pivoted blade and the cutter being indicated at 50 in Fig. 1. The pivoted blade is closed automatically, at each passage of a winding unit, by any suitable mechanism, for instance by the mechanism for closing the corresponding blade as shown in application Serial No. 103,242, filed July 6, 1949. Thus the thread of the fully wound bobbin is severed from the thread which is now clamped between the new bobbin B' and inner chuck 24, and extends to the supply. The thread from the supply package to the outer eye 23^a of the thread guide is held by the inner edge of the lower plow plate 32 out of the range of action of the pivoted blade 50 of the cutter, so that the run of thread extending from the supply package to the new bobbin B' is kept intact.

Thereupon the thread guide assembly of the winding unit is automatically shifted from the region of the base chuck over onto the thread receiving part of the bobbin by suitable overhead cam mechanism, and the winding unit is started to winding by suitable switch mechanism such for instance as provided by the above patents.

It will be understood that the manipulation of the thread guide assembly and the replacement of the fully wound bobbin B with a new bare bobbin B' and the restarting of the winding unit as explained above in connection with Figs. 12^a to 12^c and 13 is practiced in machines which are made in accordance with said Patent

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No. 2,377,367, excepting of course that the thread will fail to be wound back in a spiral on the bobbin B and will fail to be clamped in between the new bobbin B' and inner chuck 24 on the occasions when the thread has broken or exhausted, in which case it has been necessary for the operator either to find the broken end of thread of the supply package and thread it up again properly, or else replace an exhausted supply package with a new supply package and also thread this up properly.

The manipulation of the thread guide and replacement of the fully wound bobbin B with the new empty bobbin B' have been described above in connection with Figs. 12^a to 12^c and 13 as they occur in the preferred form of the present machine when the supply package has neither broken nor exhausted because it is preferred to retain this same mode of operation, previously used, in the present machine, and to coordinate with it mechanism which will detect the breakage or exhaustion of the supply, replenish the supply and associate the new thread with the new bare bobbin B', without requiring that the operator's attention be given to the particular unit on which this breakage or exhaustion has occurred.

The above Figs. 12^a to 12^c and 13 are also useful for purposes of comparison with somewhat similar Figs. 14^a to 14^c and 15 which show the different course of the thread in replacement of the winding bobbin by a new empty bobbin in the case when a new supply thread is automatically associated with the new bobbin in accordance with the present invention.

Machines made in accordance with said Patent No. 2,377,367 are most usually employed in winding filling bobbins from supply packages which consist of cones or cheeses each containing several pounds of thread which has been rewound from spinning bobbins, but can also be used to wind filling bobbins directly from supply packages consisting of the original spinning bobbins, without any preliminary operation of rewinding from spinning bobbins onto cheeses or cones. In winding directly from spinning bobbins, the supply packages will need changing much more frequently than in winding from the larger rewound cheeses or cones, and there may also be more breakage than if the thread had previously been subjected to a winding operation.

An operator, once having noticed a break or exhaustion of the thread on a passing winding unit such as that of said Patent No. 2,377,367 can find the end of thread on a new full supply package, remove the old supply package or its empty core from the winding unit and replace this with the new full supply package, and thread up the winding unit so it is in condition to wind from the new supply thread. However when changes of the supply packages are required fairly frequently, as in winding directly from spinning bobbins, close attention on the part of an operator is required, with the result that the operator needs to stay at a single machine, waiting to change the supply package on the winding units as they need such change, which seriously limits the effectiveness of the operator. In any event, if an operator attends to two of the previous machines, which is sometimes the practice where changes of the supply packages are not frequently required, as in winding from large cheeses or cones, then while she is attending to one of these machines she is obviously unable to attend to a winding unit passing her usual sta-

tion at the other machine, and when such unit requires replenishment of its supply package and the operator is unable to perform this replenishment, such unit will remain idle, with loss of productive capacity.

The present invention aims not only to reduce the actual operations required of an operator and to replenish the supply package more quickly than the operator alone could do, but more especially aims to avoid any need for constant attention of an operator to a particular machine, even though fairly frequent changes of the supply packages may be involved, and hence permit an operator to use her time to better advantage by tending a number of machines under these conditions. The invention further aims to provide for automatic replenishment of the supply packages, so that while the operator is at one machine the replenishment of supply packages at another machine or machines under her charge will be performed as required.

While these advantages of this invention are explained herein by reference to winding machines in which the winding units travel, it will be apparent that considerations similar to those here specifically discussed are also present in the case of machines where the operator is required to attend to the replenishment of supply packages of stationary filling winding units.

A further advantage of reducing the attention required of the operator, to the extent that the operator can more readily tend a number of machines or can tend an increased number of machines without undue idleness of any of the winding units, consists in an increase in flexibility as to efficient winding of various counts of thread. Machines such as that of said Patent No. 2,377,367 are intended to wind a complete filling wound bobbin during the time of one circuit of a winding unit around the machine and accordingly the machine will usually be long enough and have a sufficient number of winding units so that the units can travel at a suitable speed with regard to effective attention by an operator, for example at a speed of travel of 20 units per minute. If it is desired to change to the winding of a finer count of thread, then unless the machine is to be lengthened and the number of its winding units increased, the speed of travel of the units will need to be reduced in order to give time for winding of a greater length of the finer thread on each bobbin during a circuit around the machine. In these circumstances it is particularly advantageous to make it easy for the operator to tend a number of machines in an efficient manner, and to allow the winding units of each such machine to travel more slowly than a speed that would best utilize the operator's time under previous methods of tending the winding units. For instance, it might be desirable to cause the winding units to travel at a rate of say only ten units per minute, which under some conditions would be wasteful of the time of an operator if she were to stay constantly at a single machine. By the use of the present invention the operator's time is not wasted if the winding units travel relatively slowly because the operator can then efficiently tend an increased number of machines as the speed of travel of the units is reduced. A group of machines can thus be more economically used for widely varying counts of thread than heretofore.

Detection of breakage or exhaustion of supply

In the event that the winding unit entering

the apparatus shown in Fig. 1 has its supply thread either broken or exhausted, so that the detector wire 187 is in a lowered, detecting position as shown in Figs. 3, 4 and 5, indicating failure of the supply, package-supplying mechanism is then actuated to supply a new package P' to the winding unit, and acts in conjunction with the bobbin-changing mechanism to cause the newly supplied thread to be associated with a bobbin, for winding thereon.

Drive of package-supplying mechanism

The package-supplying mechanism which consists of a number of coordinated elements is most conveniently driven through a suitable cycle of operation through a series of individual cams which each rotate through one revolution when the bobbin-supplying mechanism is actuated.

The driving power may be taken off from one of the chain-driving sprockets 18' by an internal pinion 120 meshing with an internal gear 121 on the sprocket and driving through suitable geared connections a constantly rotating horizontal shaft 125 (Fig. 1). Shaft 125 is connected to the constantly rotating driving side of a friction clutch 126 of which the driven side 127 is secured to a cam shaft 129. The driven element 127 of the clutch is normally held against rotation by a latch 130 as indicated in Fig. 3.

A normally open mercury switch 140 is pivotally mounted at 141 in position to be tilted, and thereby closed, by engagement of the pivoted detector wire 187 passing the winding unit when the detector wire is in its lowered position. Thus a winding unit having its supply of thread either broken or exhausted closes the mercury switch. The mercury switch is connected electrically to a source of power and to a solenoid 144 which controls the latch 130, so that upon closure of the switch the latch is momentarily retracted from the driven element of the clutch, whereupon the cam shaft 129 and its various cams are rotated through one revolution and then again stopped by the latch 130. Fig. 3 shows these parts in their inactive positions just before the mercury switch has been closed.

Many of the elements at the left side of Fig. 1 may be conveniently grouped, particularly as to driving connections, into the following mechanisms: supply package core doffing mechanism; supply package feeding mechanism, having a delivery portion and a magazine portion; thread-placing mechanism; and mechanism for severing the held end of the new thread.

These several mechanisms are shown as operated from the cam shaft 129, the supply package core doffing mechanism through cam 150, cam follower 150^a and double crank 150^b; the delivery portion of the supply package feeding mechanism through cam 151, cam follower 151^a and double crank 151^b; the thread-placing mechanism through cam 152, cam follower 152^a and double crank 152^b; and the magazine portion of the supply package feeding mechanism and also the thread-severing mechanism through a cam 153 and cam follower 153^a and double crank 153^b. The several double cranks are shown as pivoted on a common shaft 155.

Supply package core doffing mechanism

The supply package core doffing mechanism includes a plate 160 pivotally mounted at 161 on the outer end of the double crank 153^b and adapted to rise and fall with the up and down motion of the outer arm of such crank. In the inactive position of this mechanism the plate

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160 rests against a stationary guard plate 162 with the upper edge of the plate somewhat below the bottom of a supply package core on the peg 100. Actuation of this mechanism raises the plate 160 so that it slides up along the conical centering member 100^a of the peg into contact with the bottom of the supply package core and thence further upward along the peg 100, pushing the supply package core endwise off the peg, whereupon the doffing plate 160 returns to its lower inactive position. The winding unit is thus prepared for the reception of a new supply package.

Delivery portion of supply package feeding mechanism

The outer arm of the double crank 151^b, as shown in Fig. 4, carries a shaft 170 on which a chute or cradle 171 is held, parallel to shaft 170, by arms 172 and 173.

The chute 171 itself has an open ended bottom, which however is closed in the inactive position of the chute (Figs. 3 and 4) by a detent 177 against which the bottom of a new supply package P' is adapted to rest. The detent 177, as best shown in Fig. 11, is pivotally mounted at 177^a to the outer arm of double crank 151^b and is normally held by a spring 177^b against a stop 177^c which is fast on the double crank 151^b. The detent thus is movable with the chute 171 as the chute is swung to the right, and in the first part of such movement the detent maintains the bottom of the chute closed.

Upon actuation of the cam 151, the chute 171 and detent 177 are swung to the right, the chute coming into axial alignment with the peg 100 and with the open throat between the yarn guides 102 and 103. In the last part of this movement of the chute the detent 177 strikes the lower part of the winding unit and is detained in the position of Fig. 5 so that the bottom of the chute 171 opens and the new package P' drops onto the peg, as shown in Fig. 5. Chute 171 normally faces as shown in Fig. 1, but can pivot a few degrees around the axis of shaft 170 (toward the observer in Fig. 5) against the restoring force of a coil spring 175. The pivotal mounting of the chute 171 around the axis of its shaft 170 permits the chute to accommodate itself to the traveling movement of the winding unit. After delivery of a new package to the peg, the chute 171 returns to its inactive position shown in Fig. 3 and in full lines in Fig. 4.

Magazine portion of supply package feeding mechanism

Various forms of mechanisms may be employed to advance a reserve supply package P' to the chute 171 or equivalent delivery portion of the feeding mechanism, and to hold the leading end of the thread for engagement by the thread-placing mechanism.

In the preferred form of mechanism shown, the reserve supply packages P' are contained in a rotatable magazine having a circularly arranged series of circular containers 180 each adapted to hold an individual package P'. Containers 180 are rotatable with a hub plate 181 around a vertical axis, and the hub plate is provided with a ratchet wheel 182 adapted to be advanced step by step, clockwise, by a ratchet pawl 183 operated by a crank arm 183^a, shaft 183^b, crank arm 183^c and link 184 from the upper arm of the double crank 153^b.

A stationary plate 185 closes the bottoms of the containers excepting at a cut-out portion 185^a

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of plate 185 above a stationary chute 186. As a container 180 arrives above chute 186, its package drops down chute 186 into the previously described tilting chute 171 which is then in its inactive position of Fig. 3.

At the central axis of the magazine a small diameter suction pipe 187, having an open top, extends down into a suction box 187^a from which air is continuously drawn by a fan 187^b. In filling the containers 180 of the magazine, the operator pulls off a short length of the leading end of thread of each package and drops it into the open top of the suction pipe 187 where the end of thread is thus held. Each container 180 is provided with a vertical slot 180^a (Fig. 1) extending from top to bottom through which a part of the thread can leave the container as the package P' drops into the chute 171 as shown in Fig. 4 and along which the thread can move upwardly as the package and thread move to the dotted line positions of Fig. 4 and then to the position of Fig. 5, the end of thread still being held by the suction pipe 187.

In the normal inactive position of the mechanism as shown in Fig. 3 the delivery chute 171 is empty and the rotatable magazine is stopped in a position such that a container 180 holds a reserve supply package P' adjacent to but not directly over the cut-out portion 185^a of the stationary plate 185. Near the beginning of a cycle of rotation of the cam shaft 129, the cam 153 acts through its connections to the pawl 183 to rotate the magazine sufficiently to discharge this reserve supply package P' from its container, down through the stationary chute 186 into the tilting chute 171 as shown in Fig. 4, the magazine then stopping. The delivery chute 171 then tilts from its full line position of Fig. 4 through its dotted line position of Fig. 4 to its position of Fig. 5, to deliver the package P' to the adjacent winding unit.

Thread-placing mechanism

The thread-placing mechanism, in its preferred form, is adapted to place the new threads into thread guides of a type that is not self-threading.

In entering the apparatus shown in Fig. 1, the thread guides of the winding units will each normally lie in the region of the tapered tip of the wound bobbin of the winding unit, but not in exactly uniform positions in the several winding units. An overhead cam 189, Fig. 1, is adapted to engage successively with the upstanding rollers 42 of the thread guide assemblies, to carry these outwardly to a uniform position relative to the winding units, such as shown by the isolated thread guide assembly (shown separately from its winding unit) at the right end of the cam 189 in Fig. 1.

The thread-placing mechanism includes a bent arm 190 pivotally mounted at 191 and connected by a link 192 to the outer arm of the double crank 152^b so that actuation of the cam 152 first lowers the bent arm 190 from its elevated position of Fig. 3 to its low position of Fig. 4 and then raises it to its elevated position in which the winding unit can pass beneath its outer end.

Bent arm 190 carries an extension 195 rotatably mounted thereon, the extension 195 having an end portion lying approximately horizontally in the elevated position of arm 190, and adapted to serve as a thread hook. As the chute 171 and new package P' swing to the right from their full line positions in Fig. 4, a bent guide wire 196 (Figs. 1 and 4) deflects the thread T'

laterally away from the extension or thread hook 195, toward the observer in Fig. 4, allowing the thread to lie above the hook as soon as the thread passes the end of wire 196. The suction conduit 187, tending to draw in the thread, prevents slackness in the thread.

As the bent arm 190 rises, the hook 195 receives the thread T' in a notched portion 195^a (see Figs. 6^a and 6^b) and forms a loop of this thread, carrying this loop of thread upwardly in front of the approaching winding unit to a level above the thread guide assembly of the winding unit as shown in Fig. 5. As will subsequently appear, means are provided for casting off this loop of thread onto the thread guide. The generally vertically extending run of thread T' from the new package P' on the peg of the winding unit to the elevated hook lies in front of the guide wires 102, 103 so that forward movement of the winding unit causes the thread to enter between the guide wires and between the tension disks 104, 104.

This same run of the thread T', extending from the new package P' to the hook, also lies in front of the approaching throat 23^a of the forward eye 23^a of the thread guide assembly as shown in Figs. 6^a and 6^b, and forward movement of the winding unit relative to the hook causes this run of the thread to enter the forward eye 23^a through the throat 23^a. Figs. 7^a and 7^b show this run of thread about to enter the throat 23^a and Figs. 8^a and 8^b show this run of thread seated in the forward eye 23^a. The other run of the thread T', from the hook 195 to the held end, being laterally displaced from the first run of the thread, does not enter the throat 23^a. At the position of Figs. 8^a and 8^b this other run of the thread T' is somewhat to the rear of the throat 23^f of the inner thread guide eye, but generally in alignment with this throat 23^f. At this stage the upstanding roller 42 on the thread guide assembly engages the hook 195, swinging it about the lever 190 against the action of a spring 195^b until the loop of thread is cast off over the outer end of hook 195 and onto the thread guide, whereupon the thread enters the inner eye 23^b and extends directly between the two eyes of the thread guide assembly as shown in Figs. 9^a and 9^b.

As shown in Fig. 5, the run of thread that extends from the hook 195 to the held leading end of thread is bent around a horizontal suction tube 200 extending along the path of travel of the winding units and having along its bottom a slit 201 into which this thread can enter when cut as subsequently described, and along which the thread can travel. Thus during the initial part of the action of the thread-placing hook the thread T' is held and maintained taut by the suction conduit 187. Preferably just before the thread is cast off from the hook 195 the thread is allowed to enter into the suction conduit 200 which then holds the thread taut during and following casting off the thread onto the thread guide and during shifting the thread into position for engagement with a new empty bobbin B'.

The suction conduit 200 may be connected to any suitable source of suction, such as the suction box 187^a, by a suitable branch connection 200^a.

Mechanism for first severing the held end of the new thread

Slightly before the thread-placing hook 195 releases the thread, continued rotation of the

cam 153 actuates the pawl 183 a second time during the same cycle, to rotate the ratchet 182 and magazine further to their next inactive position.

During this second step of rotation of the magazine, the thread extending from the hook 195 under the suction tube 200 and to the suction pipe 187 (Fig. 5) still extends through the vertical slit 183^a of the magazine container which previously carried its package P', so that the run of thread from such container to the suction pipe 187 is moved clockwise in Fig. 1 by this rotation of the magazine. This movement carries this portion of thread into a cutter having a stationary lower blade 219 and a pivoted upper blade 220 (Fig. 10). The hub plate 181 of the magazine carries a series of cam-like projections 222 engageable with a cam follower lever 223 to raise this lever and a connected link 225 which in turn is connected to the pivoted blade 220, so that the last portion of rotation of the magazine closes the pivoted blade and cuts the thread. The portion of thread extending from the cutter to the suction pipe 187 is drawn down into the suction pipe. The portion of thread extending from the cutter to the horizontal suction tube 200 is drawn into the slit 201 of the suction tube 200 and the thread is thereupon held by this tube but can move along with its winding unit. The cutter comprising blades 219 and 220 is sufficiently distant from tube 200 to provide a length of thread, between the tube and cutter, adequate to be held by the tube. Fig. 11 shows the winding unit with its new supply package P' in place and with its new thread T' under the control of the thread guide and suction tube 200, and moving along the slit 201 of the suction tube 200.

Reference has been made to two steps of rotation of the magazine, the first near the beginning of the cycle, resulting in discharge of the package P' from its container 180, and the second near the end of the cycle, resulting in cutting of the thread, and it will be observed for instance in Fig. 3 that cam 153 has two rises which cause these two steps of rotation per cycle, whereas the other cams 150, 151 and 152 each have only a single rise.

Association of new supply thread with new winding bobbin

In being prepared for association with a new winding bobbin, the newly supplied thread T' (Fig. 11) extends through a somewhat different course from that of an old thread T and is not connected to the completed wound bobbin and does not initially extend through the thread detector 187. It will be noted here that both runs of the thread T' lie in front of the rod 36. The run of thread T' that extends from the thread guide inner eye 23^b to the suction slit 201 is first engaged by the lower cam plate 32 and plowed over toward the region of the base chuck, and a little later the other run of thread from the package P' and tension disks to the outer thread guide 23^a is engaged in similar fashion by the plate 32 and similarly plowed. Such plowing of the thread tends to increase the length of run of thread between the package and the suction tube 200, and particularly that portion between the thread guide and suction tube, and in this operation the suction tube can allow some of the thread to leave the suction tube through its slit to accommodate such increase, while maintaining a little tension on the thread to prevent slackness. The wound bobbin B is discharged from wind-

ing position, whereupon the bobbin lies on the plate 32, as shown in Fig. 14^a.

By engagement of its roller 42 with the overhead cam 44^a the thread guide assembly 23 is shifted from its position of Fig. 11 to a position above the inner or base chuck 24 as shown by Fig. 14^b. The upper cam plate 53 assumes charge of the run of thread extending from the inner eye 23^b to the suction slit 201 and acts in conjunction with the thread guide to position this run of thread across the face of the inner chuck as shown in Figs. 14^b and 15. Such shifting of the thread guide assembly to the base chuck tends to decrease the length of the run of thread between the package of the suction tube 200, and particularly that portion between the thread guide and suction tube, and in this operation the suction tube can draw thread into the suction tube through its slit to prevent slackness.

An empty bobbin B' is received from the swingable fingers 55 and 56 in a manner similar to that of Fig. 12^b, as shown in Fig. 14^b and the outer chuck 25 closes upon this empty bobbin B' as shown in Fig. 14^c and withdraws it from the bobbin-feeding mechanism. The thread extending from the base chuck 24 to the suction slit 201 enters between the blades of the previously mentioned cutter 50, cutting off the thread close to the base chuck and allowing this to be sucked in and drawn away by the suction tube 201.

Preparatory to starting winding on the winding unit, the detector wire 107 is raised to a position above the new thread T' so that it hooks over the new thread. Referring to Figs. 1, 16 and 17, the upper plow plate 53 carries a cam 211, and the rotatable knock-off rod 107^d of the traveling unit carries a crank arm 212 (Fig. 17) adapted to be engaged by the cam. This engagement rotates the knock-off rod and the latch member 107^c clockwise, forcing down the rearwardly extending crank portion 107^d of the detector wire, thus momentarily raising the outer hooked end of the detector wire as in Fig. 17 to a place before the thread, following which the detector wire can drop slightly into engagement with the thread as in Fig. 14^b.

Various modes of operation

From the foregoing it will be seen that new supply packages are automatically fed to the winding units as needed and their threads are automatically associated with new empty bobbins.

Although the invention finds its fullest utility in operations in which the winding units present themselves with their supply threads in different conditions, that is, some intact and some broken or exhausted, the invention is also useful in the automatic feeding of supply packages to a whole group of winding units that may all require new supply packages.

It will be apparent that in the illustrated preferred form of machine the tilting mercury switch performs both the function of responding selectively to those winding units having a dropped detector wire indicating failure of supply, and also the function of initiating a cycle of supply package changing and thread-placing operations in the proper time relation to the passage of a winding unit.

In some cases it may be desirable to dispense with the selective response of the switch to winding units having a dropped detector wire, and use the switch or its equivalent only for its func-

tion of timing the beginning of the supply-changing and thread-placing operations.

For instance if the material being wound is sufficiently free from tendency to break, and if the new supply packages are each wound in the spinning frame to contain an even multiple, or slightly less than an even multiple, of the thread that is to be wound on each filling wound bobbin by the machine of this invention, then the detection of breakage or exhaustion can in some cases be dispensed with. The timing function of the switch can be maintained by providing each winding unit with any suitable portion (not necessarily a detector element) adapted to engage and tilt the switch as the winding unit passes the switch, and the circuit to the solenoid, controlled by the mercury switch, can be additionally controlled by any suitable switch under the control of the operator. Thus the supply-changing mechanism can be disabled or rendered operative at will by the operator, and when so rendered operative, will operate on each passing winding unit.

In this method of operation, starting with an empty winding machine, the supply-changing mechanism can first be rendered operative by the operator, and maintained so until each winding unit of the machine has encountered the supply-changing mechanism and received a supply package therefrom. Then the supply-changing mechanism can be rendered inoperative until the winding unit which had first received a supply has completed enough trips around the machine to wind the predetermined number of filling wound bobbins that are to be wound from a single supply package. The supply-changing mechanism can then again be rendered operative throughout another complete course of the winding units around the machine, to change the supplies of each winding unit.

The handling of the threads can be the same whether the changing of the supply is under the control of the thread detector of each winding unit individually, or is under the control of the operator.

We claim:

1. A winding machine comprising in combination means for rotatably holding a bobbin for winding of a thread thereon from a supply, means for holding a new thread extending from a different supply, unattached to the winding bobbin, means for automatically replacing the wound bobbin with a new bare bobbin by discharging the wound bobbin from the holding means and delivering a new bare bobbin to the holding means, and means for automatically attaching such new thread from such different supply to the new bare bobbin, said attaching means including thread-positioning mechanism acting to place the thread from said different supply in place to be engaged by said new bare bobbin as the latter is delivered to said holding means.

2. A winding machine comprising in combination means for rotatably holding a bobbin for winding of a thread thereon, means for automatically replacing the wound bobbin with a new bare bobbin by discharging the wound bobbin from the holding means and delivering a new bare bobbin to the holding means, a supply holder for holding a supply of thread to be wound, means for automatically delivering a new supply of thread to said supply holder, and means for automatically attaching the thread of the new supply to the new bare bobbin, said

attaching means including thread-positioning mechanism acting to place the thread from said different supply in place to be engaged by said new bare bobbin as the latter is delivered to said holding means.

3. A winding machine comprising in combination a plurality of winding units each including means for rotatably holding a bobbin for winding thread thereon and means for holding a supply of thread to be wound, a winding unit tending mechanism, and means for causing relative traveling movement between the tending mechanism and the winding units to present the tending mechanism successively to the winding units, the tending mechanism including means for delivering new supply threads to the supply holders of the winding units and means for delivering new bare bobbins to the bobbin holders of the winding units, and the machine including means for automatically attaching such new threads to such new bare bobbins; said attaching means including thread-positioning mechanism acting to place the thread from said different supply in place to be engaged by said new bare bobbin as the latter is delivered to said holding means.

4. A winding machine comprising in combination a plurality of traveling winding units each including means for rotatably holding a bobbin for winding thread thereon and means for holding a supply of thread to be wound, a winding unit tending mechanism past which the winding units travel, the tending mechanism including means for delivering new supply threads to the supply holders of the winding units and means for delivering new bare bobbins to the bobbin holders of the winding units, and the machine including means for automatically attaching such new threads to such new bare bobbins, said attaching means including thread-positioning mechanism acting to place the thread from said different supply in place to be engaged by said new bare bobbin as the latter is delivered to said holding means.

5. A winding machine comprising in combination means for rotatably holding a bobbin for winding, means for automatically discharging a wound bobbin from said bobbin-holding means, a supply holder for holding a supply of thread to be wound, means for automatically delivering a new supply of thread to said supply holder, means for automatically positioning the thread of the new supply in position to be held against a portion of said bobbin-holding means by a new bobbin subsequently supplied thereto, and means for supplying a new bobbin to said bobbin-holding means in contact with the thus positioned thread of the new supply.

6. A winding machine comprising in combination a plurality of winding units each including means for rotatably holding a bobbin for winding thread thereon and means for holding a supply of thread to be wound, a winding unit tending mechanism, and means for causing relative traveling movement between the tending mechanism and the winding units to present the tending mechanism successively to the winding units, the tending mechanism including means for delivering new supply threads to the supply holders of the winding units, the machine including means for automatically positioning the thread of the supply in position to be held against a portion of the bobbin-holding means by a new bobbin subsequently supplied thereto, and the

tending mechanism including means for supplying such new bobbin to said bobbin holding means to engage with the thus positioned thread of the new supply.

7. A winding machine comprising in combination a plurality of traveling winding units each including means for rotatably holding a bobbin for winding thread thereon and means for holding a supply of thread to be wound, a winding unit tending mechanism past which the traveling winding units travel, the tending mechanism including means for delivering new supply threads to the supply holders of the winding units, the machine including means for automatically positioning the thread of the supply in position to be held against a portion of the bobbin-holding means by a new bobbin subsequently supplied thereto, and the tending mechanism including means for supplying such new bobbin to said bobbin-holding means to engage with the thus positioned thread of the new supply.

8. A winding machine including means for holding a winding bobbin for winding thereon from a supply, automatic bobbin-changing mechanism presented to said holding means periodically and arranged to furnish a new winding bobbin to said holding means at each such presentation, and mechanism acting preparatory to the bobbin-changing mechanism and comprising a detector of failure of thread of the supply, mechanism responsive to such detection for changing the supply, and mechanism for positioning the leading end of a new supply in position for engagement by a new winding bobbin to be furnished by the bobbin-changing mechanism.

9. A winding machine including a plurality of winding units each adapted to hold a supply of thread, and winding bobbin-changing mechanism, with relative movement between the winding units and the bobbin-changing mechanism to present the changing mechanism to the several winding units in regular order, the changing mechanism being constructed to act on each winding unit to furnish a new winding bobbin thereto at each passage of the unit and changing mechanism, mechanism acting preparatory to the bobbin-changing mechanism and comprising a detector of failure of thread of the supply, mechanism responsive to such detection for changing the supply, and mechanism for positioning the leading end of a new supply thread in position for engagement by a new winding bobbin to be furnished by the bobbin-changing mechanism.

10. A winding machine including a plurality of traveling winding units each adapted to hold a supply of thread, and winding bobbin-changing mechanism past which the winding units travel, the changing mechanism being constructed to furnish a new winding bobbin to each winding unit at each passage of the winding unit past the changing mechanism, means for detecting failure of the supply thread of a winding unit approaching the bobbin-changing mechanism; a magazine for new supplies of thread for the winding units, said magazine being controlled by said detecting means to deliver new supply thread selectively to those winding units upon which such failure of the supply has been detected, and mechanism for positioning the leading end of a new supply thread in position for engagement by a new winding bobbin to be furnished by the bobbin-changing mechanism.

11. In a winding machine including automatic winding bobbin delivering mechanism and constructed to permit winding from the same supply of thread onto successive winding bobbins: mechanism acting preparatory to the action of the bobbin delivering mechanism and comprising a detector of failure of the supply, mechanism responsive to such detection for changing the supply, and mechanism for positioning the leading end of a new supply thread in position for engagement by a new winding bobbin to be furnished by the bobbin delivering mechanism.

12. In a winding machine including a plurality of winding units and automatic winding bobbin delivering mechanism presented to the successive winding units by relative traveling movement between the winding units and the bobbin delivering mechanism, the machine being constructed to permit winding from the same supply of thread on a winding unit onto the successive winding bobbins delivered to the unit by said delivering mechanism: mechanism acting preparatory to the action of the bobbin delivering mechanism upon a winding unit and comprising a detector of failure of the supply of thread of the winding unit, mechanism responsive to such detection for changing the supply, and mechanism for positioning the leading end of a new supply thread in position for engagement by a new winding bobbin to be furnished by the bobbin delivering mechanism.

13. In a winding machine including a plurality of traveling winding units and automatic winding bobbin delivering mechanism past which the winding units travel, the machine being constructed to permit winding from the same supply of thread on a winding unit onto the successive winding bobbins delivered to the unit by said delivering mechanism: mechanism acting preparatory to the action of the bobbin delivering mechanism upon a winding unit and comprising a detector of failure of the supply of thread of the winding unit, mechanism responsive to such detection for changing the supply, and mechanism for positioning the leading end of a new supply thread in position for engagement by a new winding bobbin to be furnished by the bobbin delivering mechanism.

14. A winding machine including means for holding a winding bobbin, means for winding from a supply onto the bobbin, means for discharging the wound bobbin from winding position, means for furnishing a new bobbin to the winding bobbin-holding means, thread-positioning means for moving the thread from the old formerly unwinding supply into position for engagement with the new bobbin for further winding from said supply, a detector responsive to failure of thread of the supply, and mechanism controlled by the detector for carrying thread of a new supply into position for engagement with said thread-positioning means.

15. A winding machine including means for holding a winding bobbin, means for winding from a supply onto the bobbin, means for discharging the wound bobbin from winding position, means for furnishing a new bobbin to the winding bobbin-holding means, means for positioning the thread of the old formerly unwinding supply in position for engagement with the new bobbin, a detector responsive to failure of thread of the supply, and mechanism controlled by the detector for substituting a new supply

thread for a missing old thread in position for engagement by the new bobbin.

16. A winding machine including a bobbin-holding center adapted to hold a winding bobbin, means for winding thread from a supply onto the bobbin, means for discharging the wound bobbin from said center, means for furnishing a new bobbin to said center, means for placing the old supply thread across said center for engagement by the new bobbin, a detector responsive to failure of thread of the supply, mechanism controlled by the detector for substituting a new supply thread for a missing old thread, across said center for engagement by the new bobbin.

17. A winding machine including means for holding a winding bobbin, a thread guide for distributing the thread on a winding bobbin, means for discharging a wound bobbin from winding position, means for carrying the run of thread extending past the thread guide into position for engagement by a new bobbin, a detector responsive to failure of thread of the supply, and mechanism controlled by the detector for substituting a new supply thread in place of the old supply thread, in said thread guide, to permit said new supply of thread to be carried into position for engagement by a new bobbin.

18. A winding machine including a thread guide having a progressive movement of its range of traverse to wind a filling wound bobbin, means for discharging a wound bobbin from winding position, means for carrying the run of thread extending past the thread guide into position for engagement by the end of a new bobbin, a detector responsive to failure of thread of the supply, and mechanism controlled by the detector for substituting a new supply thread in place of the old supply thread, in said thread guide, to permit said new supply thread to be carried into position for engagement by the end of a new bobbin.

19. A winding machine including a plurality of traveling winding units each adapted to wind a thread from a supply onto a bobbin, and a thread guide having a progressive movement of its range of traverse from adjacent to the base of the bobbin to adjacent to the tip of the bobbin to wind the thread onto the bobbin with a filling wind, means operative at a place in the travel of the winding units to discharge the bobbins from winding position while leaving the threads of the supplies in engagement with the thread guides, means for shifting the thread guides of the successive units to a position adjacent to the position to be occupied by the base end of a new bobbin, for engagement of the thread with the end of such new bobbin, a detector responsive to failure of thread of the supplies of the several winding units, and mechanism controlled by the detector for substituting a new supply thread in place of the old supply thread, in the thread guide of the winding unit, to permit such new supply thread to be carried into position for engagement by the end of the new bobbin.

20. A winding machine including a plurality of winding units each adapted to wind from a supply onto a bobbin, a detector on each winding unit for detecting failure of thread of the supply of that unit, the machine including means for stopping winding on the winding units and, as to those units on which the supply thread has not failed, permitting the detectors to indicate

the presence of such supply thread after such stopping of winding, supply-changing mechanism presented periodically to the several winding units after such stopping of winding, the supply-changing mechanism including control mechanism therefor actuable by the individual detectors of the successive winding units to avoid change of the supply in the event of presence of available supply thread on the winding unit.

21. A winding machine including a plurality of winding units each adapted to wind from a supply onto a bobbin, a detector on each winding unit for detecting failure of thread of the supply of that unit, the machine including means for stopping winding on the winding units and, as to those units on which the supply thread has not failed, permitting the detectors to indicate the presence of such supply thread after such stopping of winding, supply-changing mechanism and bobbin-changing mechanism each presented periodically to the several winding units after such stopping of winding, the supply-changing mechanism including control mechanism therefor actuable by the individual detectors of the successive winding units to avoid change of the supply in the event of presence of available supply thread on the winding unit and said bobbin-changing mechanism acting invariably to supply a bobbin to each winding unit irrespective of the operation or non-operation of the supply-changing mechanism.

22. A winding machine including means for holding a winding bobbin, means for rotating the bobbin to wind thereon from a thread supply, means for discharging a bobbin from winding position, means for furnishing a new winding bobbin to said holding means, a thread plow adapted to move the thread from said supply into position for engagement between said bobbin-holding means and a new bobbin supplied thereto, and mechanism for holding a thread of a new supply in position to be engaged by said thread plow.

23. A winding machine including means for holding a winding bobbin, means for rotating the bobbin to wind thereon from a thread supply, means for discharging a bobbin from winding position, means for furnishing a new winding bobbin to said holding means, cooperating members on opposite sides of the position of the winding bobbin for moving the thread from said supply into position for engagement between said bobbin-holding means and the new bobbin supplied thereto, and mechanism for holding a thread of a new supply in position to be engaged by said cooperating members.

24. A winding machine including means for holding a winding bobbin, means for rotating the bobbin to wind thereon from a thread supply, means for furnishing a new winding bobbin to said holding means, thread-positioning means adapted to position the thread from said supply for engagement between said bobbin-holding means and said new bobbin furnished to the bobbin holding means for further winding from said supply, mechanism for carrying a thread of a new supply into engagement with said thread-positioning means, and means for holding the end of such new thread during operation of the thread-positioning means.

25. A winding machine including means for holding a bobbin for winding thread thereon from the supply, a thread guide for distributing the thread on the winding bobbin, supply-thread holding means for holding a leading end of thread

of a new supply as yet unconnected to thread of the bobbin to be wound, mechanism for placing a portion of the thread of the new supply in the thread guide while said leading end is so held, and means for associating the thread which has been placed in the thread guide with a bobbin for winding thereon.

26. A winding machine including a plurality of winding units each including means for rotatably supporting a winding bobbin and a thread guide for distributing thread onto the winding bobbin, mechanism cooperating successively with such winding units in succession to place in the thread guide of the unit a new supply thread as yet unconnected to thread of the bobbin to be wound, and mechanism cooperating successively with the winding units to associate the thread which has been so placed in the thread guide with a bobbin for winding thereon.

27. A winding machine including a plurality of winding units each including means for rotatably supporting a winding bobbin and a thread guide for distributing thread onto the winding bobbin, the thread guide having a progressive movement of its range of traverse so as to distribute the thread on the bobbin with the filling wind, mechanism for positioning the thread guides of the several winding units in a predetermined location upon completion of the winding of a filling wound bobbin on the unit, mechanism cooperating successively with the thread guides of the several winding units to place in the thread guide a new supply of thread as yet unconnected to thread of the bobbin to be wound, and mechanism cooperating successively with the winding units to associate the thread which has been so placed in the thread guide with a bobbin for winding thereon.

28. A winding machine including a plurality of traveling winding units each including means for rotatably supporting a winding bobbin and a thread guide for distributing thread onto the winding bobbin, the thread guide having a progressive movement of its range of traverse so as to distribute the thread on the bobbin with the filling wind, mechanism for positioning the thread guides of the several winding units in a predetermined location upon completion of the winding of a filling wound bobbin on the unit, mechanism cooperating successively with the thread guides of the several winding units to place in the thread guide a new supply of thread as yet unconnected to thread of the bobbin to be wound, and mechanism cooperating successively with the winding units to associate the thread which has been so placed in the thread guide with a bobbin for winding thereon.

29. In a winding machine including a plurality of traveling winding units each including means for rotatably supporting a winding bobbin and a thread guide for distributing thread onto the winding bobbin, mechanism past which the winding units travel and adapted to act on the traveling winding units to place in the thread guides new supply threads as yet unconnected to threads of the bobbins to be wound, and mechanism acting on the threads after they have been so placed in the thread guides to associate the threads with bobbins for winding thereon.

30. A winding machine including means for holding a bobbin for winding thread thereon from the supply, a thread guide for distributing the thread on the winding bobbin, supply-thread holding means for holding a leading end of thread of a new supply, means for placing a por-

tion of the thread of the new supply in the thread guide while said leading end is so held, and means for clamping against a new bobbin a portion of the thread which has been placed in the thread guide, to connect the thread with said bobbin.

31. A winding machine including a plurality of traveling winding units each including a thread guide for distributing winding thread, a hook past which the winding units move, said hook being movable downwardly from a position above the level of a thread guide of a winding unit to pick up a new thread, and being movable upwardly to above the thread guide to place the thread in front of the thread guide of the traveling unit, so that the traveling motion of the winding unit brings the thread guide into engagement with such new thread, and means for releasing the new thread from the hook to the thread guide.

32. A winding machine including a plurality of traveling winding units each including a thread guide for distributing winding thread, a hook past which the winding units move, said hook being movable upwardly to carry a loop of a new thread above the level of an approaching traveling thread guide, the thread guide having an eye positioned so that the forward movement of the thread guide with the traveling unit causes said eye to receive one of two generally vertically extending runs of the loop of thread, the thread guide having a further eye, and means for causing the hook to release the thread to such further eye.

33. A winding machine including a plurality of traveling winding units each including a thread guide for distributing the winding thread, means for delivering supply packages of thread to the traveling winding units, a holder for the end of the thread of the delivered supply package, and means for placing, in front of the thread guide of the traveling unit in position for reception thereby, a portion of the thread which extends between the delivered supply package and said holder, for reception of the thread by said thread guide.

34. A winding machine including a plurality of traveling winding units each including a thread guide for distributing the winding thread, the thread guide having an open eye opening in the direction of travel of the winding unit, means for delivering supply packages of thread to the traveling winding units, a holder for the end of the thread of the delivered supply package, and means for placing, in front of said open eye of the thread guide of the traveling unit, a portion of the thread which extends between the delivered supply package and said holder, for reception of the thread by said thread guide.

35. A winding machine including a plurality of traveling winding units each including a thread guide for distributing the winding thread, means for delivering supply packages of thread to the traveling winding units, a holder for the end of the thread of the delivered supply package, and means for placing, in front of the thread guide of the traveling unit, a portion of the thread which extends between the supply package and said holder, for reception of the thread by said thread guide, said thread-placing means being movable to release said thread upon reception of the thread by the thread guide.

36. In a winding machine, the combination of a thread guide adapted to distribute the winding thread, a holder for the end of thread to be

wound, a hook movable into engagement with the thread to be wound to form a loop of thread in position to be cast off onto the thread guide, means for casting off such loop onto the thread guide, and means for clamping a portion of the thread, extending between the thread guide and the held end, against the bobbin.

37. In a winding machine, the combination of a thread guide adapted to distribute the winding thread, said thread guide including two open eyes, a hook for placing the thread in the thread guide, means for causing a relative motion between the hook and thread guide such as first to form a loop of thread over the thread guide and then to cast off the loop from the hook, said eyes being adapted to receive the loop thus cast off, and means for tightening the thread during the casting off.

38. In a winding machine the combination of a thread guide adapted to distribute the winding thread, said thread guide including two open eyes, a hook for placing the thread in the thread guide, means for carrying the hook from below to above the thread guide so as to form a loop of thread over the thread guide, means for casting off the loop from the hook, said eyes being adapted to receive the loop thus cast off, and means for tightening the thread during the casting off.

39. A winding machine including a plurality of winding units each adapted to wind thread onto a winding bobbin and including a thread guide for distributing the winding thread on the bobbin, a holder for the ends of threads to be wound, a hook movable into engagement with threads to be wound by the various winding units to form loops of such threads in position to be cast off onto the thread guides of the winding units, means for casting off such loops onto the thread guides, and means for clamping a portion of each thread, extending between the thread guide and the held end, against a bobbin.

40. A winding machine including a plurality of winding units each adapted to wind thread onto a winding bobbin and including a thread guide for distributing the winding thread on the bobbin, mechanism for delivering new supplies of thread to the several winding units, a holder for the ends of thread to be wound, a hook movable into engagement with the new threads of the various winding units to form loops of such threads in position to be cast off onto the thread guides of the winding units, means for casting off such loops onto the thread guides, and means for clamping a portion of each thread, extending between the thread guide and the held end, against a bobbin.

41. A winding machine including a plurality of traveling winding units each adapted to wind thread onto a winding bobbin and including a thread guide for distributing the winding thread on the bobbin, a holder for the ends of thread to be wound, a hook past which the traveling units move, said hook being movable into engagement with the threads to be wound by the various winding units to form loops of such threads in position to be cast off onto the thread guides of the winding units, means for casting off such loops onto the thread guides, and means for clamping a portion of each thread, extending between the thread guide and the held end, against a bobbin.

42. A winding machine including a plurality of traveling winding units each adapted to wind

thread onto a winding bobbin and including a thread guide for distributing the winding thread on the bobbin, mechanism for delivering new supplies of thread to the several winding units, a holder for the ends of thread to be wound, a hook past which the traveling units move, said hook being movable into engagement with the new threads of the various winding units to form loops of such threads in position to be cast off onto the thread guides of the winding units, means for casting off such loops onto the thread guides, and means for clamping a portion of each thread, extending between the thread guide and the held end, against a bobbin.

43. A winding machine including a plurality of traveling winding units and a magazine adapted to hold a plurality of supply packages and discharge such supply packages to winding units as the units travel past the magazine, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to a winding unit, and a member engageable with the run of thread extending from the discharged supply package to said holder for placing a portion of such thread in advance of a part of the traveling unit for engagement thereby while the end of such run of thread is held by said holder.

44. A winding machine including a plurality of traveling winding units each including a thread guide adapted to distribute the winding thread, a magazine adapted to hold a plurality of supply packages and to discharge such supply packages to said winding units, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to the winding unit, and a member engageable with the run of thread from such discharged supply package to said holder for moving the thread into a position in advance of the thread guide of a traveling winding unit for association with the thread guide of said winding unit while the end of such run of thread is held by said holder.

45. A winding machine including a plurality of winding units and a magazine adapted to hold a plurality of supply packages and discharge such supply packages to such winding units, the machine including means for causing a relative traveling movement between the magazine and the winding units so as to present the magazine to the successive units, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to a winding unit, and a member engageable with the run of thread extending from the discharged package to said holder for placing a portion of such thread in position to be engaged in the thread guide of the winding unit by such relative traveling movement.

46. A winding machine including a plurality of traveling winding units each including a thread guide adapted to distribute the thread, and a magazine adapted to hold a plurality of supply packages and discharge such supply packages to winding units as the units travel past the magazine, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to a winding unit, and a member engageable with the run of thread extending from

the discharged supply package to said holder for placing a portion of such thread in advance of the thread guide of the traveling unit for engagement thereby.

47. A winding machine including a plurality of traveling winding units each including a tension device, and a magazine adapted to hold a plurality of supply packages and discharge such supply packages to winding units as the units travel past the magazine, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to a winding unit, and a member engageable with the run of thread extending from the discharged supply package to said holder for placing a portion of such thread in advance of the tension device of the traveling unit for engagement thereby.

48. A winding machine including a plurality of winding units and a rotatable magazine adapted to be associated periodically with the winding units and adapted to hold a plurality of supply packages and including means for discharging such supply packages to the winding units, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to a winding unit, and means for severing the thread extending from a discharged package to said holder, the magazine having a step by step rotary motion, an initial step of such rotary motion rendering the discharging means operative to discharge a package from the magazine and a further step of such rotary motion rendering the severing means operative to sever the thread.

49. A winding machine including a plurality of winding units and a rotatable magazine adapted to be associated periodically with the winding units and adapted to hold a plurality of supply packages and including means for discharging such supply packages to the winding units, a holder for the ends of threads of the supply packages of the magazine, said holder being arranged to hold the end of thread of a package after discharge of the package from the magazine to a winding unit, means for severing the thread extending from a discharged package to said holder, the magazine having a step by step rotary motion, an initial step of such rotary motion rendering the discharging means operative to discharge a package from the magazine and a further step of such rotary motion rendering the severing means operative to sever the thread, a further holder adapted to receive the thread between said severing means and the discharged package, and means for carrying the thread into position to be engaged by said further holder in between the initial step and further step of rotary motion of the magazine.

50. A winding machine including means for rotating a winding bobbin and a thread guide for distributing the winding thread on the bobbin, means for placing in the thread guide a thread extending from a supply, a suction conduit adapted to hold the end portion of thread placed in the thread guide, and means for moving the thread guide away from the suction conduit and toward the region to be occupied by the base of the next bobbin, the suction conduit being adapted to take up thread during such movement of the thread guide.

51. A winding machine including means for rotating a winding bobbin and a thread guide

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for distributing the winding thread on the bobbin, means for placing in the thread guide a thread extending from a supply, a suction conduit adapted to hold the end portion of thread placed in the thread guide, and a plow arranged to plow a portion of the run of thread extending from the thread guide to the suction conduit away from the suction conduit and toward the region to be occupied by the base of the next bobbin to be wound, the suction conduit being adapted to let out thread as the thread is so plowed.

52. A winding machine including means for rotating a winding bobbin and a thread guide for distributing the winding thread on the bobbin, means for placing in the thread guide a thread extending from a supply, a suction conduit adapted to hold the end portion of thread placed in the thread guide, a plow arranged to plow a portion of the run of thread extending from the thread guide to the suction conduit away from the suction conduit and toward the region to be occupied by the base of the next bobbin to be wound, the suction conduit being adapted to let out thread as the thread is so plowed, and means for moving the thread guide away from the suction conduit and toward the region to be occupied by the base of the next bobbin, the suction conduit being adapted to take up thread during such movement of the thread guide.

53. A winding machine including a plurality of winding units each including means for winding thread upon a bobbin and a thread guide for distributing the winding thread, a winding unit tending mechanism, and means for causing relative traveling movement between the tending mechanism and the winding units to present the tending mechanism successively to the several units, the tending mechanism including means for placing threads in the thread guides of the winding units, a suction conduit adapted to hold the ends of threads so placed, and thread-positioning mechanism acting to shift a portion of the thread which extends from the thread guide to the suction conduit in preparation for association of a new bobbin with the thread, the suction conduit extending in the direction of such relative traveling movement and being longitudinally slotted to permit relative travel of a held thread with relation to said conduit during action of said thread-positioning mechanism.

54. A winding machine including a plurality of traveling winding units each including means for winding thread upon a bobbin and thread guide for distributing the winding thread, and a winding unit tending mechanism past which the several units travel, the tending mechanism including means for placing threads in the thread guides of the winding units, a suction conduit adapted to hold the ends of threads so placed, and thread-positioning mechanism acting to shift a portion of the thread extending from the thread guide to the suction conduit in preparation for association of a new bobbin with the thread, the suction conduit extending in the direction of traveling movement of the units and being longitudinally slotted to permit travel of a held thread along said conduit during action of said thread-positioning mechanism.

55. A winding machine comprising means for winding thread from a supply package onto a winding bobbin including a rotatable center for holding an end of such bobbin, a suction conduit for holding the end of thread of a supply package, thread-positioning mechanism engageable with a portion of thread extending between the pack-

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age and suction conduit to carry such portion of thread into position to be engaged between said center and a new winding bobbin delivered thereto, and means for delivering such new winding bobbin to said center in engagement with the so positioned thread.

56. A winding machine comprising means for winding thread from a supply package onto a winding bobbin including a rotatable center for holding an end of such bobbin, a suction conduit for holding the end of thread of a supply package, thread-positioning mechanism engageable with a portion of thread extending between the package and suction conduit to carry such portion of thread into position to be engaged between said center and a new winding bobbin delivered thereto, means for delivering such new winding bobbin to said center in engagement with the so positioned thread, and means for severing, adjacent to the new winding bobbin, the portion of thread extending therefrom to the suction conduit to allow such portion to be carried away by the suction conduit.

57. A winding machine including a plurality of winding units each adapted to wind thread from a supply package onto a winding bobbin and including a center for holding an end of a winding bobbin, and winding unit tending mechanism, there being relative traveling movement between the winding units and the tending mechanism so as to present the winding units in succession to the tending mechanism, the tending mechanism including a suction conduit extending along such path of relative movement for holding the ends of threads of supply packages and means for delivering new winding bobbins to said centers of the successive winding units, and the machine including thread-positioning mechanism engageable with a portion of thread extending between a package and the suction conduit to carry such portion of thread into position to be engaged between the center of a winding unit and a new winding bobbin delivered thereto.

58. A winding machine including a plurality of traveling winding units each adapted to wind thread from a supply package onto a winding bobbin and including a center for holding an end of a winding bobbin, and winding unit tending mechanism, past which the winding units travel in succession, the tending mechanism including a suction conduit extending along such path of relative movement for holding the ends of threads of supply packages and means for delivering new winding bobbins to said centers of the successive winding units, and the machine including thread-positioning mechanism engageable with a portion of thread extending between a package and the suction conduit to carry such portion of thread into position to be engaged between the center of a winding unit and a new winding bobbin delivered thereto.

59. A winding machine comprising in combination means for rotatably holding a bobbin for winding, means for automatically discharging a wound bobbin from said bobbin-holding means, a supply holder for holding a supply of thread to be wound, means for delivering a new supply of thread to said supply holder, a suction conduit adapted to receive an end of the thread of the new supply, means for automatically positioning the thread of the new supply in position to be held against a portion of said bobbin-holding means by a new bobbin subsequently supplied thereto, and means for supplying a new bobbin

to said bobbin-holding means in contact with the thread of the new supply.

60. A winding machine including a plurality of winding units each including a holder for rotatably holding a winding bobbin, a winding unit tending mechanism, and means for causing relative traveling movement between the tending mechanism and the winding units to present the tending mechanism successively to the several units, the tending mechanism including means for delivering new supplies of thread to the winding units, means for delivering empty bobbins to the bobbin holders of the winding units, means for positioning the thread of the new supply in position to be engaged between the bobbin holder of a winding unit and such empty bobbin delivered to the winding unit, and a suction conduit adapted to hold the ends of threads of the new supplies during operation of the thread-positioning means, the suction conduit extending in the direction of such relative traveling movement and being longitudinally slotted to permit relative travel of a held thread with relation to said conduit.

61. A winding machine including a plurality of traveling winding units each including a holder for rotatably holding a winding bobbin, and a winding unit tending mechanism past which the several units travel, the tending mechanism including means for delivering new supplies of thread to the winding units, means for delivering empty bobbins to the bobbin holders of the winding units, means for positioning the thread of the new supply in position to be engaged between the bobbin holder of a winding unit and such empty bobbin delivered to the winding unit, and a suction conduit adapted to hold the ends of threads of the new supplies during operation of the thread-positioning means, the suction conduit extending in the direction of traveling movement of the units and being longitudinally slotted to permit travel of a held thread along said conduit.

62. A winding machine including a plurality of winding units each adapted to wind onto a bobbin from a supply, supply-changing mechanism presented periodically to the winding units in succession, said supply-changing mechanism including supply delivering mechanism adapted to deliver a new supply to the winding unit and thread-placing mechanism adapted to place the thread of the new supply in the thread guide of the winding unit, a friction clutch constantly tending to drive the supply-changing mechanism, latch means normally latching the supply-changing mechanism against operation, and means for releasing said latch means to permit a single cycle of operation of the supply-changing mechanism upon presentation of the supply-changing mechanism to a winding unit.

63. A winding machine including a plurality of winding units each adapted to wind onto a bobbin from a supply, supply-changing mechanism presented periodically to the winding units

in succession, said supply-changing mechanism including supply delivering mechanism adapted to deliver a new supply to the winding unit and thread-placing mechanism adapted to place the thread of the new supply in the thread guide of the winding unit, a friction clutch constantly tending to drive the supply-changing mechanism, latch means normally latching the supply-changing mechanism against operation, means for detecting failure of the threads of the supplies of the several winding units, and means for releasing said latch means in the event of presentation of the supply-changing mechanism to a winding unit having failure of its supply thread.

64. A winding machine including a plurality of winding units each adapted to wind thread onto a bobbin and each including a holder for a supply of thread to be wound and a detector engageable with the winding thread and movable into a detecting position in the event of failure of the supply thread, the machine including mechanism controlled by the detectors of the several winding units for delivering fresh supply packages of thread to said holders of those winding units whose detectors have moved into detecting position, and mechanism for associating the threads of fresh supply packages delivered to winding units with bobbins for winding the threads on such bobbins.

65. A winding machine including a plurality of winding units each adapted to wind thread onto a bobbin and each including a holder for a supply of thread to be wound and a detector engageable with the winding thread and movable into a detecting position in the event of failure of the supply thread, the machine including mechanism controlled by the detectors of the several winding units for delivering fresh supply packages of thread to said holders of those winding units whose detectors have moved into detecting position, mechanism for associating the threads of fresh supply packages delivered to winding units with bobbins for winding the threads on such bobbins, and mechanism for automatically moving the detectors of individual winding units into engagement with the threads of such fresh supply packages.

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Executor under the will of Edward J. Abbott, deceased.

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