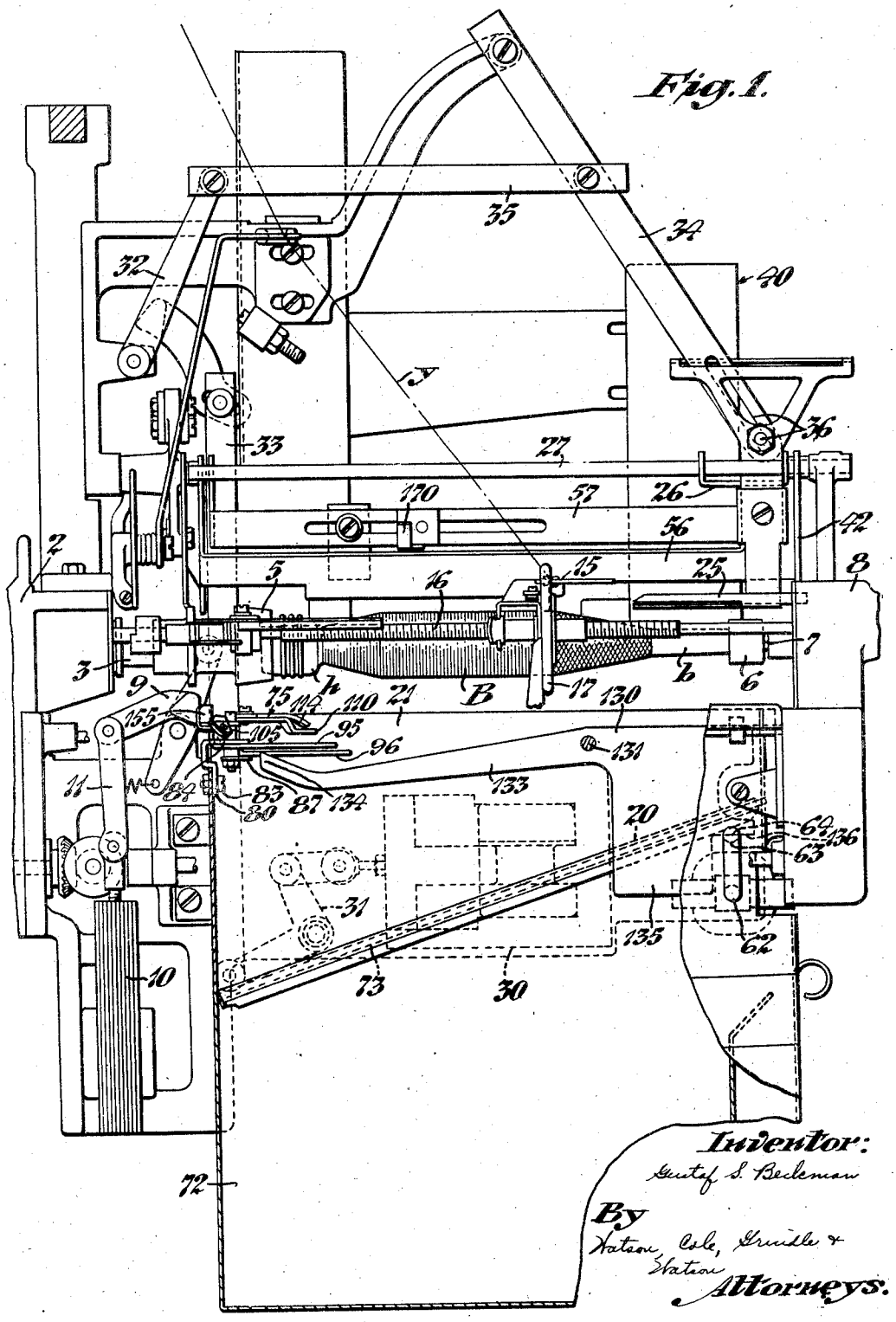
Oct. 31, 1944. G. S. BECKMAN 2,361,813

AUTOMATIC BOBBIN-WINDER

Filed Jan. 13, 1943 4 Sheets-Sheet 1

Fig. 1.



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AUTOMATIC BOBBIN-WINDER

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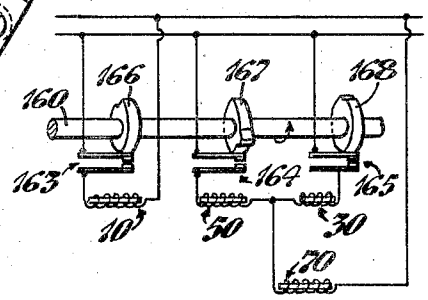


Fig. 13.

Fig. 2.

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AUTOMATIC BOBBIN-WINDER

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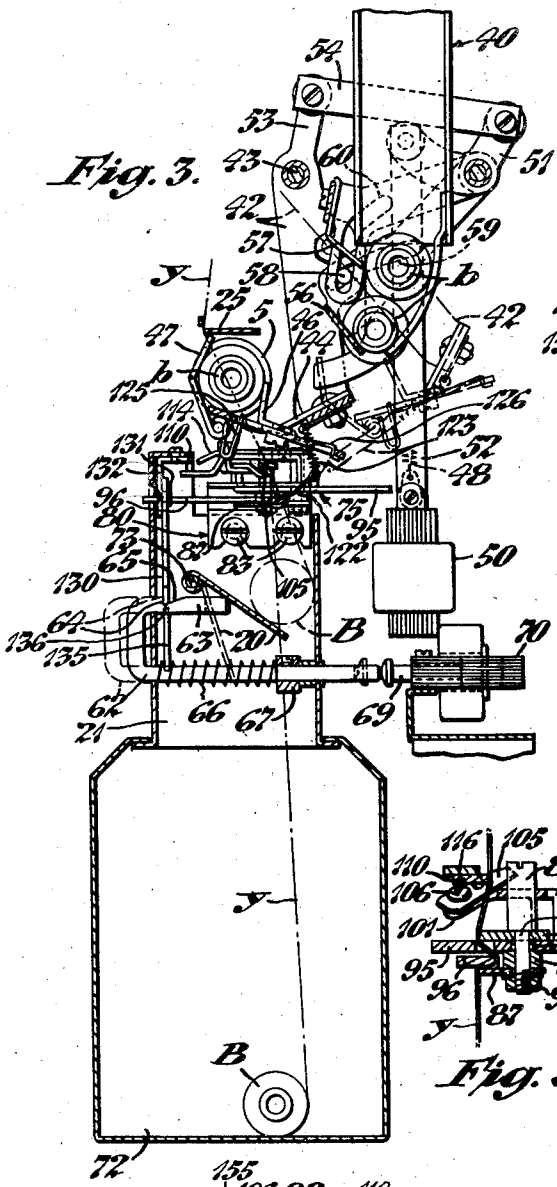


Fig. 3.

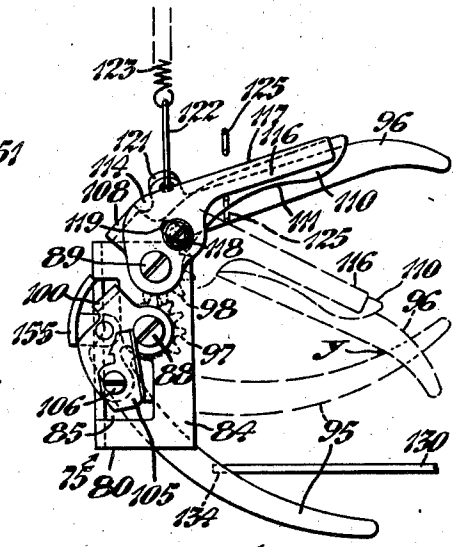


Fig. 4.

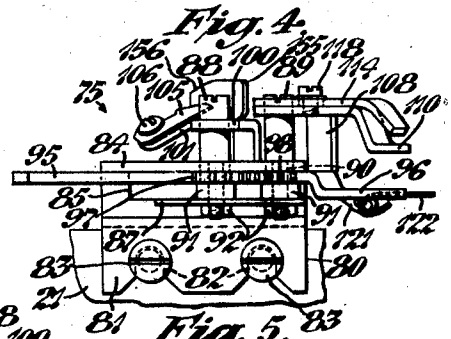


Fig. 5.

Fig. 8.

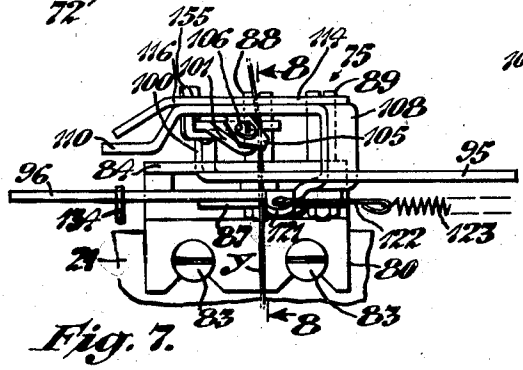


Fig. 7.

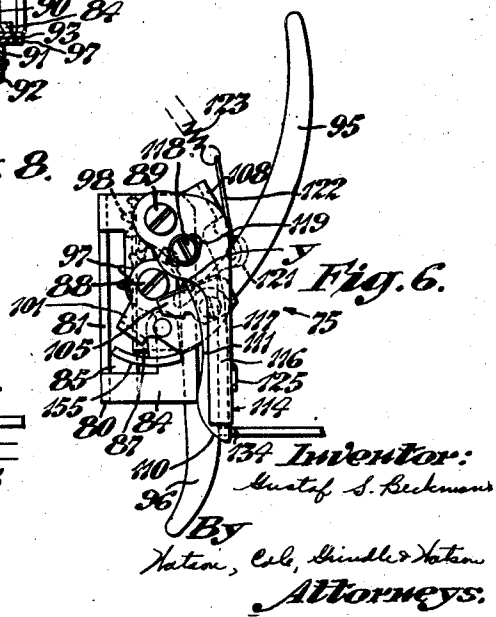


Fig. 6.

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AUTOMATIC BOBBIN-WINDER

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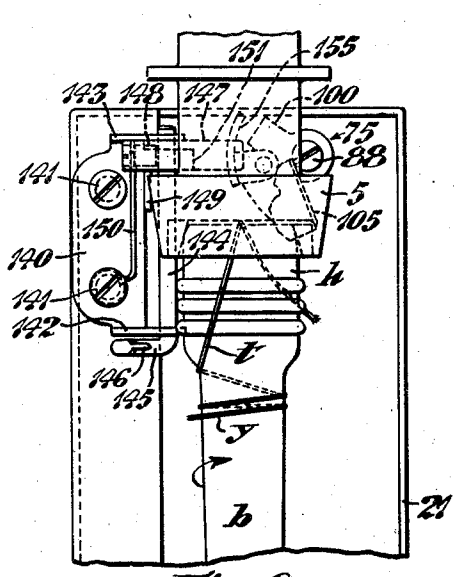


Fig. 9.

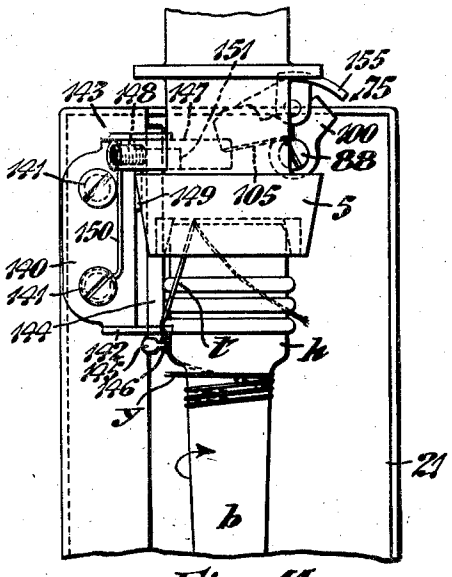


Fig. 11.

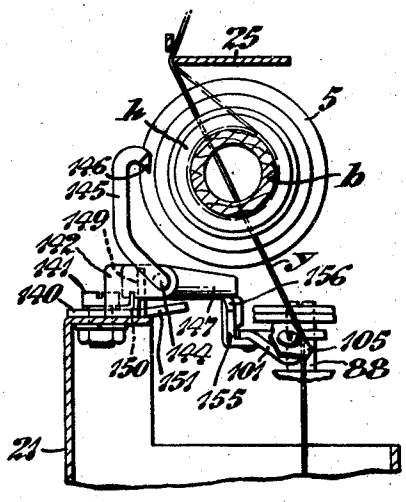


Fig. 10.

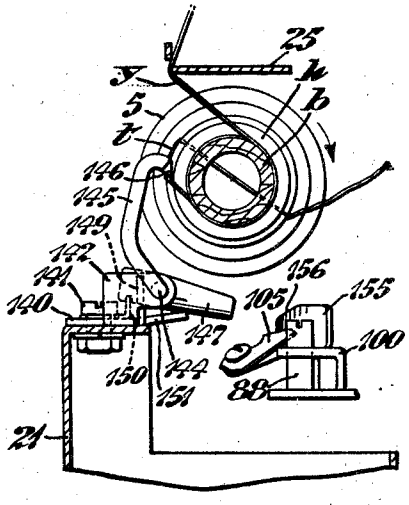


Fig. 12.

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Patented Oct. 31, 1944 2,361,813

UNITED STATES PATENT OFFICE

2,361,813

AUTOMATIC BOBBIN WINDER

Gustaf S. Beckman, Cranston, R. I., assignor to Universal Winding Company, Boston, Mass., a corporation of Massachusetts

Application January 13, 1943, Serial No. 472,262

17 Claims. (Cl. 242—31)

This invention relates to automatic bobbin-winding machines of the type disclosed in United States Letters Patent No. 2,302,715 issued November 24, 1942, to Charles D. Reynolds et al., and particularly to a yarn-trap for automatically catching the thread or yarn trailing from a doffed bobbin and locating it in position to be joined to a new bobbin. The invention also includes means for severing the yarn from the doffed bobbin and auxiliary yarn-severing means operative by the yarn-trap for cutting off the "tail" end of yarn projecting from the first coils of winding on the new bobbin.

One object of the invention is to provide in a machine of the type indicated, means for catching the yarn-strand trailing from a doffed bobbin and carrying it into position for attachment to a new bobbin, combined with yarn-severing means operated thereby to sever the strand closely adjacent the new bobbin.

Another object of the invention is to provide in a machine of the type indicated, a yarn-trap for locating the trailing yarn-strand in position for attachment to a new bobbin and embodying means in the trap for severing the strand closely adjacent the new bobbin and further means for tensioning the strand during the severing operation.

Another object of the invention is to provide in an automatic bobbin-winding machine, a yarn-trap of the type indicated adapted to be operated by the means for transferring a new bobbin into winding position and positively and automatically locked in operative position until the winding of the new bobbin is started and the strand severed.

Another object of the invention is to provide in an automatic bobbin-winding machine, a yarn-trap and severing device of the type indicated embodying means for operating a second yarn-severing device aranged to sever the loose length or "tail" of yarn projecting from the first coils wound on the new bobbin.

Another object of the invention is to provide in a machine of the type indicated, a pair of pivoted yarn-catching fingers or jaws adapted to be swung into closed relationship to draw the yarn-strand into position for attachment to a new bobbin with a knife-blade movable with one of the fingers to adapt it to engage the yarn held by the fingers to sever the strand as it is drawn thereacross during the initial winding on the new bobbin.

Another object of the invention is to provide in a machine of the type indicated, a yarn-trap and severing device of simple construction which is positive in action and proof against derangement or getting out of order.

Further objects of the invention are set forth in the following specification which describes a preferred form of construction of the device, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a side elevational view of the essential mechanism of an automatic bobbin-winding machine showing the yarn-trap as applied to use therewith and indicating the position of the elements of the trap during a winding operation;

Fig. 2 is a view similar to Fig. 1 showing the parts in position after a wound bobbin has been doffed from the winding spindle and the yarn-trap operated to position the trailing end from the doffed bobbin for attachment to a new bobbin and locked in operative position;

Fig. 3 is a transverse sectional view on line 3—3 of Fig. 2 showing the electromagnetic means for operating the locking device;

Fig. 4 is an enlarged plan view of the yarn-trap shown with its parts in inoperative relationship and indicating in dash-lines the manner in which the yarn trailing from a doffed bobbin is grasped by the fingers or jaws of the device;

Fig. 5 is an end elevational view of the yarn-trap showing the parts in the same position as illustrated in Fig. 4;

Fig. 6 is a plan view similar to Fig. 4 showing the fingers operated to locate the yarn in position for attachment to a new bobbin and the knife-blade moved into position to sever the strand when the latter is drawn thereacross during the initial winding on the new bobbin;

Fig. 7 is an end elevation of the device with the parts shown in the same position as illustrated in Fig. 6;

Fig. 8 is a transverse sectional view on line 8—8 of Fig. 7 showing the means for tensioning the yarn-strand during the severing operation;

Fig. 9 is a plan view of a portion of the bobbin-gripping and rotating means, showing an empty bobbin in place to start the winding operation and illustrating the auxiliary yarn-severing device for severing the loose length or "tail" of yarn projecting from the initial winding on the bobbin;

Fig. 10 is an end elevation of the tail-end severing device showing the parts in the same relationship as that illustrated in Fig. 9;

Fig. 11 is a view similar to Fig. 9 showing the tail-end severing device operative to sever the

loose end or tail projecting from the initial coils of yarn wound on the empty bobbin;

Fig. 12 is an end elevation of the same; and

Fig. 13 is a diagrammatic view of the electrical control-means for timing the operations of certain of the doffing and donning mechanisms.

In the automatic bobbin-winding machine illustrated in the patent referred to above the empty bobbin is held between a spindle-cup or driver and a similar cup on a stub-spindle. The bobbin is rotated by the driver to wind the coils of yarn thereon in overlying courses as it is distributed along its length by means of a reciprocating thread-guide. When the winding on the bobbin is completed the bobbin is doffed automatically by retracting the driving cup to permit the full bobbin to drop through a chute and into a suitable receptacle. During the doffing of the wound bobbin the length of yarn leading thereto from the thread-guide is carried back toward the face of the retracted spindle-cup in readiness to be gripped between the cup and a fresh bobbin later transferred from a magazine into axial alinement with the spindle-cups. The length of yarn leading from the thread-guide to the doffed bobbin is carried toward the driving cup by a reciprocable yarn-retriever and the doffed bobbin descends in such a manner as to shift the length of yarn trailing therefrom toward the face of the cup. In other words, the length of yarn extending between the doffed bobbin and the thread-guide is carried laterally into position across the face of the retracted spindle-cup by the combined action of the yarn-retriever and the doffed bobbin itself. During the positioning of the yarn-strand in this manner, the strand is carried against a knife-blade to cause it to be severed from the doffed bobbin when the winding on the fresh bobbin is started.

After the yarn has been located across the face of the spindle-cup an empty bobbin is transferred into position in axial alinement with the spindle-cups and the retracted driving cup released to engage it with the head of the bobbin with the strand firmly gripped thereagainst. When the driving cup and bobbin are rotated to start the winding operation the yarn depending from the driving cup is drawn upwardly across the knife-blade and thus severed from the doffed bobbin. As a result of this action, a short end of yarn, commonly termed a "tail," is left projecting from the first coils of yarn wound on the empty bobbin. This tail is severed from the bobbin by means of a tail-end severing device shown and described in an application for United States Letters Patent, Serial No. 346,635, filed July 20, 1940, by Gustaf S. Beckman, now Patent No. 2,351,472, dated June 13, 1944.

It is the aim of the present invention to provide means for more positively controlling the disposition of the yarn-strand across the face of the spindle-cup so that the strand will be attached securely to the new bobbin. In accordance with the present invention a combined yarn-positioning and severing device, herein termed a "yarn-trap," is located below the spindle-cup, closely adjacent thereto. The yarn-trap comprises a pair of pivoted fingers or jaws operated by the bobbin-donning means to swing them into closed relationship to seize the length of yarn extending from the yarn-retriever to the doffed bobbin and draw it into position across the end face of the spindle-cup. A knife-blade carried by one of the fingers is movable into position to engage the yarn-strand trapped by the fingers. Simultaneously with the positioning of the yarn-strand, means incorporated in the trap act to apply tension to the strand. When the spindle-cup is released and advanced axially the strand is gripped between the cup and the end of the new bobbin and as the winding operation is started the tensioned yarn is drawn upwardly at an angle to the cutting edge of the knife-blade to cause it to be severed thereby. A weight-operated locking lever is arranged to engage one of the fingers or jaws of the trap, after the latter has located the yarn-strand in position, to temporarily maintain both fingers and the knife-blade in operative position. After the first few coils of yarn have been wound on the new bobbin and the strand severed, the locking lever is actuated by an electromagnet to release the fingers or jaws and the parts of the trap are returned to inoperative position by a spring.

A second yarn-severing device, similar to that disclosed in the patent application referred to previously, is employed for severing the short end or tail projecting from the first coils of yarn wound on the new bobbin. In the present improved winding machine the tail-end severing device is operated from the yarn-trap in timed relation to the operation thereof. The yarn-trap is provided with means for rocking the tail-severing blade away from the head of the new bobbin to maintain the blade inoperative during the donning operation. When the fingers of the yarn-trap move to inoperative position after the start of the winding, the tail-cutting blade is released and carried into position to cause its sharpened edge to engage the projecting tail to sever it from the winding bobbin.

Referring to Figs. 1, 2 and 3 of the drawings, the automatic bobbin-winder illustrated therein is of substantially the same construction as that shown and described in the patent mentioned above and is therefore described only briefly herein in its relation to the present improvements. The machine comprises a casing 2 housing the main driving elements for several winding units, only one unit being herein illustrated. A rotatable spindle 3 projecting from the casing 3 carries a driving head or spindle-cup 5 which is recessed to receive the head *h* of a wooden bobbin *b* or other like core. The tip end of the bobbin *b* is held in the recessed end or cup 6 on a stub-spindle 7 journaled in an outboard bearing 8. The spindle-cup 5 or bobbin-driver is keyed to the spindle 3 and constitutes the means for rotating the bobbin *b*, being adapted to be slid axially of the spindle to doff a wound bobbin B and don an empty wooden bobbin *b*. The bobbin-driver or cup 5 is slid axially in one direction to release a wound bobbin B by means of a bell-crank lever 9 actuated by an electromagnet 10 and link 11, and in the opposite direction to grip a new bobbin *b* by means of a spring 12 compressed within the hollow sleeve on the cup as shown in Fig. 2.

During the winding operation the yarn-strand *y* leads downwardly from its source of supply, not herein shown, through a suitable tension-device, not shown, and thence through the eye of a thread-guide 15 mounted on a reciprocable traverse-rod 16. The thread-guide 15 carries a feeler-wheel 17 having a threaded connection with the screw-threads on the traverse-rod 16 and adapted to contact the yarn wound on the bobbin in the manner explained in the patent noted above to intermittently advance the guide lengthwise of the rod to produce "filling-wound"

bobbins. When the spindle-cup 5 is withdrawn by energization of the electromagnet 10 the wound bobbin B drops by gravity onto a gate 20 pivotally mounted in a chute 21, to be later described, and through means described in my prior patent the traverse-rod 16 is rotated to feed the thread-guide 15 rearwardly thereof toward the spindle-cup 5 to return the guide to initial winding position.

Substantially simultaneously with the return movement of the thread-guide 15 to initial position a yarn-retriever 25 engages the yarn-strand *y* extending from the guide to the doffed bobbin B in the chute 21 and shifts it rearwardly to a position where it reaches downwardly across the forward face of the retracted spindle-cup 5. The yarn-retriever 25 comprises a plate formed with a longitudinal groove for receiving the yarn-strand and is carried at the lower end of a slide 26 arranged for reciprocatory movement along a horizontal rod 27. The slide 26 is slid along the rod 27 by the energization of an electromagnet 30, shown by dotted lines in Fig. 1, having its armature connected to rock a bell-crank lever 31. The bell-crank lever 31 is connected to operate a second bell-crank 32 pivoted above the winding unit by means of a link 33. Rocking motion of the bell-crank 32 is transmitted through a link 35 to a pivoted lever 34 having its lower end joined to the slide 26 by a pin-and-slot connection 36. Upon energization of the electromagnet 30 its armature is drawn thereinto, thereby rocking the bell-crank lever 31 which, acting through the link 33, bell-crank 32, link 35 and lever 34 acts to slide the member 26 rearwardly, or toward the left as viewed in Fig. 1. The slide 26 is thus caused to move the yarn-retriever 25 in a horizontal path beneath the eye of the thread-guide 15 to engage it with the yarn-strand leading from the guide to the doffed bobbin B and shift this portion of the strand toward the end face of the spindle-cup 5. The yarn-retriever 25 is retained in the position last explained until the strand has been attached to a new bobbin placed in alinement with the spindle-cup 5 and stub-spindle cup 6, at which juncture the retriever is shifted forwardly by means of a spring 38 attached to the lever 31, see Fig. 2.

Located adjacent the winding unit is a hopper or magazine, indicated generally in Figs. 1 and 3 by the reference character 40, for containing a supply of empty bobbins *b*. The empty bobbins *b* are arranged in stacked relationship in the magazine 40 and released one at a time from the bottom thereof onto a bobbin-transferring cradle 42 in the manner explained in the patent referred to above. The cradle 42 comprises a U-shaped frame pivoted on studs 43, see Figs. 2 and 3, and carrying plates 44 and 45 on its lower horizontal portion. The plates 44 and 45 mount pivoted, spring-controlled bobbin-gripping fingers 46 and 47 for receiving and gripping the bobbins *b* as they are released from the magazine 40. When the cradle 42 is rocked in clockwise direction, as viewed in Fig. 3, the bobbin held by the fingers 46 and 47 will be shifted to a position in axial alinement with the spindle-cup 5 and stub-spindle cup 6 to adapt it to be gripped therebetween. Rocking movement of the cradle 42 in this direction is effected by a spring 48, see Fig. 3, which is adapted to raise the armature of an electromagnet 50. The armature is connected to one arm of a bell-crank lever 51 by means of a link 52 while the bell-crank is connected to an arm 53 of the cradle 42 by a link 54, this construction being similar to that described in the patent referred to above. Upon energization of the electromagnet 50 its armature, acting through the link 52, bell-crank lever 51 and link 54, will rock the cradle 42 in counterclockwise direction from the position shown in full lines to that indicated by dash-lines in Fig. 3 to adapt it to receive another bobbin as the latter is released from the magazine 40. The bobbins *b* are released one at a time from the magazine 40 by means of cooperating gates 56 and 57 which are actuated in timed relation to the movement of the cradle 42 by means of a pin 58 on the cradle engaging in angular slots 59 and 60 in the gates, see Fig. 3 and the prior patent referred to above.

When a wound bobbin B is doffed from winding position it drops onto the rockable gate 20 in the chute 21, as indicated by dash-lines in Fig. 3, where it is detained until the yarn-retriever 25 acts to locate the yarn-strand adjacent the end face of the spindle-cup 5. The gate 20 normally is held in the raised position shown by full lines in Fig. 3 by an operating rod 62. One end of the rod 62 is bent into U-shape with the legs of the U arranged to slide in apertures in the side of the chute 21. The upper leg 63 of the rod 62 engages the under side of the gate 20 and is slotted at 64 to provide an inclined cam-surface 65 which operates for a purpose as explained hereinafter. A spring 66 coiled around the rod 62 acts between one side of the chute 21 and a collar 67 on the rod normally to urge the latter toward the right as viewed in Fig. 3. The end of the rod 62 projects beyond the right-hand side of the chute with its end engaging the end of the armature 69 of an electromagnet 70. When the electromagnet 70 is energized its armature 69, acting on the rod 62, will slide the latter toward the left against the action of the spring 66 to permit the gate 20 to swing downwardly by gravity to the position indicated by dash-lines in Fig. 3. The wound bobbin B will thus be released and permitted to fall into a receptacle 72 removably mounted on the lower end of the chute 21. The hinge-pivot 73 for the gate 20 is arranged at an angle to the horizontal, see Fig. 1, so that when the wound bobbin B is released from the gate to drop into the receptacle 72 it will be caused to assume the position shown in Fig. 2 with its head *h* closely adjacent the rearward wall thereof.

Filling bobbins are sometimes provided with a reverse or "back wind" comprising a few coils of yarn applied after the regular winding is completed to extend rearwardly from its tip to its head end. Through this provision the last few coils of winding are arranged adjacent the head of the bobbin and as the latter is released from winding position and drops into the receptacle 72 the length of yarn extending from these coils to the yarn-retriever is drawn into position across the face of the spindle-cup 5. In other instances, however, when the back-wind is eliminated the length of yarn extending upwardly from the tip of the doffed bobbin to the yarn-retriever will lead across the end face of the spindle-cup 5 at a relatively sharp angle. The present invention provides a yarn-trap, indicated generally by the reference character 75, for catching this length of yarn regardless of the angle at which it extends to positively locate it in parallel relation to the face of the spindle-cup 5.

The yarn-trap 75 comprises a mounting in the form of a sheet-metal frame or bracket 80 fas-

tened to the rearward wall of the chute 20 and supporting the movable elements of the device. The frame 80 has a vertical portion 81 provided with slots 82 for receiving screws 83 which are threaded into the wall of the chute 21 to secure the frame thereto, see Fig. 3. The frame 80 also has a horizontal plate-like portion 84 which, with the portion 81, is cut away to provide a relatively large opening 85, see Figs. 4 and 5. Arranged below the plate-portion 84 of the frame 80 in spaced parallel relation thereto is a horizontal plate 87 fastened to the frame 80 by means of studs 88 and 89. As shown in Figs. 5 and 8, the studs 88 and 89 have elongated heads seated against the top of the plate-portion 84 of the frame 80 and reduced shanks 90 extending downwardly through holes in the plate-portion with nuts 92 screwed onto their lower ends. Bushings 91 surrounding the reduced shanks 90 of the studs 88 and 89 between the plates 84 and 87 serve to maintain the latter in spaced relationship.

The upper ends of the bushings 91 are reduced in diameter to provide bearings 93, see Fig. 8, for pivotally mounting a pair of yarn-catching fingers or jaws 95 and 96. The bearing portions of the fingers 95 and 96 are formed with meshing gear-teeth 97 and 98, see Figs. 4, 5 and 6, for connecting the fingers to swing in unison about their pivot-bearings 93. The fingers or jaws 95 and 96 project forwardly from their toothed portions and the finger 96 is offset downwardly to underlie the finger 95, see Fig. 7, to adapt the two fingers to be rocked past each other as shown in Fig. 6. The finger or jaw 95 is of arcuate shape throughout its entire length while the finger 96 is relatively straight along the major portion of its length and curved inwardly at its end. Projecting from the toothed bearing portion 97 of the finger 95 is an ear 100, see Figs. 4 and 5, which is bent upwardly and then laterally with its end perforated to receive the elongated head of the stud 88. The ear 100 is formed with an inclined extension 101 for mounting a thread-severing knife 105, conveniently, a portion of a razor-blade, secured to the extension by a screw 106.

The toothed bearing 98 of the finger 96 is also provided with an ear 108, similar to the ear 100, which is pivoted on the elongated head of the stud 89. An auxiliary arcuate finger 110 having a rearward curved edge 111, see Figs. 4 and 6, extends from one side of the ear 108 in spaced relation to the main finger 96. Fastened to the top of the auxiliary finger 110 is an actuating lever 114. As shown in Fig. 4, the lever 114 is pivoted on the head of the stud 89 and has a radial arm 116, one edge 117 of which projects beyond the outer edge of the auxiliary finger 110. An adjusting screw 118 arranged with its shank projecting through an arcuate slot 119 in the lever 114 is screwed into a threaded hole in the auxiliary finger 110 to secure the two parts together. By loosening the screw 118 the lever 114 may be swung on the pivot 89 to adjust its edge 117 angularly with respect to the finger 110, after which the screw is tightened to bind the parts in fixed relationship. As shown in Figs. 5 and 7, the outer ends of the lever 114 and auxiliary finger 110 are offset downwardly to provide clearance for the parts of the bobbin-donning mechanism.

The thread-catching finger or jaw 96 is provided with a perforated ear 121 for receiving the end of a wire link 122. A helical spring 123 having one end anchored to the bobbin-transfer cradle 42 and its opposite end hooked through the end of the link 122 normally tends to rock the finger or jaw 96, auxiliary finger 110 and lever 114 in counterclockwise direction to the position shown by full lines in Fig. 4; and through the engagement of the gear-teeth 97 and 98 the jaw 95 will be swung simultaneously in the opposite direction. The fingers 95 and 96 normally are held in open relationship to receive the length of yarn extending from the yarn-retriever 25 down to the doffed bobbin B in the receptacle 72, see dash-line designated Y in Fig. 2. The two fingers 95 and 96 are adapted to be swung into their closed position shown in Fig. 6 to seize the length of yarn extending down to the doffed bobbin B to draw it laterally into juxtaposition with and leading directly across the face of the spindle-cup 5, as indicated by the dot-and-dash line designated *y* in Figs. 2 and 3.

The means for closing together the fingers or jaws 95 and 96 consists in a resilient wire loop 125 depending from a part of the bobbin-transferring cradle 42 and adapted to engage the edge of the lever 114 fastened to the finger 96. As shown in Fig. 3, the loop 125 is formed at the end of a wire 126 which is hooked around a portion of the plate 44, previously referred to, extended rearwardly and anchored to the end thereof. During the bobbin-donning operation, when the cradle 42 is rocked to carry a new bobbin into axial alinement with the spindle-cup 5 and stub-spindle cup 6 the wire-loop 125 will engage with and slide along the edge 117 of the actuating lever 114 to rock the latter from the position shown in Fig. 4 to that indicated in Fig. 6. In this manner the fingers or jaws 95 and 96 are rocked to closed position to trap the yarn as explained more fully hereinafter.

It is essential that the length of yarn be held by the fingers or jaws 95 and 96 until it is fastened to the end of the empty wooden bobbin transferred to winding position and, therefore, means are provided for latching or locking the fingers in closed position until after the winding operation is started. The locking means may comprise a lever 130 pivoted on a stud 131 held in a frame 132 attached to a portion of the chute 21, see Figs. 2 and 3. As shown in Figs. 1 and 2, one arm 133 of the locking lever 130 extends from the pivot 131 toward the yarn-trap 75 and is provided with a beveled end adapted to act as a latch 134 therefor. The opposite shorter arm 135 is enlarged to provide a weight which overbalances the longer arm 133, thus normally tending to rock the latter upwardly. The weighted arm 135 is recessed or cut away on its under side to provide a shoulder 136, see Figs. 2 and 3, which is adapted to engage in the slot 64 of the gate-operating rod 62, previously described. When the rod 62 is slid toward the right, as viewed in Fig. 3, the shoulder 136 on the lever 130 will rock downwardly into the deeper portion of the slot 64 to cause the latching end 134 of the lever 130 to tilt upwardly to engage it with the side of the finger 96, thereby acting to latch or lock both fingers or jaws 95 and 96 in closed relationship. When the rod 62 is slid toward the left at a later stage in the operation of the machine the shoulder 136 on the lever 130 will ride up the inclined cam-face 65 of the slot 64 to rock the lever to withdraw its latching end 134 from engagement with the finger 96 and the spring 123 will act to return the fingers of the yarn-trap to open relationship.

In accordance with the present invention,

means are provided for severing the short end or tail of yarn projecting from the first coils of yarn wound on the bobbin. As noted previously, this means is of substantially the same construction as that shown and described in the application referred to above, but in the present improved construction it is arranged to be operated from the yarn-trap. The tail-end severing device, shown in Figs. 9 to 12 but omitted from the other views for the sake of clarity, comprises a sheet-metal frame or support 140 fastened to a ledge at the top of the chute 21 by means of screws 141 and provided with bearing-ears 142 and 143 for pivotally mounting a yarn-severing member 144. The member 144 may be constructed of wire or rod formed with a horizontal bearing-portion and an arm 145 projecting upwardly therefrom at the side of the bearing 142 and bent over at its end. The upper curved end of the arm 145 is ground to a bevel to provide a sharpened point 146 adapted to engage across the length of yarn extending from the winding bobbin to the spindle-cup 5 at a point adjacent the innermost ring on the bobbin-head *h*, see Fig. 11. A follower-finger 147 is secured to the horizontal bearing-portion of the member 144 by a set-screw 148 adjacent the inner face of the bearing 143. A lug 149 struck up from the base of the frame 140 and engaging the side of the finger 147 acts to restrain the member 144 against axial displacement. A wire spring 150 anchored to one of the screws 141 and engaging under the rearward end of the finger 147 tends to rock it downwardly to pivot the member 144 in clockwise direction as viewed in Fig. 10. An ear 151 on the frame 140, see Fig. 12, is positioned to engage the finger 147 to limit the rocking movement of the member 144 under the action of the spring 150 whereby to maintain its cutting point 146 in close proximity to the periphery of the head *h* of the bobbin *b*.

The means for rocking the yarn-severing member 144 in counterclockwise direction to remove its cutting point 146 from operative position comprises a cam 155 mounted for movement with the thread-engaging finger or jaw 95. As shown in Figs. 4, 5, 9 and 10, the cam 155 is constructed in the form of an angular strip having a portion riveted to the under side of the ear 100 of the finger 95 and a vertical portion projecting upwardly therefrom. The vertical portion of the cam 155 is curved in an arc concentric to the axis of the pivot-stud 88 and its upper edge is formed with an inclined cam-face 156. The cam-face 156 is adapted to engage the under side of the finger 147 during the rocking motion of the finger 95 to closed position to thereby rock the tail-end severing member 144 from its operative position shown in Figs. 11 and 12 to its inoperative position indicated in Figs. 9 and 10.

The various doffing and donning operations of the machine are effected by electromagnets, three of which are shown herein, and the energization of the electromagnets is controlled by switches described in the patent referred to above and indicated diagrammatically in Fig. 13. Suffice it to state herein that a cam-shaft 160 operated from the drive of the machine carries a plurality of cams which operate in timed sequence to close switches connected in the circuits for the various electromagnets. Rotation of the shaft 160 is initiated by an electromagnetically-operated clutch, not herein shown, controlled by a suitable switch. The switch is actuated by means arranged to be shifted by the thread-guide when the bobbin reaches a predetermined length. Switches 163, 164 and 165, see Fig. 13, are connected in the circuits for the electromagnets 10, 50 and 30, respectively, being closed in the proper sequence by cams 166, 167 and 168 on the shaft 160. As shown in Fig. 13, the electromagnet 70 for operating the gate 20 is connected in series with the electromagnet 50 for returning the bobbin-transfer cradle 42 to initial position and also with the electromagnet 30 for operating the yarn-retriever 25. Through this provision, the energization of either electromagnet 50 or 30 will cause simultaneous energization of the electromagnet 70. The invention having been described in detail the method of operation of the complete machine is explained as follows:

Let it be assumed that the winding operation is in progress with the yarn-strand *y* feeding downwardly from its source of supply through a tension-device, not herein shown, and thence through the eye of the thread-guide 15 to the rotating bobbin *b* which is held between the spindle-cup 5 and stub-spindle cup 6. The thread-guide 15 is reciprocated by the traverse-rod 16 and advanced longitudinally thereof by means of the contact-wheel 17 in a manner well known to those versed in the art of winding. The winding operation is continued in this manner until the thread-guide 15 reaches a position adjacent the tip of the bobbin *b*, at which time the guide will engage suitable means such, for example as shown in the patent referred to above, to close a switch to energize an electromagnet connected to shift a clutch for the control-shaft 160. The clutch, not shown herein, connects the control-shaft 160 to the drive of the machine whereby it is caused to rotate the cams 166, 167 and 168 to close the several switches 163, 164 and 165 in the circuits for the electromagnets 10, 50 and 30. The cam 166 will first act to close the switch 163 in the circuit for the electromagnet 10 to energize the latter and cause it to retract the cup 5 to release the wound bobbin B which will drop onto the gate 20 in the chute 21.

Through the means disclosed in the patent referred to above, the traverse-rod 16 will be rotated to return the thread-guide 15 to initial winding position. Substantially simultaneously with the return of the thread-guide 15 the cam 168 on the control-shaft 160 will close the switch 165 in the circuit for the electromagnet 30. The electromagnet 30 thus will be energized and operating through the bell-crank 31, link 33, bell-crank 32, link 35 and lever 34 it will slide the yarn-retriever 25 toward the spindle-cup 5. The yarn-retriever 25 thus will be caused to engage the yarn-strand *y* extending from the thread-guide 15 to the doffed bobbin B in the chute 21 to shift the strand toward the end face of the retracted spindle-cup 5, see Fig. 2. It has been explained that the electromagnet 70 is arranged in series with the electromagnet 30 so that both electromagnets will be energized simultaneously. When the electromagnet 70 is energized its armature will act against the end of the rod 62 to slide the latter toward the left against the action of the spring 66 to shift it into the position indicated by dash-lines in Fig. 3. The end of the leg 63 of the rod 62 thus will be released from the gate 20 to permit the latter to swing downwardly to the position indicated by dash-lines in Fig. 3, whereby to cause the wound bobbin B to drop into the receptacle 72. As the bobbin B drops into the receptacle 72 it will take up the slack in the length of yarn extending from its end to

the thread-guide 15. The sliding movement of the gate-actuating rod 62 toward the left, as viewed in Fig. 3, will cause the shoulder 136 of the locking lever 130 to ride up the inclined cam-face 65 of the slot 64 in the rod to rock the lever from the position shown by full lines to that indicated by dash-lines in Fig. 2, thereby depressing the latching end 134 on the lever 130. It is to be noted that the rocking motion of the lever 130 at this juncture has no effect on the yarn-trap 75 since the fingers 95 and 96 of the latter are in open relationship.

The doffed bobbin B in dropping into the receptacle 72 will assume the position shown in Fig. 2 with the length of yarn extending from its tip end to the yarn-retriever 25 at an angle to the vertical as indicated by the dash-line Y. It will be observed by reference to Fig. 2 that at this juncture the strand Y will lead in a direction sharply inclined to the end face of the spindle-cup 5 and in order to properly grip the yarn-strand between the cup and a newly supplied bobbin it is necessary that the strand be carried into position parallel to and in close relation to the end face of the cup.

To properly position the yarn across the end of the spindle-cup 5 the present invention provides the yarn-trap 75 which, as previously explained, is operated by the bobbin-transferring means. Referring to Fig. 3, the bobbin-transfer cradle 42 normally assumes the position indicated by dash-lines in this view to adapt it to receive an empty bobbin *b* from the magazine 40. A magnetically-operated detent or latch, shown in the patent referred to above, is automatically withdrawn from engagement with the cradle 42 after the yarn-retriever 25 has been actuated and the spring 48 then will act to rock the cradle to the position shown in full lines in Figs. 2 and 3, whereby to carry a fresh bobbin *b* into axial alinement with the spindle-cup 5 and stub-spindle cup 6. During this rocking movement of the cradle 42 the wire-loop 125 carried thereby will engage the edge 117 of the actuating lever 114 of the yarn-trap 75 to rock the latter and swing the finger 96, to which it is attached, in clockwise direction as viewed in Fig. 4. This swinging movement of the finger or jaw 96 is transmitted to the jaw 95 through the gear-tooth connection 97, 98 to simultaneously swing the finger 95 in the opposite direction. The fingers 95 and 96 thus will be swung toward each other in the manner indicated by dash-lines in Fig. 4, to cause their outer curved ends to catch and seize the length of yarn *y*. As the cradle 42 continues its rocking movement, the fingers or jaws 95 and 96 will be swung into closed position as shown in Figs. 3, 6 and 7 and the strand carried into alinement with the face of the spindle-cup 5 closely adjacent thereto as represented by the dot-and-dash line *y* in Fig. 2. When the yarn-catching fingers 95 and 96 are swung into closed position the knife-blade 105 carried by the finger 95 will assume the position shown in Figs. 6, 7 and 8 with its sharpened edge located above the crotch formed by the closed fingers. The strand *y* also will be guided above the knife-blade 103 to hold it against the edge thereof by the curved edge 111 of the auxiliary thread-finger 110. It will be observed by reference to Fig. 8 that the fingers 95, 96 and 110 cooperate with the forward edges of the plates 84 and 87 to form a bend or bight in the strand to cause it to follow a tortuous path and thus apply tension thereto.

The movement of the fingers 95 and 96 into closed relationship will cause the cam 155 on the finger 95 to move to the position shown in Figs. 9 and 10. The cam-surface 156 thus will ride under the finger 147 of the tail-end severing member 144 to rock the latter in counter-clockwise direction, as viewed in Fig. 10, against the action of the spring 150 to withdraw its point 146 from close proximity to the head *h* of the new bobbin *b*.

After the yarn-strand has been located across the face of the spindle-cup 5 in the manner explained above the electromagnet 10 is deenergized and the spindle-cup projected forwardly by the spring 11 to cause it to grip the empty bobbin *b* between it and the stub-spindle cup 6. The head *h* of the bobbin *b* will enter the recessed end of the spindle-cup 5 and the yarn-strand *y* thus will be securely clamped between the cup and the end of the bobbin. The electromagnet 30 then is deenergized and the yarn-retriever 25 slid forwardly by the spring 38 until its side engages an abutment-plate 170 mounted on the bobbin-cradle 42, see Fig. 1. The yarn-retriever 25 thus will be moved to a position forwardly of the head of the bobbin where it will operate as a bunch-builder to cause a relatively few coils of yarn to be wound on the barrel of the bobbin in the manner and for the purpose explained in the patent referred to above.

Simultaneously with the deenergization of the retriever-operating electromagnet 30 the electromagnet 70 is deenergized and the rod 62 in the chute 21 will be actuated by the spring 66 to slide it toward the right as viewed in Fig. 3 to raise the gate 20. When the rod 62 is actuated in this manner its inclined slot 64 will release the lever 130 to permit it to rock to the position shown by full lines in Fig. 2 with its latching end 134 engaging the side of the finger or jaw 96 to lock the several elements of the yarn-trap 75 in operative position.

During the operation of the doffing and donning mechanism of the machine in the manner as explained above the spindle 3 remains at rest, but immediately the empty bobbin *b* is gripped thereto with the yarn attached to the head of the bobbin rotation of the spindle is started and the thread-guide 15 is reciprocated by the traverse-rod 16. Rotation of the bobbin *b* will cause the yarn to be wound across the head *h* of the bobbin *b* and onto its barrel portion to first wind a bunch thereon, whereafter the service winding is performed. As the spindle-cup 5 commences its rotation the length of yarn trailing from the winding bobbin will be drawn upwardly and as the strand is tensioned to resist its draft across the sharpened edge of the blade 105 it will be severed thereby.

After the winding operation has been started again in the manner explained above the bobbin-transfer cradle 42 will be returned to position below the magazine 40 to adapt it to receive another empty bobbin *b*. The cradle 42 is rocked to initial position by the electromagnet 50, see Fig. 3, acting through the link 52, bell-crank 51 and link 54, the electromagnet being energized when the switch 164 is closed by the control-cam 167.

As before explained, the electromagnet 70 is connected in series with the electromagnet 50 so that when the cradle 42 is returned to inoperative position the gate-actuating rod 62 in the chute 21 again will be slid toward the left, as viewed in Fig. 3. Movement of the rod 62 in this directoin will cause its cam-surface 65 to cam the weighted

end 135 of the locking-lever 130 upwardly to withdraw its latching end 134 from engagement with the side of the finger 96 of the yarn-trap 75. Upon release of the finger 96 the spring 123, see Figs. 3 and 4, will act to return both fingers 95 and 96 to their inoperative position shown by full lines in Fig. 4.

Rocking movement of the parts of the yarn-trap 75 to inoperative position will cause the cam 155 on the finger 95 to be moved to the position shown in Figs. 11 and 12 to release it from the follower-finger 147. Upon release of the finger 147 the tail-end severing member 144 will be rocked in clockwise direction under the action of the spring 150 to move it into the position shown in Figs. 11 and 12 and locate its pointed end 146 adjacent the periphery of the head of the bobbin *b*. As the bobbin *b* continues its rotation the blade 146 will be caused to engage the length of yarn *t* extending from the first coils of winding on the bobbin to the spindle-cup 5 to sever this short tail therefrom, see Fig. 11. When the bobbin later is doffed from winding position the relatively short tail *t* of waste yarn will drop away from the spindle-cup 5 and descend through the chute.

The energization of the electromagnets 70 and 50 is of short duration and upon deenergization of the magnet 70 the rod 62 in the chute 21 will be moved by the spring 66 to release the locking-lever 130 and permit it to return to the position shown by full lines in Fig. 2. After the cradle 42 has been moved into position beneath the magazine 40 by the operation of the electromagnet 50 it is latched in this position by the detent means previously referred to until actuated again to transfer another empty bobbin into winding position. Rocking movement of the cradle 42 into inoperative position acts to withdraw its abutment-plate 170 from engagement with the yarn-retriever 25 to permit the latter to return to its initial position shown in Fig. 1.

It will be observed from the foregoing that the present invention provides improvements in automatic bobbin-winding machines for performing the several functions of winding a filling bobbin, doffing the wound bobbin, donning a fresh bobbin and restarting the winding operation. The present invention is directed particularly to a yarn-trap for locating the yarn-strand trailing from a doffed bobbin in proper position to insure its attachment to the next empty bobbin transferred to winding position and for thereafter severing this length of yarn relatively close to the new bobbin. It has been the experience with machines previously used that when the wound bobbins are doffed the yarn-strand trailing therefrom will be inclined at a sharp angle to the vertical and positioned away from the bobbin-driver or spindle-cup so that it cannot be attached thereby to a new bobbin. By means of the present invention the yarn-strand is caught and grasped in the yarn-trap to shift it positively into parallel relation to the spindle-cup and in close juxtaposition thereto regardless of the angular position of the strand. The improved device also acts to sever the strand close to the spindle-cup after it has been clamped to a new bobbin. As a further feature of improvement the tail-end severing means for removing the waste end of yarn is operated from the yarn-trap so that it is timed in sequence with the operation thereof.

While a preferred form of construction of the present yarn-trap is shown and described herein with the device applied to use on a particular type of automatic bobbin-winding machine, it is to be understood that various modifications may be made in the structure and arrangement of the parts of he device and in its application to use without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, I claim:

1. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means for attaching the yarn trailing from the doffed bobbin to the new bobbin, a yarn-trap located adjacent the yarn-attaching means and comprising spaced stationary members, a pair of jaws pivotally mounted between said members and projecting outwardly therefrom, means for normally maintaining the jaws in open relationship to adapt them to receive the trailing yarn therebetween, and means for closing the jaws to seize the yarn and trap it between the spaced members to position it for attachment to the new bobbin.

2. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means for attaching the length of yarn trailing from the doffed bobbin to the new bobbin, a pair of stationary tension-members, a pair of jaws movably mounted between said members, means for normally maintaining said jaws in open relationship to adapt them to receive the trailing yarn therebetween, and means for moving the jaws into closed relationship to seize the yarn and carry it into position between the tension-members, said members and jaws cooperating to tension the yarn and maintain it in position for attachment to the new bobbin.

3. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means for attaching the length of yarn trailing from the doffed bobbin to the new bobbin, a yarn-trap comprising a pair of stationary plates, a pair of jaws rockably mounted between the stationary plates, means for connecting said jaws for simultaneous rocking movement toward and away from each other, means for normally maintaining the jaws in open relationship to adapt them to receive the trailing length of yarn therebetween, and means for closing the jaws to shift the yarn into position between the plates in adjacent relation to the yarn-attaching means.

4. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin, means for attaching the length of yarn trailing from the doffed bobbin to the empty bobbin, a pair of movable fingers, a knife-blade carried by and movable with one of said fingers, means for normally maintaining the fingers in open relationship to adapt them to receive the trailing length of yarn therebetween, and means for closing the fingers together to trap the yarn and engage it with the edge of the knife-blade, said blade acting to sever the yarn as it is drawn across the edge thereof during the initial winding on the empty bobbin.

5. In an automatic winding machine, means for winding a bobbin, means for doffing a wound bobbin, means for donning an empty bobbin, means for attaching the length of yarn trailing from the doffed bobbin to the empty bobbin, a yarn-trap comprising a pair of rockably-mounted jaws, a knife-blade carried by one of the jaws, means for normally maintaining the jaws in

open relationship to adapt them to receive the trailing length of yarn therebetween, and means for closing the jaws to seize the trailing yarn and locate it adjacent the blade, said blade acting to sever the yarn as it is drawn thereacross during the initial winding on the empty bobbin.

6. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin, means operative on the yarn trailing from the doffed bobbin to attach it to the empty bobbin, means for trapping the yarn to retain it in position for attachment to the empty bobbin comprising a pair of movable jaws, a knife-blade carried by one of the jaws, an actuating lever arranged for movement with the other jaw, resilient means for normally maintaining the jaws in open relationship, and means for operating the actuating lever to move the jaws into closed relationship to seize the yarn and trap it in position leading across the knife-blade.

7. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin, means operative on the length of yarn trailing from the doffed bobbin to attach it to the empty bobbin, means for trapping the length of yarn in position to be attached to the empty bobbin comprising a pair of jaws arranged for relative movement toward and away from each cther, means for normally maintaining the jaws in open relationship to adapt them to receive the trailing length of yarn therebetween, means for tensioning the trapped yarn, means for closing the jaws to catch the yarn and draw it into position for attachment to the empty bobbin while engaging it with the tensioning means and means for locking the jaws in closed relationship during the operation of the yarn-attaching means.

8. In an automatic winding machine, means for winding a bobin, means for doffing the wound bobbin, means for donning an empty bobbin, means engageable with the length of yarn trailing from the doffed bobbin to attach it to the empty bobbin, means for trapping the trailing length of yarn to adapt it for attachment to the empty bobbin and thereafter severing the yarn comprising jaws operatively connected for simultaneous movement to open or closed relationship, a knife-blade carried by one of said jaws, means for normally maintaining the jaws in open relationship to receive the trailing length of yarn therebetween, means for closing the jaws to seize the yarn and draw it into position to be acted upon by the yarn-attaching means and against the blade, said blade acting to sever the yarn after the latter has been attached to the empty bobbin, means for locking the jaws and blade in operative position, and means operative after the yarn has been severed to release the locking means.

9. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin, means for attaching the length of yarn trailing from the doffed bobbin to the empty bobbin, a yarn-trap for retaining the trailing length of yarn in position for attachment to the empty bobbin comprising a pair of rockable jaws, means for normally maintaining the jaws in open relationship to receive the yarn therebetween, means for rocking the jaws into closed relationship to seize the yarn and position it adjacent the yarn-attaching means, means for locking the jaws in closed relationship, and electromagnet-operated means for actuating the locking means.

10. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin, means for attaching the yarn trailing from the doffed bobbin to the empty bobbin, means for trapping the trailing yarn in position to be attached to the empty bobbin and thereafter severing the yarn comprising a pair of jaws mounted or rock toward and away from each other, a knife-blade, means for normally maintaining the jaws in open relationship to receive the trailing length of yarn therebetween, means for closing the jaws to seize the yarn and shift it into position to be acted upon by the yarn-attaching means and the knife-blade, said blade acting to sever the yarn during the initial winding thereof on the empty bobbin, means for locking the jaws in closed relationship, and means for releasing the locking means after the first coils of yarn have been wound on the bobbin.

11. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means operative on the length of yarn trailing from the doffed bobbin to attach it to the new bobbin, means for trapping the trailing length of yarn in position to be acted upon by the yarn-attaching means, and means operated by the yarn-trapping means for severing the tail of yarn projecting from the first coils of winding on the new bobbin.

12. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means operative on the yarn trailing from the doffed bobbin to attach it to the new bobbin, means for trapping the trailing length of yarn in position for attachment to the new bobbin, means for severing the trapped yarn between the yarn-attaching means and the doffed bobbin, means for winding the attached yarn on the new bobbin, and means normally held inoperative by the yarn-trapping means and releasable thereby to sever the tail of yarn projecting from the first coils of winding on the new bobbin.

13. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means operative on the length of yarn trailing from the doffed bobbin to attach it to the new bobbin, means for trapping the trailing length of yarn in position for attachment to the new bobbin, means for severing the trapped yarn between the doffed bobbin and the yarn-attaching means, means for winding the attached yarn on the fresh bobbin, means normally positioned adjacent the head of the new bobbin and adapted to sever the tail of yarn projecting from the first coils of winding thereon, and means operated by the yarn-trapping means for withdrawing the tail-severing means from the winding bobbin.

14. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin in winding position, means operative on the length of yarn trailing from the doffed bobbin to attach it to the empty bobbin, a yarn-trap comprising means operative to close together to grasp the trailing length of yarn and position it for attachment to the end of the empty bob-

bin, means for severing the length of yarn extending from the end of the bobbin to the first coils wound thereon, and means actuated by said yarn-trap for operating said last-named severing-means.

15. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin in winding position, means operative on the length of yarn trailing from the doffed bobbin to attach it to the new bobbin, a yarn-trap for catching the trailing length of yarn and carrying it into position for attachment to the new bobbin, means for severing the yarn from the doffed bobbin, means for severing the tail-end of yarn extending from the first coils of yarn wound on the new bobbin, and a cam actuated by the yarn-trap to operate the last-named severing-means.

16. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning an empty bobbin, means operative on the length of yarn trailing from the doffed bobbin to attach it to the empty bobbin, movable jaws arranged adjacent the yarn-attaching means, means for actuating said jaws to seize the trailing length of yarn and position it for attachment to the empty bobbin, means for severing the length of yarn extending from the first coils wound on the empty bobbin to its point of attachment thereto, and a cam on one of the jaws movable therewith to actuate said severing-means.

17. In an automatic winding machine, means for winding a bobbin, means for doffing the wound bobbin, means for donning a new bobbin, means operative on the yarn trailing from the doffed bobbin to attach it to the end of the new bobbin, a yarn-trap located adjacent the yarn-attaching means and comprising a pair of pivoted jaws adapted to grasp the length of yarn trailing from the doffed bobbin, means for operating said jaws to cause them to seize the yarn and position it adjacent the attaching means, a yarn-severing member, resilient means for moving said member toward the winding bobbin to sever the length of yarn extending from the first coils of winding thereon to its point of attachment thereto, and a cam on one of the jaws operative on the severing-member to withdraw it from operative position with respect to the winding bobbin.

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