

Dec. 25, 1945.

R. E. MORTON

2,391,472

WINDING MACHINE

Filed Nov. 3, 1942

4 Sheets-Sheet 1

Inventor:

Robert E. Morton

By

Watson, Cole, Grindle & Watson
Attorneys.

Attorneys.

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4 Sheets-Sheet 2

Fig. 2.

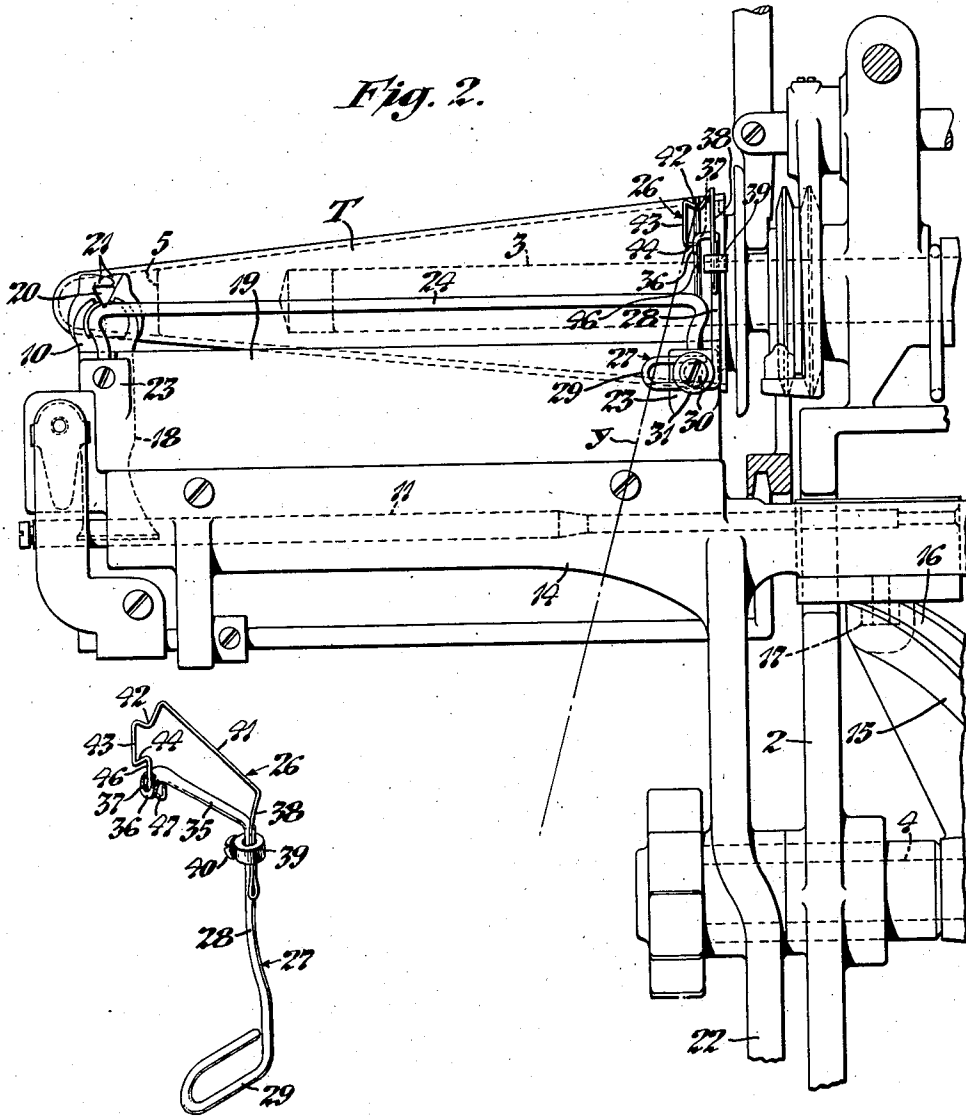


Fig. 3.

Inventor:
Robert E. Morton
By
Watson, Cole, Grindle & Watson
Attorneys.

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4 Sheets-Sheet 3

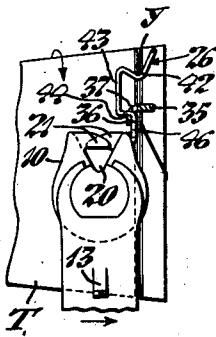


Fig. 4.

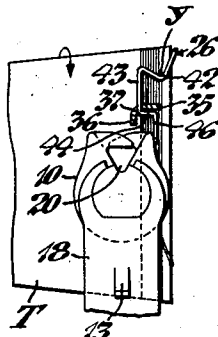


Fig. 5.

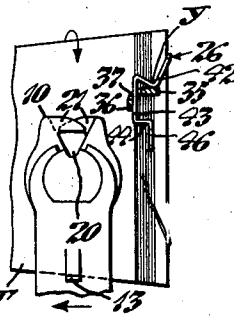


Fig. 6.

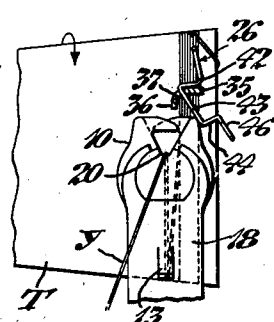


Fig. 7.

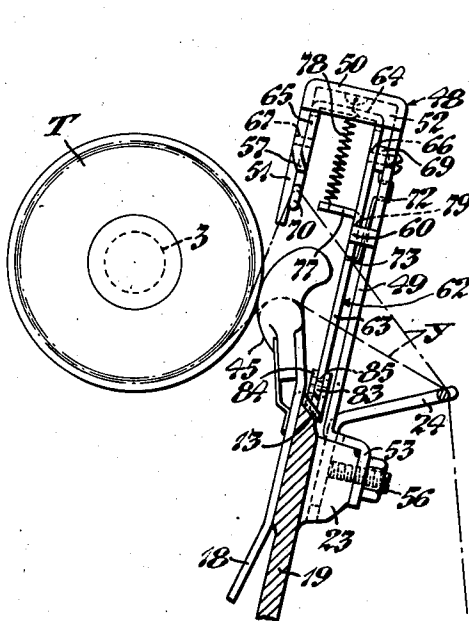


Fig. 8.

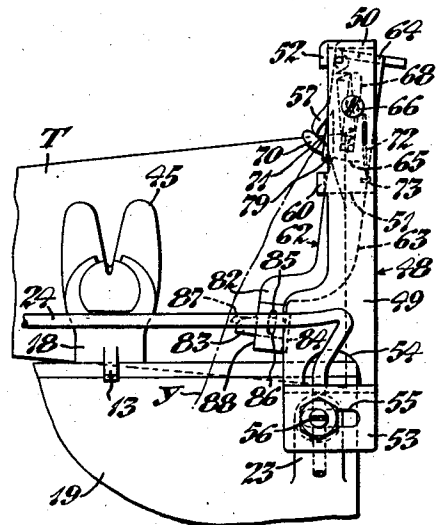


Fig. 9.

Inventor:

Robert E. Morton

By

Watson, Cole, Grindle & Watson
Attorneys.

Dec. 25, 1945.

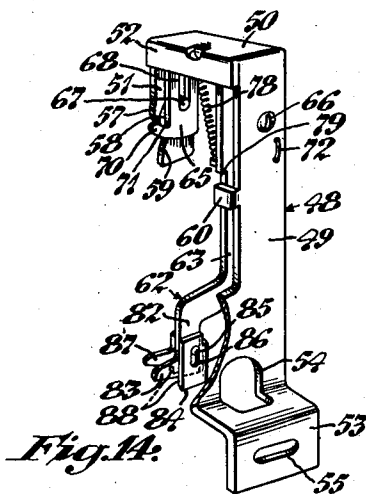
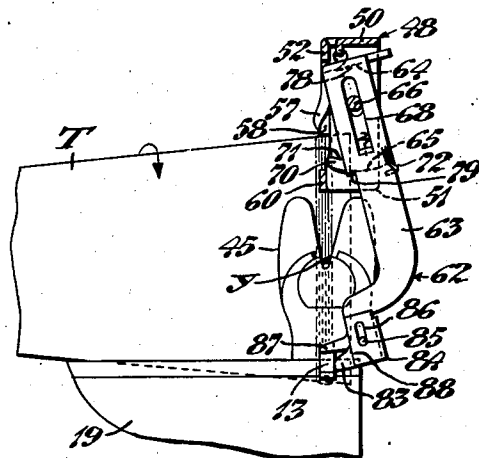
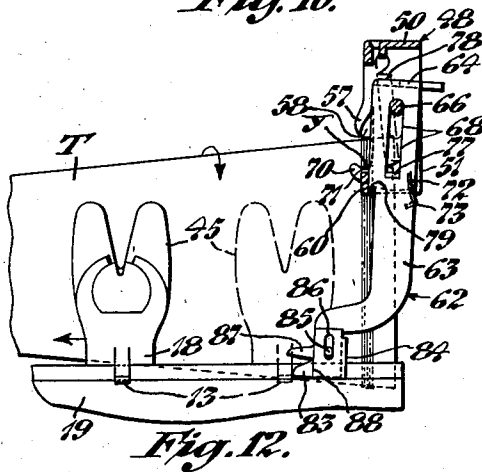
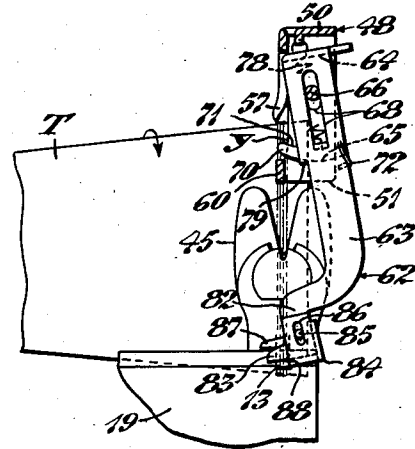
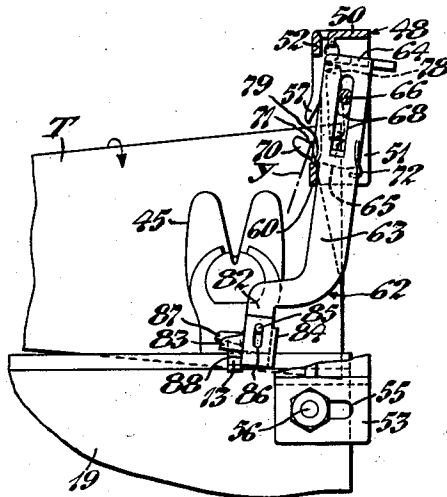
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4 Sheets-Sheet 4



Inventor:
Robert E. Morton
By
Watson, Cole, Grindle & Watson
Attorneys.

UNITED STATES PATENT OFFICE

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WINDING MACHINE

Robert E. Morton, Warwick, R. I., assignor to
Universal Winding Company, Boston, Mass., a
corporation of Massachusetts

Application November 3, 1942, Serial No. 464,367

22 Claims. (Cl. 242—43)

This invention relates to improvements in winding machines and particularly to an automatically-operated device for winding a reserve length of yarn on the end of the core, tube, bobbin, or other package-support before winding the package itself.

In accordance with a recent practice, supply packages such as cones, cheeses or the like are magazined on a creel or other holder by tying the last end of one package to the leading end of another package so that the yarn will deliver continuously from the several supplies. In this way the delivery of the yarn may be maintained continuous for an indefinite period by replacing each exhausted package with a fresh supply and connecting the last delivering end from one to the first delivering end of another. For this purpose a reserve length of yarn, sometimes called a "transfer tail" or "tail-end," is initially wound on the core, tube or package-support before winding the layers which form the package, the reserve length or tail of yarn being deposited on the end of the core beyond the end of the package to make it available for splicing or tying to the leading end of another package. Likewise, in winding filling bobbins for use in the shuttles of looms a few coils or "bunch" of yarn is wound on the core or wooden support for the bobbin before the service winding is commenced; the yarn in the bunch providing a reserve length to prevent the filling from running out before the bobbin is changed in the shuttle of an automatic loom.

Originally, the reserve length of yarn or tail was wound on the package-support by hand, but, recently various types of bunch-winders and tail-winders have been devised for this purpose. Certain of these devices embody pawl-and-ratchet mechanism for actuating the means for restraining the yarn from traversing during the initial stages of the winding and then releasing it to the thread-guide which traverses it to build the package. Such devices require complicated mechanism and are not entirely automatic since they must be adjusted or reset manually before each operation.

In certain other cases a stationary hook or the like is used for holding the yarn to prevent its traverse by the thread-guide until several coils have been wound around the end of the core or package-support, but with such devices only a limited number of turns or coils can be wound for the reserve length of yarn and in most instances the parts of the machine must be set in certain position to insure the winding of even a few coils on the end of the support. In other

words, these last-mentioned devices require manual control and supervision so that they are not entirely automatic in their operation.

It is an object of the present invention to provide an entirely automatic device of the type specified for winding a reserve length of yarn, either a "bunch" or a "transfer tail," on each package-support without adjusting or resetting the device after each operation.

Another object of the invention is to provide a device of the type indicated which, while being fully automatic in its operation, avoids the use of pawl-and-ratchet means and is otherwise extremely simple in construction and proof against derangement or getting out of order.

Another object of the invention is to provide a device of the type indicated which requires no manual control or supervision beyond the placing of the strand of yarn therein and which is automatically reset after each operation without any attention on the part of the operator.

Another object of the invention is to provide a device of the type specified which will wind the reserve length or tail of yarn in crossing coils to bind the turns in place and prevent unwarranted unwinding or dislocation thereof; and to also adapt a portion of the reserve length to be unwound without disturbing the remainder of the tail-end.

Further objects of the invention are set forth in the following specification which describes several preferred forms of construction of the device as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is an end view of a winding machine of conventional type showing one form of the present improved device as applied to use therewith;

Fig. 2 is a partial front view of the same showing the essential elements of the winding machine and illustrating the present improved device in its initial position for winding a transfer tail on the end of the cop-tube or package-support;

Fig. 3 is a perspective view of this form of the improved device shown as disconnected from the winding machine;

Fig. 4 is an enlarged detailed view of the device showing the yarn-retaining member in the position it assumes during the first stage of its operation while the yarn is being wound into a tail and illustrating its position relative to the thread-guide when the latter is near the end of its traverse toward the right;

Fig. 5 is a similar view showing the yarn-retainer as having been engaged and moved by the thread-guide at the end of the traverse stroke

of the latter toward the device to shift it from its initial position;

Fig. 6 is a similar view showing the yarn-retainer in the position it assumes when released by the thread-guide during the movement of the latter in the reverse direction;

Fig. 7 is a similar view showing the thread-guide engaging the yarn-retaining member as the guide finishes its stroke in a direction toward the member whereby to rock the latter to release the yarn to the thread-guide to cause it to be traversed thereby to wind the package;

Fig. 8 is a partial end view of the cooperating elements of a winding machine showing a modified form of construction of the tail-end winding device comprising a yarn-retaining member pivotally mounted for rocking movement on a supporting bracket;

Fig. 9 is a front view of the tail-end winding device illustrated in Fig. 8 showing the yarn-retaining member in the position it assumes during the first stage of its operation;

Fig. 10 is a similar view showing the contact member at the end of the depending leg of the yarn-retaining member as having been engaged by the guide-lip or bunter on the thread-guide near the end of the traverse stroke of the latter toward the right;

Fig. 11 is a similar view showing the yarn-retaining member as having been rocked by the thread-guide at the end of the traverse stroke of the latter to release the member for vertical movement;

Fig. 12 is a similar view showing the yarn-retaining member in the position it assumes when released by the thread-guide and illustrating the member as moved downwardly to locate a laterally-extending toe at the end of its leg in position to be engaged by the bunter on the thread-guide;

Fig. 13 is a similar view showing the bunter on the thread-guide in engagement with the laterally-extending toe of the yarn-retaining member during the next traverse stroke of the guide toward the right whereby to rock the member to release the yarn to the thread-guide to cause it to be traversed thereby to wind the package; and

Fig. 14 is a perspective view of the modified form of tail-end winding device shown as disconnected from the winding machine.

Figs. 1 to 7, inclusive, illustrate the present improved device in possibly its simplest form. The winding machine shown in Figs. 1 and 2 is of conventional type for winding conical or cylindrical packages used as supplies for subsequent transfer of the yarn in various processes of the textile art. As herein shown the winding machine comprises a box-like frame 2 supporting bearings for a winding spindle 3 and a cam-shaft 4 journaled therebelow. The winding spindle 3 may have mounted thereon any suitable form of mandrel or holder 5 for a cop-tube or other core or support for the package. As shown more particularly in Fig. 2, the winding mandrel 5 may take the form of a truncated cone for receiving a conical cop-tube T, usually constructed from paper-pulp or other fibrous material. It is to be understood, however, that the core or support for the package may take other forms such as a cylindrical tube, a wooden bobbin or the like; it being noted here that in the present specification and claims the term "yarn-carrier" is intended to apply to any form of package-support and the term "yarn" is used to indicate any

type of strand material whether textile or otherwise.

Suitable means, not herein shown or described, are provided for securing the cop-tube or yarn-carrier T on the mandrel 5 to be rotated by and with the winding spindle 3. A thread-guide 10 of usual form is mounted to reciprocate longitudinally of the axis of the spindle to deposit the yarn on the tube T in helical coils which build up in overlying concentric layers to form the body of the package. The thread-guide 10 may be mounted on a reciprocable traverse-rod 11 which is slidable in a groove 12 formed on the swinging traverse-frame 14. The traverse-frame 14 is pivotally mounted on the cam-shaft 4, as indicated in Figs. 1 and 2 of the drawings, and this shaft carries and rotates a helical cam 15 shown in partial view in Fig. 2. The cam 15 is formed with a helical groove 16 engaged by a stud or roller 17 at the end of the traverse-rod 11, this mechanism being of well-known form for reciprocating the thread-guide 10 to traverse the yarn longitudinally of the spindle 3.

The thread-guide 10 is supported at the upper end of an arm or holder 18 which is mounted on the traverse-rod 11 and is slidable along the forward face of a traverse-frame back 19. As shown in Fig. 1, the thread-guide arm or holder 18 is formed with a lip 13 hooked over the beveled upper edge of the traverse-frame back 19 to maintain it bearing thereagainst and the upper end of the arm 18 is forked to enclose and grip the button-like thread-guide 10. The thread-guide 10 may be of any usual form, but as shown in Figs. 1 to 7 it is of lozenge-shape with a V-shaped notch or groove 20 in its upper portion adapted to receive and guide the yarn γ . Preferably, the thread-guide 10 is provided with a guard comprising prong-like projections 21 crossing each other and overlying the notch 20 in the guide to prevent the yarn from being released therefrom. The thread-guide 10 is of the self-threading type, however, as provided by a re-entrant opening between the prongs 21 through which the yarn enters the notch 20 as it is drawn down across the curved edges of the prongs.

The traverse-frame 14 has a depending arm or extension 22 which is weighted to maintain the convex face of the thread-guide 10 bearing against the surface on which the winding is performed and as the package increases in diameter with the growth of the winding the traverse-frame 14 is swung outwardly on its pivot on the cam-shaft 4 with the thread-guide receding from the axis of the winding spindle 3. Projecting rearwardly from the traverse-frame back 19 are bosses 23 having holes in which are mounted the legs of an inverted U-shaped wire-bail 24 secured in place by suitable screws. The horizontal bar of the bail 24 is offset rearwardly from and extends parallel to and in alinement with the surface of the cop-tube T on which the winding is performed to adapt it to function as a guide or rest across which the yarn γ leads as it feeds through the thread-guide 10 to deliver onto the surface of the package-support or tube T.

A tension-device, shown generally at 25, is usually provided for tensioning the yarn as it feeds to the thread-guide 10 and the machine embodies suitable starting and stopping mechanism which may be of any approved form, but is not herein shown or described as it forms no part of the present invention.

The reserve length or tail-end winding device

of the present invention may take several forms and, as illustrated in Figs. 1 to 7, it comprises substantially only two elements, namely, a yarn-retaining member 26 constructed of spring wire and a supporting bracket 27 which may be made from relatively heavy wire and shaped to the form shown in Fig. 3. As shown in Figs. 2 and 3, the support 27 for the yarn-retainer 26 when constructed from a rod or wire may comprise an upright arm 28 bent into an elongate loop 29 at its lower end to adapt it to encompass the shank of a stud or screw 30 used to fasten the leg of the bail 24 in the right-hand boss 23 on the traverse-frame back 19. A washer 31 underlying the head of the screw 30 is tightened against the sides of the loop 29 to clamp the support 27 fixedly in position with its upright arm 28 projecting upwardly above the thread-bail 24. The upright arm 28 of the wire is bent laterally to form a substantially horizontal arm 35 which reaches outwardly toward the periphery of the cop-tube T when the latter is in position on the winding mandrel 5, see Fig. 1 of the drawings. The outer end of the arm 35 is flattened somewhat and bent or curved downwardly in an ear 36 formed with an elongate opening or slot 37 therein.

The yarn-retainer 26 when constructed of relatively fine tempered wire may comprise a vertical branch 38 folded or doubled rearwardly on itself and clamped to the upright arm 28 of the support 27. For this purpose a collar 39 surrounds the arm 28 and the doubled portion of the branch 38 of the member 26. A screw 40 threaded through the collar 39 is set up against the arm 28 to clamp the member 26 in place thereon with its main portion extending forwardly from the branch 38 in a substantially horizontal arm 41. At the end of the arm 41 the wire is bent downwardly and laterally and formed with a V-shaped crotch 42 with the lateral end of the crotch continued downwardly in a vertical branch or leg 43. At the lower end of the leg 43 the wire is bent at substantially right-angles to provide an offset length 44, see Fig. 3, and then bent downwardly again to provide a portion 45 projecting through the slot 37 in the ear 36 at the end of the arm 35 of the support or bracket 27. The terminal portion of the branch 46 of the member 26 is bent at right-angles and then upwardly to provide a sort of hook 47 under the ear 36 so that the tension of the spring wire in the arm 41, which normally tends to hold the member raised, will not cause release of the lower portion 46 from the slot 37 in the ear 36. It will be understood that the tension of the spring wire from which the member 26 is constructed normally tends to hold its arm 41 raised to its uppermost position shown in Fig. 3 of the drawings. As will be explained more fully hereinafter, the yarn strand *y* is received in the crotch 42 of the member 26 and as the winding operation is started the tension on the strand will rock the member downwardly until the offset portion 44 of its branch or leg 43 rests against the lower end of the notch 37 in the ear 36, see Figs. 2 and 4 of the drawings.

In operation, the tail-winding device constructed in the form described above functions in the manner explained as follows: Referring to Figs. 1 and 2, to prepare the winding machine for operation the yarn *y* is drawn upwardly from its supply, not herein shown, through the tension-device 25, threaded through a slub-catcher 32 arranged thereabove and thence led across the horizontal bar of the thread-bail 24. The end of the strand may be fastened to the cop-tube T or

other package-support in any suitable manner, the usual practice being to wind a few turns around the mandrel 5 and then to slip the tube T onto the latter to cause it to bind the end turns of the strand to the mandrel. The traverse-frame 14 is then swung into position manually to place the thread-guide 10 against the surface of the cop-tube T. The operator next grasps the yarn in the fingers and places it in the crotch 42 of the yarn-retainer 26 so that it is held above the thread-guide 10, free from engagement therewith. The machine is then started to operate and as the cop-tube T is rotated by the winding spindle 3 the strand of yarn *y* will be wound around the base or larger end of the conical cop-tube in the manner indicated in Fig. 2.

As the yarn is wound onto the tube T in this manner the tension on the strand will cause the yarn-retaining member 26 to be rocked or drawn downwardly until the offset portion 44 of its leg 43 brings up against the lower end of the notch 37 in the ear 36 on the support 27. This action takes place immediately the cop-tube T starts to rotate and meanwhile the thread-guide 10 will be reciprocated by the traverse-bar 11 under the action of the cam 15. The thread-guide 10 may be in any particular position longitudinally of the tube T at the start of the winding operation and while the yarn *y* is held in the retaining member 26 the guide will make several traverse strokes back and forth along the cop-tube without having any traversing effect on the yarn. That is to say, the yarn feeding through the crotch 42 in the retainer 26 will be held out of the range of the reciprocating thread-guide 10. When the thread-guide moves toward the right-hand end of the cop-tube T it will eventually reach the position shown in Fig. 4 where a portion of the guide, for example, the edge of the guard finger 21, will strike against the hook-portion 47 of the yarn-retaining member 26. As the guide 10 continues its motion in the direction indicated by the arrow in Fig. 4 it will shift the yarn-retainer 26 to the position shown in Fig. 5, thereby releasing its offset portion 44 from the lower end of the slot 37 in the ear 36 on the arm 35 of the support 27. Then, as the thread-guide 10 reverses its stroke to move in the opposite direction, as indicated by the arrow in Fig. 6, it will release the member 26 and the latter will be caused to rock downwardly under the tension of the yarn drawing through the crotch 42 and winding onto the cop-tube T. Thereafter, the thread-guide 10 will move outwardly to the left-hand end of its traverse stroke and upon its return stroke it will again strike against the member 26 in the manner indicated in Fig. 7. During this last movement of the thread-guide 10 toward the right it will engage the leg 43 of the member 26 to rock the latter laterally as it pivots on the upper end of the slot 37 in the manner indicated in Fig. 7. This lateral rocking action of the member 26 will tilt the crotch 42 into position to release the strand which has been held therein and the tension on the yarn will cause it to slide downwardly over the rounded face of the ear 36 which at this juncture directly overlies the notch 20 in the thread-guide 10. The tension on the yarn thus will cause the strand to be drawn down through the opening 70 between the prongs 21 and into the bottom of the groove 20, whereof it is engaged by the thread-guide to traverse it longitudinally of the cop-tube T. In this manner the strand is released from the yarn-retainer 26 and caused to be engaged with the thread-guide 10 to traverse it length-

wise of the tube T and distribute it in helical coils thereon. The winding continues in this manner until the package is completed to the desired size and removed from the machine. It is to be noted that while the yarn strand *y* is held in the crotch 42 of the retaining member 26 the latter is caused to be moved laterally to a slight extent by the action of the thread-guide 10, see Figs. 4 and 5, and this results in giving a short traverse to the coils or turns constituting the tail-end. This tends to bind the yarn more securely in place on the tube T while yet leaving the first end of the strand available for drawing off a length in piecing it up to another package.

After the yarn-retainer 26 has released the yarn to transfer it to the thread-guide 10 the resilience of the arm 41 of the member 26 will cause the latter to spring upwardly into its initial position shown in Fig. 3 so that it is reset automatically for the next operation. When a new package is to be wound the operator places a fresh tube T on the mandrel 3 and proceeds to attach the thread thereto in the manner explained above. The traverse-frame 14 which has been swung outwardly during the growth in diameter of the previously-wound package is returned to initial position manually to place the thread-guide against the surface of the cop-tube T and after the end of the yarn leading from the tension-device 25 has been fastened to the cop-tube T and placed in the crotch 42 of the yarn-retainer 26 the winding operation can be started again without any further attention on the part of the operator. That is to say, the operator is not required to adjust or reset the tail-winding device or to perform any other manual operations such as holding the traverse-frame in a certain position away from the winding mandrel or adjusting the thread-guide to any certain position lengthwise of its range of traverse; such operations being necessary in most tail-winding devices previously used in the art.

Figs. 8 to 14 illustrate a modified form of construction of the tail-end winding device which is of more rugged construction and adapted for universal application to machines having different types of thread-guides. It is the usual practice to use different forms of porcelain eyes or thread-guides for the different kinds and sizes of yarn wound on machines of the present type. Such thread-guides vary in size and shape so that considerable adjustment of the tail-end winding device first described would be required each time a different kind or size of yarn is to be wound on the machine to adapt the thread-guide to actuate the device during successive strokes of the guide. In the form of construction illustrated in Figs. 8 to 14 a standard, non-changeable part of the thread-guide holder constitutes a bunter for actuating the tail-end winding device instead of the thread-guide proper as shown in Figs. 1 to 7.

Referring to Fig. 8, the essential elements of the winding machine are of the same general construction as illustrated in Fig. 1, comprising a thread-guide 45 mounted to reciprocate along the forward face of the traverse-frame back 19 and to bear against the cop-tube T mounted on the mandrel 5 of the winding spindle 3. The thread-guide 45 is of bifurcated form, providing a relatively long V-shaped slot for receiving the yarn strand *y*, and having a convex face for contact with the periphery of the winding package. The thread-guide arm or holder 18 is of standard form and provided with the usual lip 13 overlying the upper beveled edge of the traverse-frame back 19, and

in this instance the lip also functions as a bunter for actuating the tail-end winding device. The usual U-shaped wire-bail 24 has its legs secured in the bosses 23 on the traverse-frame back 19 by means of suitable screws and the screw 56 for securing the right-hand leg of the bail also serves to fasten the tail-end winding device in place on the traverse-frame back.

The tail-end winding device comprises a one-piece supporting bracket 48, see Figs. 8 and 9, preferably constructed of sheet-metal, and constituted with an upright leg 49, a top-portion 50 bent at right-angles to the leg, and a depending portion 51 bent downwardly from the top-portion to provide an inverted U-shaped frame. A flange 52 is folded downwardly from the top portion 50 to overlie the edges of the leg 49 and depending portion 51 at one side thereof, being welded or otherwise suitably joined thereto to strengthen the frame. The lower end of the leg 49 has an offset foot 53 for seating the bracket against the top and side of the boss 23 at the right-hand end of the traverse-frame back 19, see Fig. 8. The leg 49 and foot 53 are apertured to provide an opening 54 through which one leg of the wire-bail 24 projects and the foot is provided further with a horizontal slot 55 through which the attaching screw 56 extends, see Figs. 9 and 14. The slot 55 provides for initial lateral adjustment of the bracket 48 longitudinally of the traverse-frame back 19. An ear 57 on the depending portion 51 of the bracket 48 extends forwardly and downwardly therefrom, forming an opening 58 at its rear and the forward edge of the depending portion 51 below the opening is inclined rearwardly to provide an arcuate face 59, see Fig. 14. Projecting inwardly from the leg 49 of the bracket 48 intermediate its ends is a lug 60 formed by a bent portion extended from the metal of the bracket.

A yarn-retaining member 62, is mounted to rock and slide vertically on the supporting bracket 48, being of the same general inverted U-shape as the bracket. The yarn-retaining member 62 is mounted within the U-shaped frame of the bracket 48 and has a relatively long leg 63 positioned adjacent the leg 49 of the bracket, a top portion 64 bent at right-angles to the leg and a depending portion 65 bent downwardly from the top portion and positioned adjacent the depending portion 51 of the bracket. The yarn-retaining member 62 is mounted for pivotal and vertical sliding movement on the bracket 48 by means of a screw 66 having a reduced end portion projecting inwardly from the leg 49 and a pin 67 projecting inwardly from the depending portion 51 of the bracket. The ends of the screw 66 and pin 67 engage through vertical slots 68 in the leg 63 and depending portion 65, respectively, of the yarn-retaining member adjacent its upper end, a washer 69 being positioned between the legs 49 and 63, see Fig. 8. The depending portion 65 of the yarn-retaining member 62 has a forwardly and upwardly projecting curved finger 70 forming a crotch 71 at the rear for receiving and guiding the yarn strand *y* to cause a tail-end to be wound on the end of the cop-tube T, see Figs. 9 and 14. The yarn-retaining member 62 normally is maintained in the position shown in Fig. 9 under the tension of a wire spring 72 fastened at one end to the leg 49 of the bracket 48 and having a depending portion with an offset end 73 engaging across the edge of the leg 63 of the member, see Figs. 8 and 9. The forward movement of the yarn-retaining member 62 is limited by the engagement of the forward edge of its leg 63 with the lug 60 projecting in-

wardly from the leg 49 of the supporting bracket 48. In the normal or initial position of the yarn-retaining member 62 the finger 70 underlies the end of the ear 57 to provide a closed guard for retaining the yarn strand *y* in the crotch 71.

A helical spring 78 connected to an ear 77 bent inwardly from the leg 63 of the yarn-retaining member 62 with its opposite end anchored to the top portion 50 of the bracket 48 normally tends to hold the member in its raised position as shown in Figs. 9 and 14. The spring 78 is of relatively light tension to adapt it to yield when the yarn strand *y* is drawn across the edge of the ear 57 and into the notch 71 at the rear of the finger 70 to cause the member to be carried downwardly relative to the supporting bracket 48 as the yarn is tensioned by winding it on the cop-tube T. The leg 63 of the yarn-retaining member 62 is provided with a horizontal latching shoulder 79, see Fig. 14, which cooperates with the lug 60 on the bracket 48 to limit the downward movement of the member when in its forward position shown in Fig. 10. Adjacent its lower end the leg 63 of the yarn-retainer 62 projects laterally and then downwardly to provide a depending foot 82. The foot 82 is provided with a laterally-projecting toe 83 at its lower end for a purpose as explained hereinafter. Slidably mounted on the foot 82 is a contact member 84 of U-shape or folded form which embraces the sides and rearward edge of the foot, see Figs. 8 and 14. The contact member 84 is mounted on the foot 82 by means of a pin 85 fast in the latter with its ends projecting through slots 86 in the sides of the contact member. The contact member 84 is thus free to slide on the foot 82 to normally drop by gravity to its lowermost position shown in Fig. 14, but is adapted to be slid upwardly on the foot to the position shown in Fig. 12. One side of the contact member 84 has a laterally-projecting lug or finger 87 positioned above its lower edge while the edges of the sides of the contact member below the lug constitute vertical shoulders 88. As shown in Fig. 10, the lower edge of the finger 87 is inclined upwardly. With the contact member 84 in its lowermost position on the foot 82 as shown in Figs. 9 and 10, the shoulders 88 will depend below the toe 83, but when the contact member is slid upwardly on the foot the shoulders 88 will be raised above the lower edge of the toe. The lower edges of the contact member 84 are beveled as shown in Figs. 8 and 14 to adapt them to rest on the beveled upper edge of the traverse-frame back 19.

The method of operation of the tail-end winding device illustrated in Figs. 8 to 14 is generally similar to that explained with respect to the device illustrated in Figs. 1 to 7. The strand of thread or yarn *y* is first drawn upwardly through the tension-device 25 and slub-catcher 32 and thence led across the ear 57 and down along the finger 70 to thread it into the crotch 71 in the yarn-retaining member 62. By drawing the strand of yarn *y* across the finger 70 the yarn-retaining member 62 will be depressed against the action of the spring 78 to permit the strand to slide into the crotch 71; after which the spring will act to raise the member to retain the yarn in the guide-eye formed between the finger 70 and ear 57 in the manner shown in Fig. 9. The end of the strand *y* is then fastened to the cop-tube T supported on the mandrel 5 of the winding spindle 3.

After the traverse-frame 14 has been adjusted

to place the thread-guide 45 against the cop-tube T the machine may be started to operate and as the cop-tube is rotated by the winding spindle 3 the strand of yarn *y* will be wound around the larger end of the tube in the manner indicated in Fig. 11. As the strand *y* is taken up by the winding operation the tension on the yarn will cause the yarn-retainer 62 to be depressed or slid downwardly on the bracket 48 to the position shown in Fig. 10 against the action of the spring 78, the slots 86 in its leg 63 and depending portion 65 permitting it to slide on the reduced end of the screw 66 and the pin 67. The downward movement of the yarn-retainer 62, however, will be limited by the engagement of the shoulder 79 on its leg 63 with the lug 60 on the bracket 48. This action will take place immediately the cop-tube T starts to rotate, and meanwhile the thread-guide 45 will be reciprocated by the traverse-rod 11 under the action of the cam 15. The thread-guide 45 may be in any particular position longitudinally of the cop-tube T at the start of the winding operation and while the yarn strand *y* is held in the crotch 71 of the yarn-retainer 62 to wind a tail-end on the tube the guide will make several reciprocatory strokes back and forth along the tube without traversing the yarn.

When the thread-guide 45 moves toward the right-hand end of the cop-tube T eventually it will reach the position shown in Fig. 10 where the lip or bunter 13 on the guide-holder 18 will strike the shoulders 88 of the contact member 84. As the guide 10 continues its motion toward the right it will rock the yarn-retainer 62 on the pivots 66 and 67 to carry it to the position shown in Fig. 11, thereby releasing its shoulder 79 from the lug 60 on the bracket or support 48. Immediately upon release of the shoulder 79 from the lug 60 the tension of the winding yarn strand *y* will act to further depress the yarn-retainer 62 against the action of the spring 78, but such downward movement will be limited by the engagement of the lower edge of the laterally-projecting toe 83 on its foot 82 with the top of the bunter 13 on the guide-holder 18. The yarn-retainer 62, however, will continue to be rocked toward the right by the bunter 13 on the guide-holder 18 to carry it to the position shown in Fig. 11. However, such movement will not be sufficient to release the yarn strand *y* from the edge of the finger 70. As the thread-guide 10 reverses its stroke and moves in the opposite direction indicated by the arrow in Fig. 12, it will release the retainer 62 and the latter will be rocked toward the left by the spring 72 to the position shown in this view. During such rocking movement of the yarn-retainer 62 the yarn strand *y* is retained in the crotch 71 so that the winding of the tail-end will be continued. Upon disengagement of the bunter 13 from the yarn-retainer 62 the tension of the yarn strand *y* will depress the retainer further against the action of the spring 78 to the position shown in Fig. 12. During this downward movement of the yarn-retainer 62 the lower beveled edges of the contact member 84 will come to rest against the beveled upper edge of the traverse-frame back 19 so that the foot 82 will slide downwardly relative thereto, the pin 85 and slot 86 connection permitting such movement.

In the lowered position of the yarn-retainer 62 shown in Fig. 12, the laterally-projecting toe 83 will be in position to be engaged by the bunter 13 on the thread-guide holder 18 during the next right-hand stroke of the thread-guide 45. The

thread-guide 45 will move through its stroke toward the left and then return toward the right until the bunter 13 is in the position indicated by dash-lines in Fig. 12 at which juncture the bunter again will engage the toe 33 at the lower end of the leg 63 of the yarn-retaining member 62. The inclined lower edge of the laterally-projecting fingers 87 on the contact member 84 will also be engaged by the bunter 13 to raise the contact member slightly on the leg 63 of the yarn-retaining member 62 to hold its lower edge above the beveled edge of the traverse-frame back 19 whereof to prevent it from binding or cramping thereon. During movement of the thread-guide 16 from the position illustrated in Fig. 12 to that illustrated in Fig. 13 the yarn-retainer 62 again will be rocked toward the right against the action of the spring 72. As will be noted by reference to Fig. 13, the finger 70 will be moved further toward the right at this point due to the engagement of the bunter 13 with the toe 33 on the foot 82 until the end of the finger passes back of the forward edge of the depending portion 51 of the bracket 43. The yarn *y* will thus be engaged by the curved edge 59 on the depending portion 51 to force it off from the finger 70 and the tension on the yarn will draw it downwardly into the V-shaped slot in the thread-guide 45 as it is guided on the edge 59. To recapitulate, the yarn-retaining member 62 will be swung through an arc of predetermined extent during the first traverse of the thread-guide 45 toward the right due to the engagement of the bunter 13 on the thread-guide holder 13 with the shoulders 88 on the contact member 84 and will be moved through an arc of greater extent during the second traverse of the thread-guide 45 toward the right, due to the engagement of the bunter with the forwardly-projecting toe 33 on the leg 63 to cause the yarn strand to be stripped from the finger 70. The yarn strand *y* then will be received in the thread-guide 45 to traverse it to wind the package in the usual manner. It is to be noted that due to back and forth oscillation of the yarn-retainer 62 as caused by its engagement during several traverses of the thread-guide and the action of the spring 72, the yarn in the tail-end will be deposited in crossing coils which tend to bind it more firmly in place and prevent dislocation or unwinding thereof.

It will be observed from the foregoing specification that the present invention provides a tail-end winding device of extremely simple and compact construction to adapt it for economical manufacture. It also will be observed that the present invention provides a tail-end winding device of two different forms, each form of the device being automatically operable to release the yarn strand in position to be caught by the thread-guide and thereafter traversed to wind a package. It will be observed further that the present invention provides a tail-end winding device which may be applied to standard types of winding machines and adapted to be operated by the reciprocation of the thread-guide. The last-described form of the device is designed for universal application with thread-guides of various forms, its operation being effected by the engagement of the lip or bunter 13 on the guide-holder which is standard construction on practically all winding machines of the present type.

While two forms of construction of the tail-end winding device are herein shown and described, by way of illustration, it will be understood that other modifications may be made in the structure

and arrangement of the parts of the device without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, I claim:

1. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn lengthwise of the carrier to wind a package thereon, a member for holding the yarn to prevent its traverse by the traversing means, means for shifting said member into different positions with a step-by-step movement to cause it to eventually release the yarn to permit it to be traversed by the traversing means, and resilient means for returning said member to initial position after it releases the yarn.

2. In a winding machine, a rotatable yarn-carrier, means for traversing yarn lengthwise of the carrier to wind a package thereon, a member constructed and arranged to hold the yarn to prevent it from being traversed whereby to wind a reserve length thereof on the end of the carrier, means operated by the traversing means to shift said member with a step-by-step movement during several rotations of the carrier, said last-named means operating eventually to shift said member into position to release the yarn to permit it to be traversed by the traversing means, and means for automatically returning said member to initial position after it has released the yarn.

3. In a winding machine, a rotatable yarn-carrier, means for traversing yarn lengthwise of the carrier to wind a package thereon, a tail-winding device comprising a member engageable with the yarn to restrain it from being traversed, means operated by the traversing means for shifting said member by stages during several rotations of the carrier, means to retain said member initially in the different positions to which it is shifted, said shifting means operating to eventually shift said member into position to release the yarn to cause it to be traversed by the traversing means, and means for automatically returning said member to initial position after it has released the yarn.

4. In a winding machine, a rotatable yarn-carrier, means for traversing yarn longitudinally of the carrier to wind a package thereon, a member for holding the yarn disengaged from the traversing means to cause it to wind on one end of the carrier, means actuated by the traversing means for shifting said member into different positions by stages during a predetermined number of rotations of the receiver, said shifting means acting finally to shift said member into position to transfer the yarn to the traversing means after several coils of yarn have been wound on the end of the carrier, and means for automatically returning said member to initial position after it has released the yarn.

5. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn lengthwise of the carrier to deposit it in concentric layers equal in length to that of the package to be wound, and a tail-winding device comprising a member for holding the yarn away from the traversing means to direct it onto the carrier at a point out of the range of movement of the traversing means, said traversing means operating to periodically and progressively shift said member during the initial stages of the winding to carry the yarn into position within the range of the traversing means to cause it to be engaged thereby to wind the package, and said member being resilient to adapt it to return to initial po-

sition after the yarn has been engaged by the traversing means.

6. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn lengthwise of the carrier to wind a package thereon, a member for holding the yarn to prevent its traverse by the traversing means, means for shifting said member into different positions with a step-by-step movement to cause it to eventually release the yarn to permit it to be traversed by the traversing means, and means for automatically returning said member to first position after it has released the yarn.

7. In a winding machine, means for rotating a yarn-receiver, means for traversing yarn lengthwise of the receiver to wind a package thereon, a member constructed and arranged to hold the yarn to restrain it from being traversed whereby to wind a reserve length thereof on the end of the carrier, means for shifting said member by stages during several rotations of the carrier, means to retain said member in the different positions to which it is shifted, said shifting means acting eventually to shift said member into position to release the yarn to cause it to be traversed by the traversing means, and means for automatically returning said member to initial position after it has released the yarn to the traversing means.

8. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn lengthwise of the carrier to wind a package thereon, a member engageable by the yarn to restrain it from being traversed by the traversing means, means actuated from the winding machine to shift said member intermittently during several rotations of the yarn-carrier, said member being adapted to rock after its final shifting movement to cause it to release the yarn to permit it to be traversed by the traversing means, and means for automatically returning said member to initial position after it has released the yarn.

9. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn lengthwise of the carrier to wind a package thereon, a yarn-retaining member for holding the yarn to prevent its traverse by the traversing means, means for mounting said member to adapt it to move in two directions, means for first moving said member in one direction with a progressive step-by-step action, said member being adapted to move eventually at right-angles to the direction of its first movement to cause it to release the yarn to permit it to be traversed by the traversing means, and means for automatically returning said member to initial position after it has released the yarn.

10. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retaining member pivoted to move in a direction substantially parallel to the axis of the carrier, and also to move in a direction normal thereto, and means actuated from the winding machine for moving the member in the first direction, said member being operative thereafter to move in the second direction to cause it to release the yarn to permit it to be traversed by the traversing means.

11. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retaining member for holding the yarn to prevent its traverse by the traversing means, means for mounting said member to adapt it to rock in two directions, means for actuating said member to cause it to

rock in the first direction, means for initially retaining said member in the different positions to which it is rocked, and means operated by the traversing means for rocking said member in the second direction to cause it to release the yarn to permit it to be traversed by the traversing means.

12. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retainer having means constructed and arranged to hold the yarn to prevent it from being traversed by the traversing means, means for mounting said member to adapt it to move in two directions, said member being engageable by the traversing means to shift it to cause it to move in one direction and thereafter in another direction to finally release the yarn to permit it to be traversed by the traversing means.

13. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, and a resilient member formed with a crotch for holding the yarn to restrain it from being traversed by the traversing means, said member being engageable by the traversing means to shift it with a step-by-step motion to cause it to move in one direction and thereafter being engageable by the traversing means to move it in another direction to cause it to release the yarn to permit it to be traversed by the traversing means, said member being adapted to return to initial position due to its resiliency after it has released the yarn.

14. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a member constructed of resilient material and formed with a crotch for receiving the yarn leading to the yarn-carrier, and means for mounting said member to adapt it to be moved under the tension of the yarn to cause it to be engaged by the traversing means to shift it with a step-by-step movement during repeated strokes of said traversing means, said member being adapted to release the yarn during its final movement to permit the yarn to be traversed by the traversing means.

15. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retainer constructed of spring wire and formed with a crotch for holding the yarn and a leg extending downwardly therefrom, said leg being formed with an offset portion, means for mounting said yarn-retainer in position for its leg to be engaged by the traversing means during repeated strokes thereof, and means for engaging the offset portion of the leg of the retainer to hold the latter in the position to which it is first moved, the leg of said member being engageable by the traversing means to release its offset portion from the holding means and to tilt said member to cause it to release the yarn to permit it to be traversed by the traversing means.

16. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retaining member mounted for rocking movement and adapted to hold the yarn to restrain it from being traversed by the traversing means, said yarn-retaining member having stepped shoulders, and a bunter on the traversing means for successively engaging the stepped shoulders on the yarn-retaining member to rock the latter with a step-by-step movement during repeated strokes of the traversing means to cause it to eventually release the

yarn to permit it to be traversed by said traversing means.

17. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retainer constructed to hold the yarn out of range of the traversing means, said retainer having a detent-shoulder, a support for mounting the retainer having an abutment engageable by its detent-shoulder, resilient means for normally maintaining the retainer in raised position, and means on the traversing means for engaging the retainer to release its detent-shoulder from the abutment on the support, said retainer being engageable thereafter by the means on the traversing means to rock the retainer to release the yarn therefrom to permit it to be traversed by the traversing means.

18. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn on the carrier to wind a package, a yarn-retainer having a notch for holding the yarn out of range of the traversing means and formed with a detent-shoulder, a support for mounting the yarn-retainer to rock and slide thereon, said support having an abutment engageable by the detent-shoulder on the retainer, resilient means for normally holding the retainer in raised position on the support, and means carried by the traversing means for successively engaging the yarn-retainer to first disengage its detent-shoulder from the abutment on the support and thereafter rock it with respect to the support to cause the yarn to slide out of the notch therein to transfer it to the traversing means.

19. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retaining member mounted for rocking and vertical sliding movement and adapted to hold the yarn to restrain it from being traversed by the traversing means, said yarn-retaining member having stepped shoulders, resilient means for normally holding the yarn-retaining member in raised position, and a bunter on the traversing means for engaging the shoulders to rock the yarn retaining member, said yarn-retaining member being moved downwardly against the action of the resilient means by the tension on the feeding yarn strand to position another shoulder in the path of movement of the bunter, said bunter thereafter rocking the yarn-retaining member to cause it to release the yarn to permit it to be traversed by the traversing means.

20. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retaining member mounted for rocking and vertical sliding movement and constructed to hold the yarn to restrain it from being traversed by the traversing means,

said yarn-retaining member having stepped shoulders, a bunter on the traversing means for engaging the stepped shoulders on the yarn-retaining member to rock the latter with a progressively advancing movement to cause it to eventually release the yarn, and means for controlling the vertical movement of the yarn-retaining member as it is rocked by the bunter to position the stepped shoulders for successive engagement by the bunter.

21. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a yarn-retaining member mounted for rocking movement and having a notch for holding the yarn to restrain it from being traversed by the traversing means, said yarn-retaining member having a laterally-projecting toe at its lower end, and a contact member slidably mounted on the end of the yarn-retaining member and having a shoulder positioned at the rear of its forwardly-projecting toe, a bunter on the traversing means for engaging the shoulder on the contact member and the toe on the yarn-retaining member, and means for relatively moving the contact member and yarn-retaining member whereby the bunter successively engages the shoulder and the toe to rock the yarn-retaining member with a progressively increasing movement during repeated strokes of the traversing means to cause it to eventually release the yarn to permit it to be traversed by the traversing means.

22. In a winding machine, means for rotating a yarn-carrier, means for traversing yarn thereon to wind a package, a supporting bracket having an abutment thereon, a yarn-retaining member mounted for rocking and vertical sliding movement on the bracket and constructed to hold the yarn to restrain it from being traversed by the traversing means, said yarn-retaining member having a detent-shoulder intermediate its ends for cooperation with the abutment on the bracket and a laterally-projecting toe at its lower end, a contact member slidably mounted on the lower end of the yarn-retaining member and having a shoulder positioned at the rear of the laterally-projecting toe, a bunter on the traversing means for engaging the shoulder on the contact member to rock the yarn-retaining member to release its detent shoulder from engagement with the abutment, said yarn-retaining member being moved downwardly by the tension of the yarn to position the toe on the yarn-retaining member in the path of movement of the bunter whereby to cause the yarn-retaining member to be rocked by the bunter during a following stroke of the traversing means to release the yarn, and a spring for automatically returning the yarn-retaining member to initial position after it has released the yarn to the traversing means.

ROBERT E. MORTON.