Feb. 8, 1955 H. L. MUSCHAMP ET AL 2,701,689

AUTOMATIC YARN WINDING MACHINE

Filed Aug. 29, 1950 7 Sheets-Sheet 1

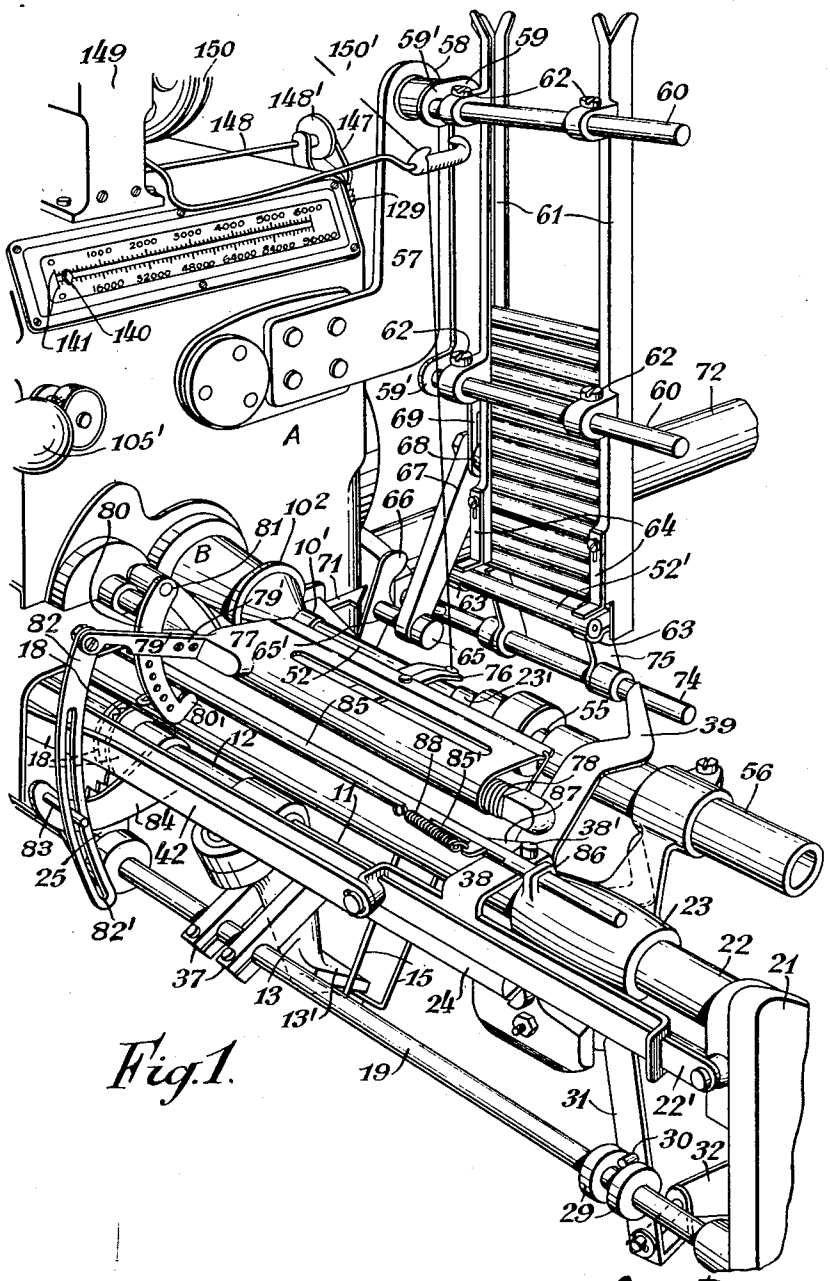

Fig. 1.

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AUTOMATIC YARN WINDING MACHINE

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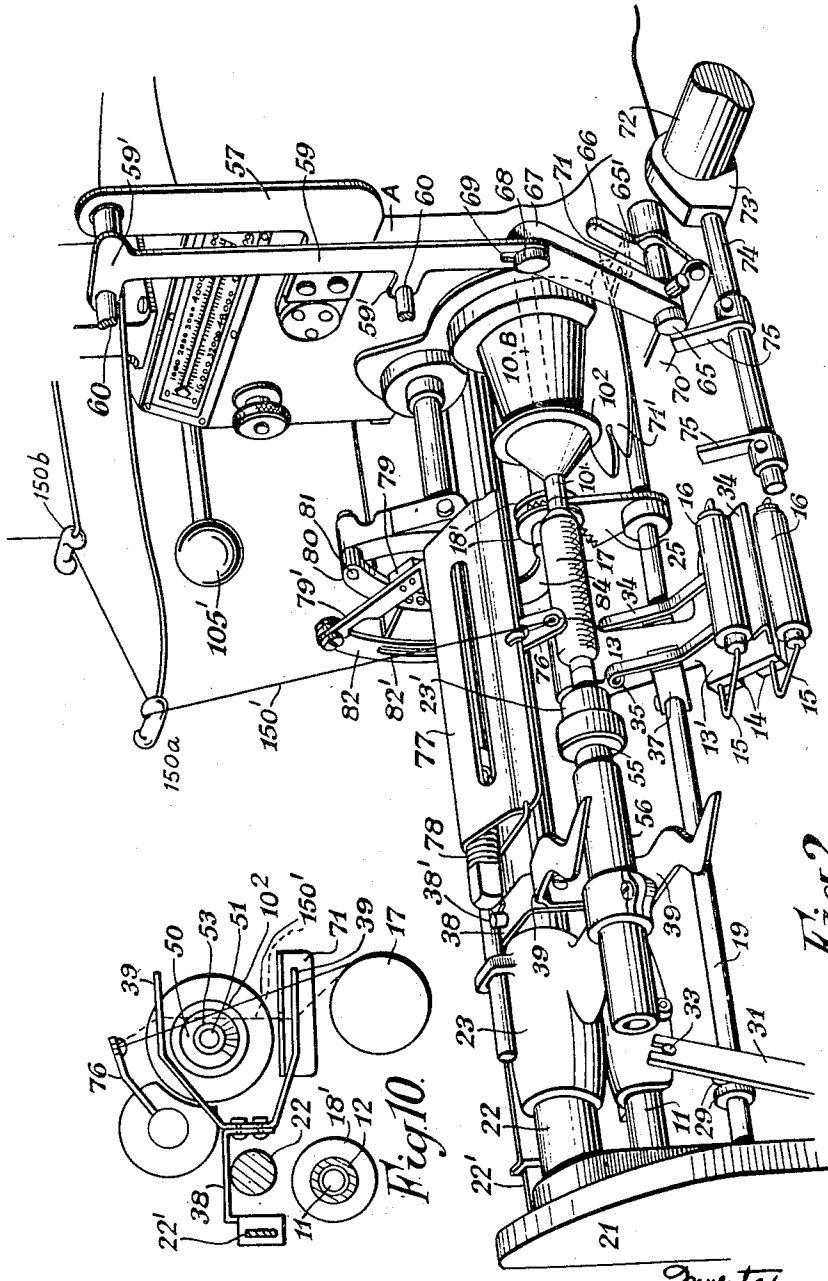

Fig. 2.

Fig. 10.

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AUTOMATIC YARN WINDING MACHINE

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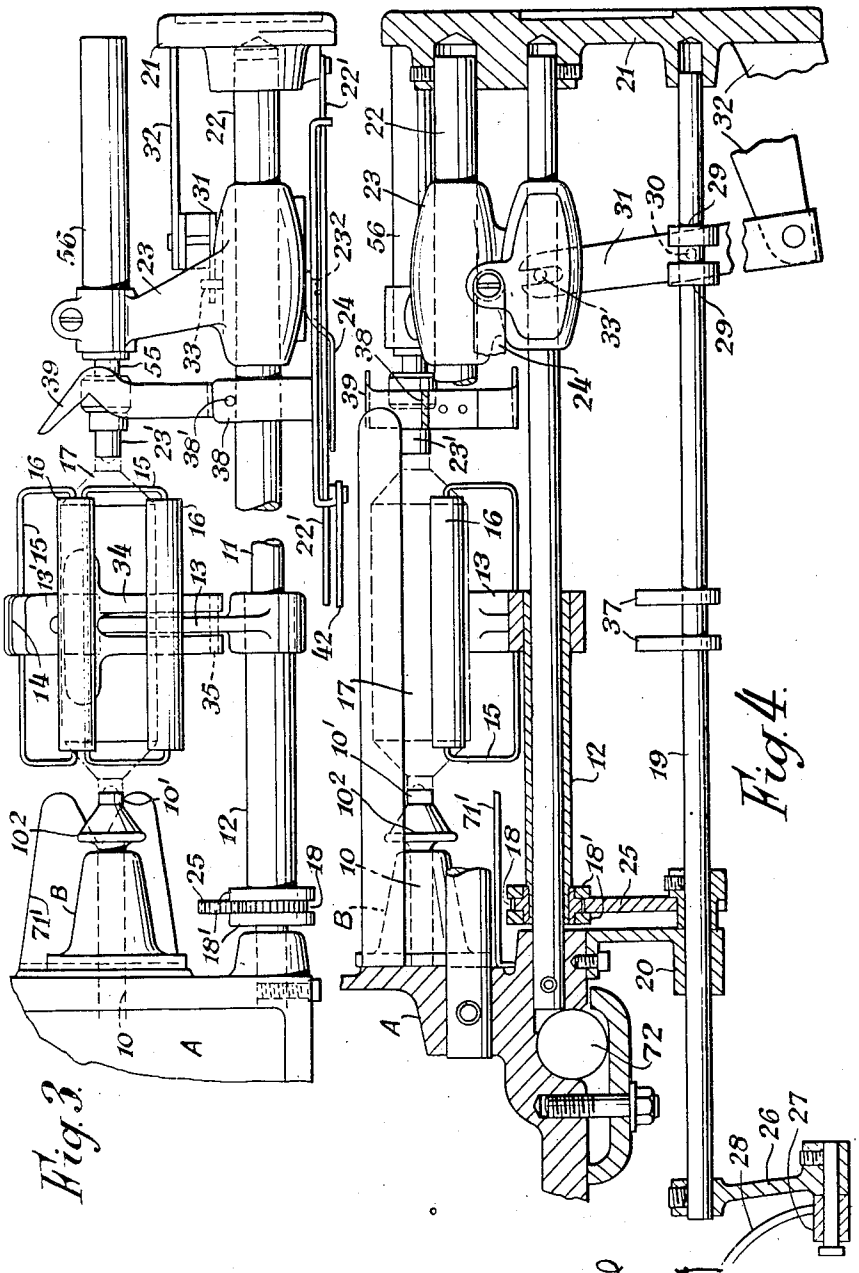

Fig. 3.

Fig. 4.

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AUTOMATIC YARN WINDING MACHINE

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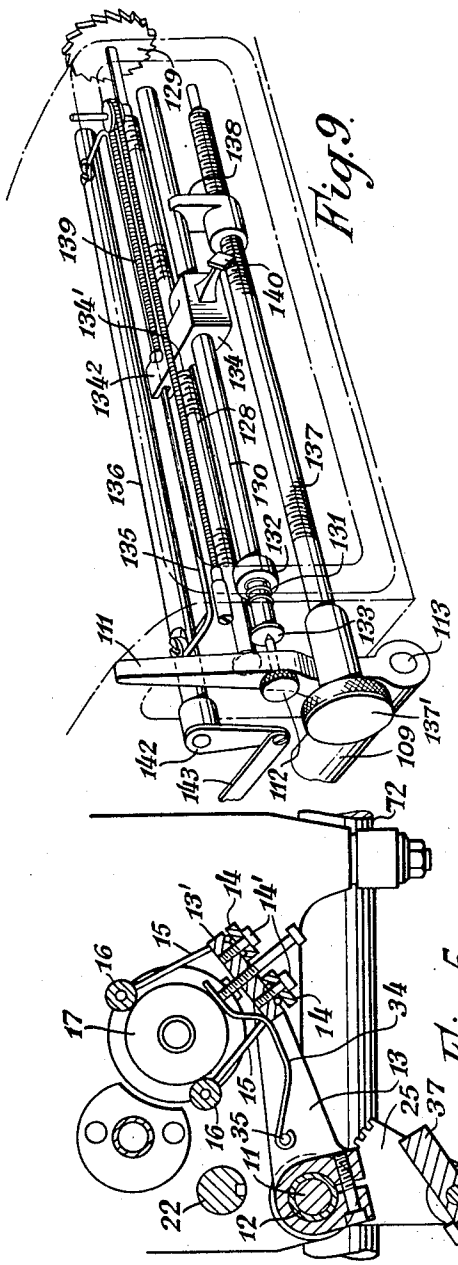

Fig. 9.

Fig. 5.

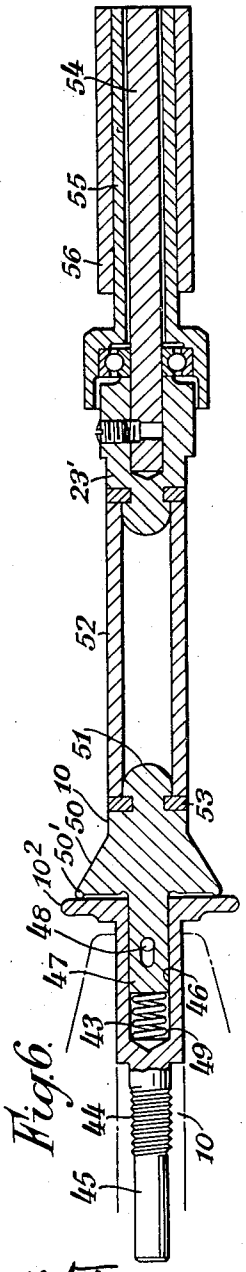

Fig. 6.

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AUTOMATIC YARN WINDING MACHINE

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Fig. 7.

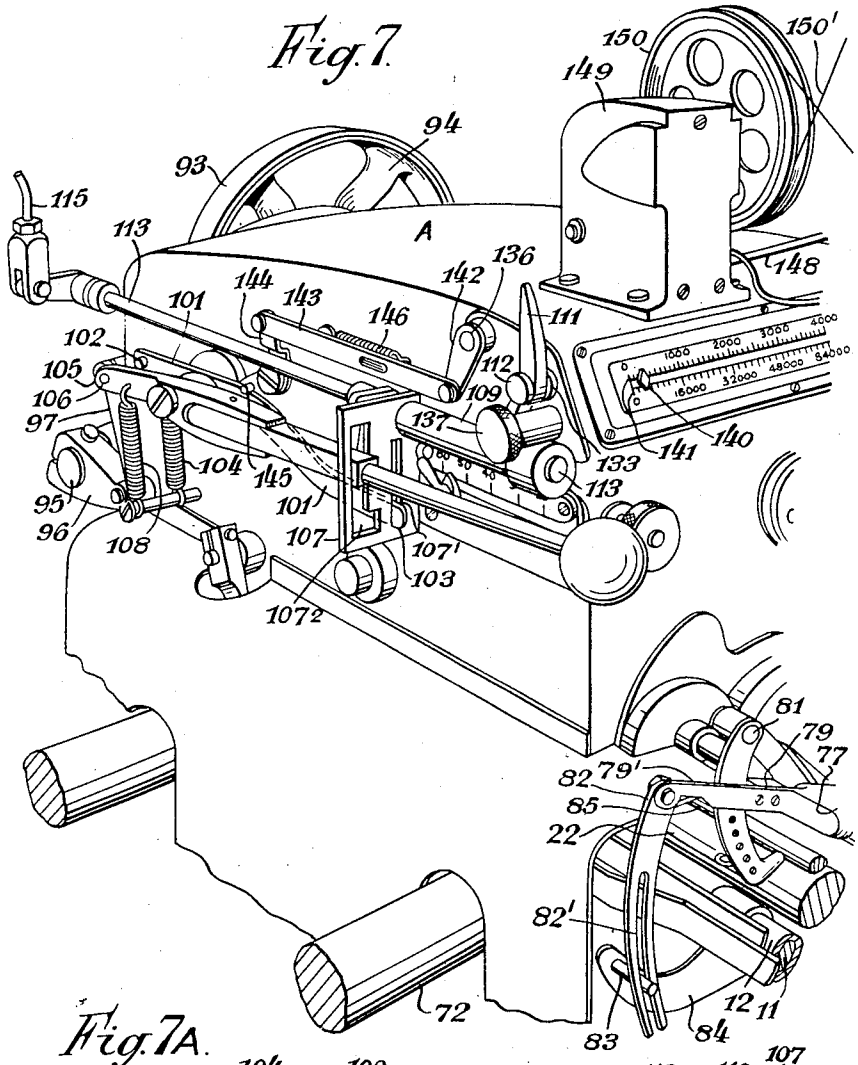
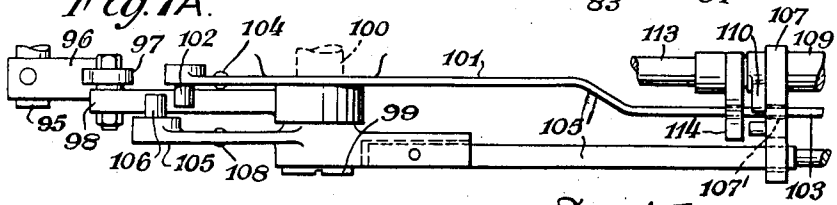


Fig. 7A.



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AUTOMATIC YARN WINDING MACHINE

Filed Aug. 29, 1950 7 Sheets-Sheet 6

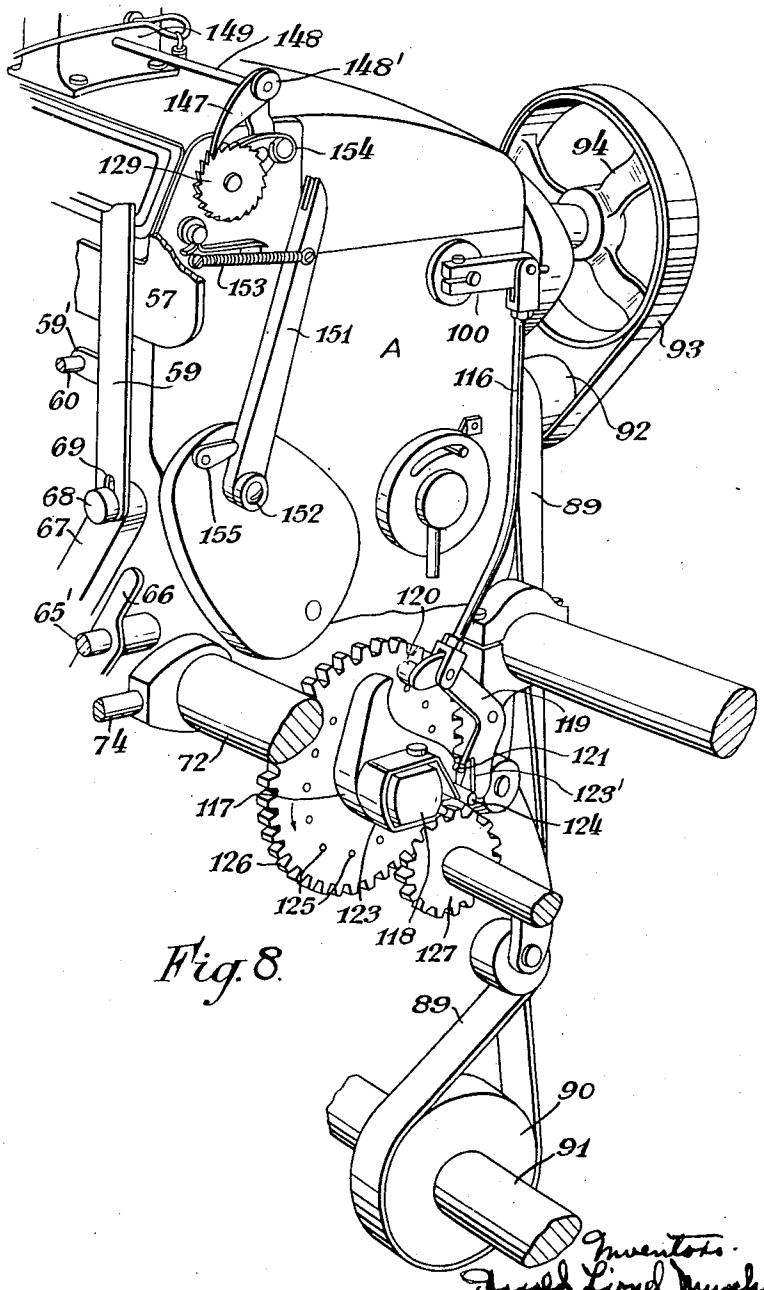

Fig. 8.

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AUTOMATIC YARN WINDING MACHINE

Filed Aug. 29, 1950 7 Sheets-Sheet 7

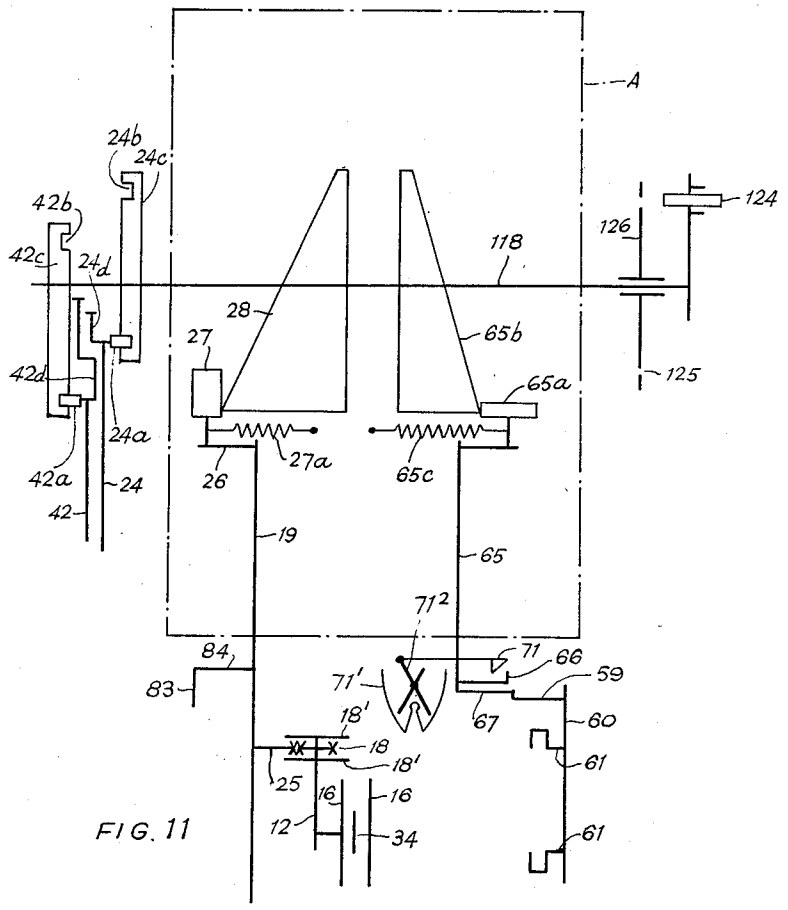

FIG. 11

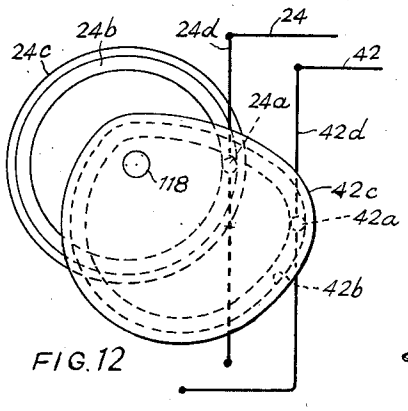

FIG. 12

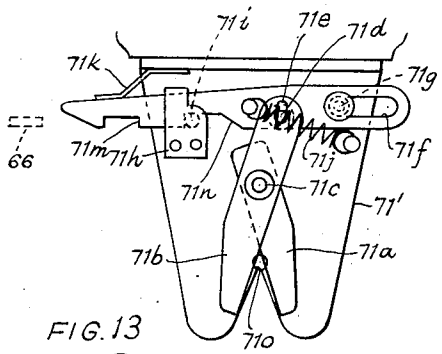

FIG. 13

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United States Patent Office

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AUTOMATIC YARN WINDING MACHINE

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Application August 29, 1950, Serial No. 181,981

Claims priority, application Great Britain April 9, 1949

13 Claims. (Cl. 242—35.5)

This invention is a continuation-in-part of our earlier application for United States Patent Serial No. 99,483, dated June 16, 1949, now abandoned, and relates to yarn winding machines of the kind in which the yarn is wound onto a core extending the full length of the package, whether it is a pirn, cop, spool or other package.

Such yarn winding machines comprise essentially a winding head having centres adapted to receive and hold an empty core on which the yarn is to be wound and which has the necessary yarn guide and traverse mechanism. Hitherto, automatic winding machines, whether single- or multi-spindle winders as they are termed, have merely brought the empty core, resting on a cradle, approximately into line with the centres of the winding station leaving the centres to do the final locating and gripping of the core. Moreover, after winding, the full package when released from the centres is quite free and allowed to fall to make room for the new core.

The present invention is based upon an appreciation that many of the stoppages with such machines is due to the freedom of the empty core and wound package respectively before and after winding, particularly where small or fragile cores are used.

One object of the present invention is an automatic winding machine in which, during the operation of removing a full package and inserting a new core, positive control of such package and of the yarn leading thereto is maintained until the interchange has been effected as compared with the previously known practice of merely releasing the full package from the winding station and allowing it to fall away relatively uncontrolled and without positively maintaining tension in the yarn. A further object is to enable this to be effected where winding occurs between centres one of which is axially movable to release the core and in which the full core also has to be moved axially for a less distance to release it from the other centre.

Still further objects of the invention are to be found in the features embodied in the appended claims for the positive control of the various elements and parts of the machine during the repeated cycle of winding operations.

In the accompanying drawings:

Fig. 1 is a perspective view from one side showing the winding station and associated mechanism of one example of a fully automatic quill winding machine made in accordance with the invention;

Fig. 2 is a perspective view from the other side of the winding station with the core feeding mechanism removed;

Figs. 3 and 4 are plan and elevation showing part only of the mechanism shown in Fig. 1;

Fig. 5 is a fragmentary and elevation showing the gripping and removing mechanism for the package;

Fig. 6 is a longitudinal section showing the winding head spindle;

Figs. 7, 8 and 9 are perspective views showing the measuring control mechanism;

Fig. 7A is a fragmentary plan of part of Fig. 7;

Fig. 10 is a diagrammatic end view showing the action of the collector fork;

Fig. 11 is a diagrammatic plan; and

Fig. 12 is a diagrammatic end view showing the main controlling cams of the automaton embodied in the winding head and their associated mechanism for effecting the cycle of operation of removing a wound package from the winding station and inserting a new core therein;

Fig. 13 is an underneath view of the yarn severing device.

As shown in the drawings the machine comprises a winding head A having a spindle bearing bracket B for the winding spindle **10** shown dotted and which is coupled in known manner to the driving gearing (not shown) in the winding head. The winding spindle has a head **10'** and a flange **10²**. Below and offset from the winding spindle is a rod **11** parallel with the axis of the spindle and fixed in the winding head. Slidably and rotatably mounted on such rod **11** is a sleeve **12** (see particularly Figures 3 and 4), at one end of which is an arm **13** having a head **13'** on which are a pair of clamps each holding a U-shaped spring wire **15**, the ends of each of which are turned into hold a roller **16**. The clamps can be released for adjusting the position and tension of the gripping rollers. The clamps consist of the plates **14** secured by screws **14'** (see Figure 5), which clamps hold the wires in grooves in the head so that the wires may be removed for the purpose of changing them for others of different size. The arm **13** is also adjustably secured on the end of the sleeve **12** so that the position of the rollers **16** relative to the quill **17** may be adjusted both radially and axially of the sleeve. At the other end of the sleeve is a toothed pinion **18** having a flange **18'** at each side of larger diameter than the teeth.

Immediately below the rod **11** is a further rod **19** which is both slidable and rotatable and is carried at one end by a bracket **20** (see Fig. 4) attached to the winding head. The tail or tip end bracket **21** of the winding machine is carried by the rod **11** and a further stiff rod **22** located above the rod **11**. The tail stock **23** which carries the tip end **23'** is slidably mounted on these two rods **11** and **22** and is adapted to be moved positively backwards or forwards to advance or retract the tail stock of the tip end relative to the quill, such movement being effected from the automaton by a push rod **24** of flat cross section, connected at **23²** to the tail stock **23**. Secured to the shaft **19** is a toothed quadrant **25** the toothed edge of which is located between the flanges **18'** and is in mesh with the pinion **18**. On the end of the shaft **19** adjacent to the headstock is fixed an arm **26** carrying a bowl **27** (see Fig. 4) which is engaged between cam edges **28**, one only of which is shown, and which cam is driven by the automaton, such cam providing oscillatory movement in both directions of the shaft **19** and through the quadrant **25** and pinion **18** amplified oscillatory movement of the sleeve **12**. Near the other end of the shaft **19** are fixed a pair of collars **29** spaced slightly apart and adapted to be engaged by a peg **30** on a lever **31** (see Fig. 1) which is pivoted by one end to a bracket **32** attached to the end bracket **21**. The other end of the lever **31** is forked and is engaged with a stud **33** (see Fig. 4) on the lower part of the tail stock **23**.

Referring to Figs. 2, 3 and 5, it will be seen that the arm **13** has an ejector **34** of T shape, the tail of which is forked, the ends of the fork being bent round to clip over a pivot pin **35** about which the ejector is free to pivot. In the head **13'** of the arm is an adjustable screw stop **36** the end of which forms a stop to position the ejector so that the head of the ejector **34** and the two rollers **16** provide triangulated holding points for the quill **17**. On the rod **19** are fixed a pair of blocks **37**, which are in register with the arm **13**, so that as described later such arm can move between them and the ejector can be engaged with the ends of the blocks for ejection of the quill.

Beside the rod **22** is a flat section bar **22'** on which is slidably mounted a slide **38** to which is attached a collector fork **39**. The slide **38** which rests on and is steadied by the rod **22** is adapted to be moved along the bar **22'** by a link **42** connected to the automaton.

In operation, assume a quill is in the winding station and winding has just been stopped by any suitable measuring mechanism which at the same time starts the automaton, such mechanism being well known in automatic winders. The cam faces **28** commence to rotate and turn the shaft **19** which through the quadrant **25** and pinion **18** causes the arm **13** to rise pushing the rollers **16** over the quill **17** and so that the head of the ejector **34** rests against

the underside of the quill (see Fig. 5), giving a triangulated contact with the quill while the latter is still between the centres of the winding head. While the arm 13 is held in this position, the tailstock 23 is pushed back by the automaton through the push rod 24 which movement also, through the stud 33, lever 31, peg 30 and collars 29, pulls back the rod 19 through about half the distance of the movement of the tailstock 23. The rod 19 through the quadrant 25 and flanges 18' moves the sleeve 12 with its arm 13 along the rod 11 through such half distance. Thus the tip end 23' is withdrawn from the quill 17 and the quill is withdrawn from the spindle head 10', the quill being still held substantially in axial alignment with the centres of the winding head. The cam faces 28 now operate to turn the arm 13 lowering the quill into a waiting position in which the ejector 34 is about to engage the blocks 37 for ejection and while the quill is held in this waiting position the automaton draws the collector fork 39 over the top of the quill so that its hooked forked ends engage the thread and draw it towards the winding spindle, such thread (not shown) being still in tension between the quill and a yarn guide described later. The thread therefore assumes a substantially vertical and predetermined position between the hooks and is brought by them towards the spindle head 10' until it engages the flange 10^2 for the purpose of enabling the thread to be brought into position for gripping between the head 10' and the flange 10^2 as described later with reference to Fig. 6.

After a new tube or core has been brought into position between the tip end 23' and the winding spindle head 10' by a magazine described later with reference to Fig. 1, the automaton now pulls the rod 24 closing the tip end 23' on to the new core and this movement of the tailstock also causes return sliding movement of the gripper arm 13 but without performing any function. Thread cutting mechanism is then brought into action and the automaton also returns the magazine and the collector fork to their original positions.

Finally, the cam faces 28 turn the sleeve 12 lowering the arm 13 for the ejection of the full quill which is caused by the engagement of the ejector 34 with the blocks 37 arresting its movement while the arm 13 is lowered further to its normal or idle position. The ejected quill falls into a basket or other suitable receptacle.

As shown in Fig. 6 the winding spindle 10, the end of which is shown in chain line, is drilled to receive alternative sizes and shapes of adaptor heads 10' according to the tube to be used. The present device is therefore shown as an adaptor head and consists of a spindle portion 43 with a screw-threaded extension 44 and spigot tail 45 adapted for fixing in location in the end of the spindle. The spindle portion 43 has a flange 10^2 and is formed with a cylindrical axial end socket 46. Slidably located in such end socket is the stem 47 of the adaptor head 10', a cross pin 48 limiting its axial movement and constraining it to rotate with the spindle end 43. In the socket is a light compression spring 49. The adaptor head 10' has a conical portion 50 the base of which is formed with a peripheral rim 50' adapted to lie against the end face of the flange 10', so that such adjacent faces form a yarn-receiving and clamping means. At the outer end, the adaptor head 10' is formed with a small extension or centre 51 of a size suitable to fit into and locate the end of the quill tube 52, behind which extension is a groove for a friction ring 53.

The tailstock is of known construction and includes a free running spindle 54 carried in a bush 55 slidably mounted in a housing 56 with limited cushion spring axial movement (the spring not being shown), the housing 56 being adjustable in the tailstock 23 which latter is adapted to be mechanically advanced and withdrawn by the automaton as already described and the cushion spring being partially compressed when a quill tube is in position. The spindle has an adaptor head or tip end 23' which is changeable for different sizes and shapes of tube.

In operation, as soon as the tailstock is withdrawn by the automaton, the full quill is released and the adaptor head 10' is urged forward by its spring 49 to open the base of the cone 50 from the flange 10^2. The parts are in this position ready to receive the yarn between them when it is brought against the flange by the hooked collector arm 39 (as shown in Fig. 10).

The magazine for holding and delivering the empty cores successively to the winding station is shown in Fig. 1. Attached to the winding head A is a bracket 57 having a lug 58 from which is pivotally suspended an arm 59 having upper and lower forwardly directed projections 59' in each of which is fixed a rod 60. Adjustably mounted on the rods 60 are a complementary pair of channel members 61 which are adapted to be secured in position by clamping screws 62. This adjustment enables the channel members to be set for the required length of core 52 and also to determine the relative axial disposition of the core which is presented to the winding head. At the lower end of each channel member is a supporting spring 63 bent at its outer end to form a cradle for one core which is located therein by adjustable angle pieces 64 secured to each arm. Fixed in the winding head A is a stud 65 on which is rotatably mounted a sleeve 65' carrying arms 66 and 67. The arm 67 carries a stud 68 engaged in a slot 69 in the lower end of the arm 59. The arm 66 is attached to a link 70 adapted to be operated by the automaton and the upper end of which arm 66 is adapted to engage and operate the trigger 71 of a thread severing device consisting of a guide plate 71' and scissors type cutters 71^2. On a frame rod 72 carrying the winding head A is a bracket 73 carrying a rod 74 on which are adjustably fixed a pair of arms 75.

In operation, the cores 52 are stacked loosely in the channel members 61 of the magazine, the lowermost core being supported on the arms 75. One core 52' is also held in the cradle having been moved into that position by engaging the front of the arms 75 as the magazine moved back into the position shown in Figure 1. When the link 70 is pushed by the automaton the magazine is swung forward until the core held in the cradle is axially in line with the winding centres and with the ends just clear of the parts 51 and 23' shown in Figure 6. When the tip end 23' is moved towards the spindle head 10' as previously described, it enters one end of the core and then slides it in the cradle of the springs 63 until the core passes over the end 51 of the spindle head and until the gripping of the thread and of the core at the winding centres has been effected. The automaton then operates to swing back the magazine. The lowermost core 52 in the magazine has fallen to the end of the channels as soon as it leaves the support of the arms 75 so that on the return of the magazine such lowermost core engages the front of such arms and is pushed by such arms into the cradle of the springs while the upper ends of the arms support the lowermost of the remaining cores. The springs 63 of course yield as the magazine is moved back to release the core which has been gripped in the winding centres. The return movement of the arm 66 also operates the trigger 71 of the thread severing device for the yarn. It is to be understood that the collector fork 39 has been moved towards the spindle 10 and located the yarn behind the head 10' and in the severing device 71' (as shown in Fig. 10) before the magazine is moved bringing the empty core into position and that the magazine is returned to the position shown in Fig. 1 or at least as far as is necessary before the collector fork is moved back.

During the winding the yarn is guided by a yarn guide 76 which is adapted to be reciprocated in known manner by mechanism is not shown. It is also adapted in known manner to be raised by the quill 17 as the winding progresses and as is also well known it is urged towards the quill by a plate 77 under the action of a spring 78, the upward movement of the plate being damped by a friction block 79 on an arm 79' frictionally engaged with the inner edge of a quadrant 80 pivoted at 81. In the present construction however the yarn guide has to be raised for the passage of the collector fork 39 and this is effected by the following mechanism. Connected to the arm 79' is a depending curved link 82 having a long slot 82' engaged with a pin 83 carried by an arm 84 fastened to the sleeve 12 previously described. The quadrant 80 has a projection 80' which is normally just clear of contact with a rod 85 which is pivoted at its inner end (not shown) and supported at its other end in a slotted lug 86 on the tip end bracket 23. In the rod 85 is a slot 85' in which is pivotally mounted a cam-faced trigger 87 shown in Fig. 1 in its normal position in which it is held by a spring 88. On the collector fork bracket 38 is a stud 38' adapted to engage the end face of the trigger.

In operation, the yarn guide 76 is free to rise as the quill builds up and by its frictional location ensures the

building of a cylindrical quill, the link **82** sliding down over the pin **83**. When the sleeve **12** is rotated to bring the grippers **16** on to the quill, the pin **83** engages the lower end of the slot **82'** and causes the guide plate **77** to be raised where it is frictionally held in a clear position above the quill though the sleeve **12** and arm **84** turn back as the grippers are lowered with the quill. Thereafter, the collector fork moves to the left of Fig. 1 and its stud **38'** merely pushes back the trigger without moving the rod **85**. On the return movement of the collector fork, the stud **38'** engages the cam face of the trigger **87** swinging the rod **85** outwards to engage the projection **80'** on the quadrant **80** so that the quadrant is moved away from the friction block **79** allowing the plate **77** to fall until the yarn guide **76** engages the new core when winding can recommence. The stud **38'** passes the trigger **87** to allow the friction mechanism to resume its normal position.

It is desirable for well known reasons that the length of yarn on the packages shall be as near constant as possible. Yarn winding machines are well known which embody a yarn length measuring device. Some of such devices operate by means of a measuring wheel around which the yarn is passed and which is rotated by the yarn and through reduction gearing which actuates the "knock-off" mechanism, while others operate according to a predetermined number of turns of the winding head through gearing to actuate the "knock-off" mechanism. With a fully automatic yarn winding machine any measuring device must embody resetting so that the device comes into operation as the winding of each successive quill or other package is started. The present invention includes an improved construction of yarn measuring device which enables the yarn to be measured either by actual length or by spindle revolutions and which automatically resets itself and is adjustable to any predetermined measurement.

As shown in Figs. 7 to 9 and 7A the winding head spindle passes through the winding head A and has a pair of fast and loose pulleys, a driving belt **89** being shown in Fig. 8 in position on and covering the loose pulley, and passing over a pulley **90** on a main driving shaft **91**. The fast pulley is not visible behind the winding head A. On the extreme end of the winding head spindle is an expandible pulley **92** of known construction coupled by a belt **93** to a pulley **94** geared in the winding head A to a cam shaft (not shown) operating the traverse of the yarn guide **76** (Fig. 1). Expandibility of the pulley **92** is provided for adjusting the proximity of consecutive turns of yarn, as is well known. Below the winding head, but not shown, is an automaton to actuate each cycle of change and consists as is also well known of a series of cams or other mechanisms on a shaft adapted to be rotated through a single revolution for each cycle of operations. Such automaton control is well known and in the example shown the rockingshaft **95** controls a belt fork (not shown) for the belt **89** and is connected by an arm **96** and link **97** to an arm **98** located on a pivot screw **99** fixed in the end of shaft **100**, the far end of the shaft being shown in Fig. 8. Behind the arm **98** and fixed to the shaft **100** is a lever **101** having at one end a stud **102** overlying the arm **98** and having at the other end a nose **103**. The lever **101** is loaded by a spring **104** and its nose **103** is located in a guide slot **107'** in the gate **107**. On the pivot **99** and in front of the arm **98** is the starter lever **105** having a stud **106** adjacent to the stud **102** and also overlying the arm **98**, the other end of the lever **105** being forked and having pivotally mounted therein a starting handle **105'** located in a slot 107^2 in the gate **107**. The starter lever is provided with a return spring **108**.

On the side of the winding head A is a sleeve **109** journaled in the gate **107**, such sleeve carrying a catch **110** complementary to the nose **103** aforesaid and against the rear face of the gate. At its other end the sleeve **109** carries a trigger **111** with adjustable stud **112** the upper end of the trigger being extended above the winding head A for manual actuation if desired. The sleeve **109** is urged by spring means (not shown) in a clockwise direction, i. e. holding the trigger **111** towards the winding head A and projecting the catch **110** into the path of the nose **103**. Journaled in the shaft **109** is a rod **113** which carries a trip lever **114** the end of which is adapted to engage and push the starter handle out of the holding notch of the gate when rotated by a link **115** actuated by stop mechanism (not shown) of any known type arranged to operate on breakage of the yarn. The shaft **100** is adapted to be actuated through a link **116** (see Fig. 8) so that such link is pushed up by a cam **117** which is mounted on the end of the single-rotation automaton shaft **118**, through a bell-crank lever **119**, one end of which has a roller **120** to be engaged by the cam and the other end of which has a pin **121**. Pivotally mounted on the shaft **118** by a pivot **122** is a clutch lever **123** carrying a clutch stud **124** the inner end of which is slidably located in the cam **117** and is adapted to be engaged with any one of a series of holes **125** in a gear wheel **126** which is freely journaled on the shaft **118** and continuously rotated by a pinion **127**, the direction of rotation of the wheel **126** being shown by an arrow. The end of the lever **123** is wedge-shaped to a point at **123'** as shown to engage with the pin **121** aforesaid and the lever moves about the pivot **122** as shown by its arrow.

In operation, the shaft **118** is caused to turn when the clutch lever **123** pivots so that its stud **124** enters one of the holes **125** in the continuously and slowly rotating wheel **126**. As the shaft reaches the end of a single revolution into the position shown in Fig. 8, the wedge-shaped end of the lever **123** engages the pin **121** and thereby pivots the clutch lever to withdraw the stud **124**. Before the wedge-shaped end of the lever **123** engages the pin **121** the cam **117** has raised the roller **120** rocking the lever **119** to bring the pin **121** into the path of the wedge-shaped end **123'** of the lever. At the same time, through the link **116** the shaft **100** is rotated in a counterclockwise direction, as seen in Fig. 8 and thereby rocks the lever **101** raising its stud **102** clear of the arm **98**. If the starting handle is down and engaged with the notch in the gate **107**, the arm **98** may rise allowing the shaft **95** to turn counterclockwise in Fig. 7 under the action of a spring (not shown) to move the belt fork and bring the belt **89** on to the fast pulley thus starting the winding head. If the trigger **111** is manually pulled away from the winding head A it rocks the sleeve **109** drawing the end of the catch **110** away from holding engagement with the nose **103** allowing the spring **104** to turn the shaft **100** and depress the arm **98** by the action of the stud **102** thereby moving the belt fork shaft **95** to move the belt on to the free pulley and thereby stopping the winding action. Such rotation of the shaft **100** is possible because the cam **117** has moved beyond the roller **120**, so that the bell-crank **119** is now moved, withdrawing the pin **121**, releasing the clutch lever **123** which under the action of a spring (not shown) presses the stud **124** against the face of the wheel **126** until it drops into one of the holes **125** when the automaton shaft **118** moves through one turn as previously described.

A measuring device is provided which normally stops the winding when the package has received a predetermined amount of yarn. In the example shown such amount of yarn can be determined either by the number of spindle revolutions or by yardage. The measuring device is located on the front of the winding head A and consists of a feed screw **128** adapted to be rotated by a ratchet wheel **129**. In front of the feed screw is a rod **130** which is slidable and normally urged to the right of Fig. 9 by a light spring **131** located between the casing and a collar **132** on the rod. The end of the rod has a head **133** adapted to engage the end of the screw **112** previously described. Slidably mounted on the rod **130** is a block **134** shaped at **134'** with a half-nut to engage the screw **128** and beyond that with a fork 134^2 to engage an operating wire **135** attached to a rocking rod **136** by which the end of the block may be raised and lowered to disengage from and engage with the feed screw. In the casing is a setting device consisting of a screw **137** with operating head **137'**, carrying a stop block **138** which is positioned against rotation by engagement with the rod **130** and in turn is adapted to be engaged by the block **134**. The block is re-set to engage such stop for the beginning of each winding operation being moved to such position by a spring **139**. On the block **134** is a pointer **140** adapted to register with a pair of scales **141** (see Fig. 1) on the front of the casing the lower of which scales shows the number of turns of the winding spindle while the upper shows yardage. On the rod **136** is an arm **142** connected by link **143** to a bell crank **144** (see Fig. 7), the lower end of which has a stud **145** adapted to engage

the top of the lever **101**. A return tension spring **146** is arranged to urge the link **143** to the left of Fig. 7.

The ratchet wheel **129** is adapted to be turned tooth by tooth either by a pawl **151** described later or by a pawl **147** mounted on an eccentric **148'** on the end of a shaft **148** which is adapted to be turned through reduction gearing in a casing **149** mounted on the winding head A, rotation being provided by a pulley **150** around which the yarn **150'** being wound is looped. The pawl **147** can be turned back out of engagement with the ratchet wheel **129** and rotation of such ratchet wheel can alternatively be effected through a pawl **151** mounted on an eccentric **152** geared within the winding head A to the winding spindle, the pawl being urged against the ratchet wheel **129** by a tension spring **153**. Reverse rotation of the ratchet wheel **129** is prevented by a check pawl **154** and the pawl **151** can be held out of engagement and in the position shown in Fig. 8 by a small turn-piece **155**.

In operation, assume that the block **134** has moved back against the stop block **138** which has been set by turning the screw **137** for the required length of wind as indicated by the position of the pointer **140** relative to the scales **141**. When the shaft **100** is turned to start or in preparation for winding as already described, the movement of the lever **101** raises the stud **145** which through the link **143** turns the rod **136** and moves the wire **135** so as to bring the half-nut on the block **134** into engagement with the feed screw **128**. Assuming the starting handle is in, or is now moved into the operative position, winding commences and the feed screw **128** causes the block **134** to be drawn along the rod **130** until it engages the collar **132** causing the rod to move axially to the left of Fig. 9 and thereby moves the lever **111** to trip its holding catch **110** releasing the lever **101** to stop the winding and start the automaton as already described. The lifting of the lever **101** through the stud **145**, bell crank **144** and link **143** causes the rod **136** to be turned which in turn through the wire **135** raises the half nut of the block **134** out of engagement with the feed screw **128** so that the spring **139** returns the block against the stop block **138** ready for the next measuring operation. When altering the setting screw **137** the block **134** may be manually lifted out of disengagement with the feed screw by finger manipulation of the lever **142**. The yarn **150'** is shown passing over guides **150***a* and **150***b* of which the latter constitutes a yarn-breakage detector operating in any known manner.

Figs. 11 and 12 show diagrammatically the main actuating cams of the automaton associated with the winding head. The parts already described in other figures of the drawing but herein shown diagrammatically are given the same reference characters. Thus, within the winding head casing A of the winding head and on the single rotation shaft **118** journaled therein, there is the cylindrical cam **28**, the end cam face of which is engaged by the bowl **27**, carried by the arm **26** fixed on the shaft **19**, whereby such shaft may be given an oscillating rotary movement to be transmitted through the quadrant **25** and the pinion **18** to the sleeve **12** carrying the package-gripping and withdrawing means **16**. The shaft **19** is also shown diagrammatically carrying the arm **84** with its pin **83** for raising the yarn guide. A return spring **27***a* diagrammatically provides return movement for the shaft though the cam **28** is described with reference to Figure 4 as having two cam edges for positive return movement.

On the shaft and also within the winding head casing A is a second cylindrical cam **65***b* the cam edge of which is engaged by a roller **65***a* carried by the rocking shaft **65** for swinging the magazine **61** (see Fig. 1) about its supporting rod **60** through the arm **67** and link **59**. On the shaft **65** there is also shown the arm **66** adapted to engage the trigger **71** of a scissor type thread-severing device **71²** mounted below its thread guide plate **71'**. The continuously driven gear **126** is also shown journaled on one end of the shaft **118** with its holes **125** adapted to be engaged by the driving pin **124** carried on the end of the shaft, which parts are described with reference to Fig. 8.

On the other end of the shaft **118**, and outside the winding head casing A are two grooved face cams respectively the cam **24***c* having a face groove **24***b* engaged by a follower **24***a* carried by an arm **24***d* connected to the rod **24** (see Fig. 1) for actuating the tail stock, and the cam **42***c* having a face groove **42***b* engaged by a follower **42***a* carried by an arm **42***d* connected to the link **42** (see Fig. 1) for actuating the collector fork **39**.

As shown in Figure 13, which is an underneath view, below the guide plate **71'** there is a scissor type severing device **71²** (see Fig. 11) consisting of a fixed blade **71***a* and movable blade **71***b*, the latter being pivotally mounted at **71***c* to the plate and connected by pin **71***d* to the trigger **71** which has a transverse slot **71***e* for the said pin and a longitudinal slot **71***f* engaged with a further pin **71***g* fixed near one edge of the plate **71'**. Near the other edge of the plate is a guide bracket **71***h* and guide pin **71***i*. A tension spring **71***j* and blade spring **71***k* hold the trigger normally in the position shown. The lever **66** shown dotted can move to engage the head of the trigger which will yield by flexing the blade spring **71***k* until the lever enters a notch **71***m* behind such head. Return movement of the lever **66** pulls the trigger to actuate the movable blade until a cam face **71***n* on the trigger engages the guide pin **71***i* and deflects the trigger head out of the path of the lever, when the springs will operate to return the parts of the severing device to the position shown in the drawing. During actuation of the severing device as above described, yarn from the package held by the package gripping mechanism in the waiting position will have been brought by the collector into the end **71***o* of a yarn guide notch for severing by the cutter blades.

What we claim is:

1. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising means for separating the said centres to release a wound package and to receive a new core, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, said magazine comprising a depending arm pivotally mounted on the winding machine adjacent the centres, a pair of rods attached to said arm and extending outwardly therefrom parallel to the winding centres and a pair of parallel upright channel members forming guides to receive the ends of the cores and hold them one above and resting on another in column form, each such channel member being secured to said bars adjustably for position and to suit cores of different lengths, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for swinging said arm about its pivot to move the lower end of the magazine toward the winding station so as to present a core in the holding station in alignment with said centres, means for closing the centres on to the said core to hold the latter, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, said core-holding station comprising core-end supporting springs located at the lower end of each channel member and extending therefrom towards the centres, the outer end of each spring being bent to form a cradle, and angle pieces attached to the channel members to form with such cradle portions the core-holding station, the lower ends of the channels being shaped to permit the lowermost core to be moved from the channels to the said station, said springs normally resiliently preventing such movement of the core ends from the channel.

2. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising means for separating the said centres to release a wound package and to receive a new core, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, said magazine comprising a depending arm pivotally mounted on the winding machine adjacent the centres, a pair of rods attached to said arm and extending outwardly therefrom parallel to the winding centres and a pair of parallel upright channel members forming guides to receive the ends of the cores and hold them one above and resting on another in column form, each such channel member being secured to said bars adjustably for position and to suit cores of different lengths, a core-holding station at the lower end of said maga-

zine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for swinging said arm about its pivot to move the lower end of the magazine toward the winding station so as to present a core in the holding station in alignment with said centres, means for closing the centres on to the said core to hold the latter, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, said core-holding station comprising core-end supporting springs located at the lower end of each channel member and extending therefrom towards the centres, the outer end of each spring being bent to form a cradle, and angle pieces attached to the channel members to form with such cradle portions the core-holding station, the lower ends of the channels being shaped to permit the lowermost core to be moved from the channels to the said station, said springs normally resiliently preventing such movement of the core ends from the channel and said means for feeding the lowermost core from the channels to the core-holding station comprising stationary arms having core-supporting ends above the level of the springs and a core-engaging forward edge, said arms being so positioned that as the magazine is returned to its normal position after delivering a core to the centres, and with a lowermost core resting at the bottom of the channels and on the springs, such lowermost core engages the core-engaging edges of the arms and is forced thereby into the core-holding station while the next core in the channels rests by gravity on the core-supporting ends of the arms.

3. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising means for separating the said centres to release a wound package and to receive a new core, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, said magazine comprising a depending arm pivotally mounted on the winding machine adjacent the centres, a pair of rods attached to said arm and extending outwardly therefrom parallel to the winding centres and a pair of parallel upright channel members forming guides to receive the ends of the cores and hold them one above and resting on another in column form, each such channel member being secured to said bars adjustably for position and to suit cores of different lengths, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for swinging said arm about its pivot to move the lower end of the magazine toward the winding station so as to present a core in the holding station in alignment with said centres, means for closing the centres on to the said core to hold the latter, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, said core-holding station comprising core-end supporting springs located at the lower end of each channel member and extending therefrom towards the centres, the outer end of each spring being bent to form a cradle, and angle pieces attached to the channel members to form with such cradle portions the core-holding station, the lower ends of the channels being shaped to permit the lowermost core to be moved from the channels to the said station, said springs normally resiliently preventing such movement of the core ends from the channel, said means for feeding the lowermost core from the channels to the core-holding station comprising stationary arms having core-supporting ends above the level of the springs and a core-engaging forward edge, said arms being so positioned that as the magazine is returned to its normal position after delivering a core to the centres, and with a lowermost core resting at the bottom of the channels and on the springs, such lowermost core engages the core-engaging edges of the arms and is forced thereby into the core-holding station while the next core in the channels rests by gravity on the core-supporting ends of the arms and said means for swinging the magazine comprising an operating arm pivotally mounted on the machine and connected by pin-and-slot means to the depending arm of the magazine, a trigger arm attached to said operating arm and an operating link attached to said trigger arm.

4. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising package gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for separating the said centres to release a wound package and to receive a new core, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, said magazine comprising a depending arm pivotally mounted on the winding machine adjacent the centres, a pair of rods attached to said arm and extending outwardly therefrom parallel to the winding centres and a pair of parallel upright channel members forming guides to receive the ends of the cores and hold them one above and resting on another in column form, each such channel member being secured to said bars adjustably for position and to suit cores of different lengths, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for swinging said arm about its pivot to move the lower end of the magazine toward the winding station so as to present a core in the holding station in alignment with said centres, means for closing the centres on to the said core to hold the latter and means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres.

5. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising package gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for separating the said centres to release a wound package and to receive a new core, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, said magazine comprising a depending arm pivotally mounted on the winding machine adjacent the centres, a pair of rods attached to said arm and extending outwardly therefrom parallel to the winding centres and a pair of parallel upright channel members forming guides to receive the ends of the cores and hold them one above and resting on another in column form, each such channel member being secured to said bars adjustably for position and to suit cores of different lengths, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for swinging said arm about its pivot to move the lower end of the magazine toward the winding station so as to present a core in the holding station in alignment with said centres, means for closing the centres on to the said core to hold the latter, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, said core-holding station comprisnig core-end supporting springs located at the lower end of each channel member and extending therefrom towards the centres, the outer end of each spring being bent to form a cradle, and angle pieces attached to the channel members to form with such cradle portions the core-holding station, the lower ends of the channels being shaped to permit the lowermost core to be moved from the channels to the said station, said springs normally resiliently preventing such movement of the core ends from the channel, said means for feeding the lowermost core from the channels to the core-holding station comprising stationary arms having core-supporting ends above the level of the springs

and a core-engaging forward edge, said arms being so positioned that as the magazine is returned to its normal position after delivering a core to the centres, and with a lowermost core resting at the bottom of the channels and on the springs, such lowermost core engages the core-engaging edges of the arms and is forced thereby into the core-holding station while the next core in the channels rests by gravity on the core-supporting ends of the arms and said means for swinging the magazine comprising an operating arm pivotally mounted on the machine and connected by pin-and-slot means to the depending arm of the magazine, a trigger arm attached to said operating arm and an operating link attached to said trigger arm.

6. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising package gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for separating the said centres to release a wound package and to receive a new core, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for moving the magazine to bring the core-holding station toward the centres so as to present and hold its core in alignment with the said centres, means for closing the the centres on to the said core to hold the latter, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, said core-holding station comprising core-end supporting springs located at the lower end of each channel member and extending therefrom towards the centres, the outer end of each spring being bent to form a cradle, and angle pieces attached to the channel members to form with such cradle portions the core-holding station, the lower ends of the channels being shaped to permit the lowermost core to be moved from the channels to the said station, said springs normally resiliently preventing such movement of the core ends from the channel, said means for feeding the lowermost core from the channels to the core-holding station comprising stationary arms having core-supporting ends above the level of the springs and a core-engaging forward edge, said arms being so positioned that as the magazine is returned to its normal position after delivering a core to the centres, and with a lowermost core resting at the bottom of the channels and on the springs, such lowermost core engages the core-engaging edges of the arms and is forced thereby into the core-holding station while the next core in the channels rests by gravity on the core-supporting ends of the arms, said means for swinging the magazine comprising an operating arm pivotally mounted on the machine and connected by pin-and-slot means to the depending arm of the magazine, a trigger arm attached to said operating arm and an operating link attached to said trigger arm and means for ejecting the wound package from the package-gripping means.

7. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising a winding spindle and tailstock respectively constituting said centres, package gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for moving the tailstock axially of and away from the core to withdraw it from the core, means for moving the package-gripping means towards the tailstock for a distance less than the movement of the latter, so as to move the package axially in alignment with the centres and withdraw its core from the winding spindle, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for moving the magazine to bring the core-holding station toward the centres so as to present and hold its core in alignment with the said centres, means for returning the tailstock to its initial position to grip the new core between the centres and means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres.

8. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising a winding spindle and tailstock respectively constituting said centres, package gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for moving the tailstock axially of and away from the core to withdraw it from the core, means for moving the package-gripping means towards the tailstock for a distance less than the movement of the latter, so as to move the package axially in alignment with the centres and withdraw its core from the winding spindle, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, said magazine comprising a depending arm pivotally mounted on the winding machine adjacent the centres, a pair of rods attached to said arm and extending outwardly therefrom parallel to the winding centres and a pair of parallel upright channel members forming guides to receive the ends of the cores and hold them one above and resting on another in column form, each such channel member being secured to said bars adjustably for position and to suit cores of different lengths, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for feeding a lowermost core from the magazine to the said core-holding station, means for swinging said arm about its pivot to move the lower end of the magazine toward the winding station so as to present a core in the holding station in alignment with said centres, means for returning the tailstock to its initial position to grip the new core between the centres, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, said core-holding station comprising core-end supporting springs located at the lower end of each channel member and extending therefrom towards the centres, the outer end of each spring being bent to form a cradle, and angle pieces attached to the channel members to form with such cradle portions the core-holding station, the lower ends of the channels being shaped to permit the lowermost core to be moved from the channels to the said station, said springs normally resiliently preventing such movement of the core ends from the channel, said means for feeding the lowermost core from the channels to the core-holding station comprising stationary arms having core-supporting ends above the level of the springs and a core-engaging forward edge, said arms being so positioned that as the magazine is returned to its normal position after delivering a core to the centres, and with a lowermost core resting at the bottom of the channels and on the springs, such lowermost core engages the core-engaging edges of the arms and is forced thereby into the core-holding station while the next core in the channels rests by gravity on the core-supporting ends of the arms, said means for swinging the magazine comprising an operating arm pivotally mounted on the machine and connected by pin-and-slot means to the depending arm of the magazine, a trigger arm attached to said operating arm and an operating link attached to said trigger arm and means for ejecting the wound package from the package-gripping means.

9. A winding station for an automatic winding machine

for producing a wound package by winding a filament on to a core held between centres, comprising a winding spindle and tailstock respectively constituting said centres, filament receiving and clamping means on the spindle and spring means for holding open the said clamping means in filament receiving position, package-gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for separating the said centres to release a wound package and to receive a new core, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, filament collector means normally adjacent the tailstock means for moving the filament collector means towards the winding spindle so as to engage the filament and carry it to a position adjacent to said winding spindle, and so that such filament enters the filament receiving and clamping means, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for moving the magazine to bring the core-holding station toward the centres so as to present and hold its core in alignment with the said centres, means for returning the tailstock to its initial position to grip the new core between the centres and so as to close the filament receiving and clamping means on to the filament, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, means for serving the filament, means for returning the filament collector to the tailstock end of the machine, means for ejecting the wound package from the package-gripping means and means for feeding a lowermost core from the magazine to the said core-holding station.

10. A winding station for an automatic winding machine for producing a wound package by winding a filament on to a core held between centres, comprising a winding spindle and tailstock respectively constituting said centres, filament receiving and clamping means on the spindle and spring means for holding open the said clamping means in filament receiving position, package gripping means adjacent to said centres, means for moving the package-gripping means into gripping engagement with a wound package held between said centres, means for separating the said centres to release a wound package and to receive a new core, means for moving the package-gripping means away from the centres to carry the wound package to a waiting position so that the filament leading thereto is held in tension in a predetermined position for further manipulation, filament collector means normally adjacent the tailstock, means for moving the filament collector means towards the winding spindle so as to engage the filament and carry it to a position adjacent to said winding spindle, and so that such filament enters the filament receiving and clamping means, core-presenting means for presenting a new core to the centres comprising a magazine adjacent the said centres and adapted to hold a plurality of cores, a core-holding station at the lower end of said magazine adapted to receive and releasably hold a single core for presentation to the centres, means for moving the magazine to bring the core-holding station toward the centres so as to present and hold its core in alignment with the said centres, means for returning the tailstock to its initial position to grip the new core between the centres and so as to close the filament receiving and clamping means on to the filament, means for returning the magazine to its normal position clear of the centres, leaving the core held between the centres, means for severing the filament, means for returning the filament collector to the tailstock end of the machine, means for ejecting the wound package from the package-gripping means, means for feeding a lowermost core from the magazine to the said core-holding station, a filament guide adapted to rest on the package during winding, means for raising the filament guide prior to movement of the filament collector means and for lowering onto the new core, driving means for the winding station, a disengageable driving coupling between the driving means and the winding spindle, a camshaft having cams for actuating the several parts of the winding station in sequence, a filament measuring means, mechanism actuated by the filament measuring means for disengaging the driving coupling to the winding spindle and engaging the driving coupling to the camshaft and means actuated by the camshaft after completing a single rotation for disengaging its driving coupling and for re-engaging the driving coupling to the winding spindle.

11. A winding station comprising a pair of relatively movable spaced centres between which a core held by a magazine adapted to hold a plurality of cores may be positioned for winding yarn thereon under tension, means for gripping and withdrawing a wound package from the centres while maintaining the yarn under tension, a yarn breakage detector held by the tension of the yarn, means for trapping the yarn between the yarn breakage detector and the withdrawn package whereby the yarn may be held to start winding of a new package and means for severing the yarn between the full package and the yarn trapping means, a filament measuring device and means controlled by the measuring device for stopping the winding mechanism, for sequentially operating the gripping and withdrawing means, for relatively moving the spaced centres to release the wound package, for moving the magazine to load a new core, between the spaced centres for positioning the yarn in the trapping means, for moving the spaced centres to clamp a new core in winding position, for severing the yarn from the wound package, for releasing a wound package from the gripping and withdrawing means, and for restarting the winding operation.

12. A winding station comprising a pair of relatively movable spaced centres between which a core held by a magazine adapted to hold a plurality of cores may be positioned for winding yarn thereon under tension, means for gripping and withdrawing a wound package from the centres while maintaining the yarn under tension, a yarn breakage detector held by the tension of the yarn, means for trapping the yarn between the yarn breakage detector and the withdrawn package whereby the yarn may be held to start winding of a new package and means for severing the yarn between the full package and the yarn trapping means, one of said centres being movable away from the other, means for moving said movable centre away from the other or fixed centre for releasing the core of the full package after the latter has been held by the gripping means and means for moving the gripping means away from the fixed centre a distance less than the movement of the movable centre so that the package is free from both centres and means for returning the movable centre to engage a new core, a filament measuring device and means controlled by the measuring device for stopping the winding mechanism, for sequentially operating the gripping and withdrawing means, for relatively moving the spaced centres to release the wound package, for moving the magazine to load a new core between the spaced centres, for positioning the yarn in the trapping means, for moving the spaced centres to clamp a new core in winding position, for severing the yarn from the wound package, for releasing a wound package from the gripping and withdrawing means, and for restarting the winding operation.

13. A winding station for an automatic winding machine for producing a wound package by winding a filament onto a core held between centres, comprising means for separating said centres to release a wound package and to receive a new core, core-presenting means for presenting a new core to the centres comprising a vertically extending magazine adjacent the said centres and adapted to hold in orderly succession, lying horizontally one above the other, a plurality of cores, and at the lower end of said magazine, extending substantially horizontally therefrom, two resilient core-receiving members and two fixed abutment members respectively thereabove adapted to hold in a positive but releasable manner parallel to the line of centres but offset therefrom a single core for presentation to the centres, means for moving the magazine to bring the core-holding station toward the centres so as to present such core, while holding it, in alignment with the said centres, means for closing the centres onto the said core to hold the latter, means for returning the magazine to its normal position clear of the centres leaving the core held between the centres and positive mechanical means for transferring consequent upon said return movement the lowermost core from said magazine

to the core-holding station between said resilient and said fixed members.

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