TEXTILE THREAD WINDER WITH TENSION COMPENSATING DEVICE

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ABSTRACT

A textile thread winder with a device for compensating for variations in tension in thread being wound due to increases and decreases in the length of the path of travel of the thread from a thread source to a package roll caused by traversing action of a traversing mechanism. The textile thread winding apparatus has a driven rotating drive roll, at least one freely rotatable package roll positioned on one side of the drive roll for engagement therewith to be driven thereby for winding of thread and mounted for linear movement away from the drive roll as the thread package builds thereon, and a thread traversing mechanism positioned on the other side of the drive roll for receiving the thread from a source and guiding the thread around the drive roll to the package roll while traversing the thread longitudinally of the drive roll. Preferably, the winding apparatus includes mechanisms for maintaining a predetermined pressure relationship between the drive roll and the package roll.

2 Claims, 8 Drawing Figures
FIG. 4
TEXTILE THREAD WINDER WITH TENSION COMPENSATING DEVICE

This invention relates to the combination of a specific textile thread winding apparatus and means for compensating for variations in tension in the thread being wound due to increases and decreases in the length of the path of travel of the thread from a thread source to a package roll caused by traversing action of a traversing mechanism.

In textile or yarn winding apparatus, there have been problems in variation in tension of the thread or yarn being wound due to increases or decreases in the length of the path of travel of the thread or yarn from a source to a package roll caused by traversing action of a traversing mechanism in the apparatus. This problem is particularly acute in textile thread winding apparatus having a driven rotating drive roll and at least one freely rotatable package roll positioned on one side of the drive roll for engagement therewith to be driven thereby for the winding of thread and mounted for linear movement away from the drive roll as the package builds thereon and, preferably, having means for maintaining a predetermined pressure relationship between the drive roll and the package roll. In this type of winding apparatus, the thread is received by a traversing mechanism positioned on the other side of the drive roll for receiving the thread from a source and guiding the thread around the drive roll to the package roll while traversing the thread longitudinally of the drive roll.

While tension compensating devices have been proposed for other types of thread winders, no tension compensating devices have been proposed for thread winders of the specific type disclosed therein.

Accordingly, it is the object of this invention to provide a tension compensating device for the specific thread winder disclosed herein.

According to this invention, the above object may be accomplished by providing the following combination.

Textile thread winding apparatus having a driven rotating drive roll, at least one freely rotatable package roll positioned on one side of the drive roll for engagement therewith to be driven thereby for the winding of thread and mounted for linear movement away from the drive roll as the package builds thereon, and a thread traversing mechanism positioned on the other side of the drive roll for receiving the thread from a source and guiding the thread around the drive roll to the package roll while traversing the thread longitudinally of the drive roll. Means for compensating for variations in tension in the thread being wound due to increases and decreases in the length of the path of travel of the thread from the thread source to the package roll caused by the traversing action of the traversing mechanism.

In the preferred embodiment of this invention, the textile thread winding apparatus includes a carriage mechanism having a stationary portion and a movable portion carried by the stationary portion for reciprocating linear movement and being secured to and carrying the package roll for reciprocating linear movement therewith. There is also included means for maintaining a desired predetermined pressure relationship between the driven roll and the package roll and for linearly driving the package roll. This means comprises a variable torque reversible motor, a screw shaft connected to and rotated by the torque motor and a nut secured to the movable carriage portion and receiving the screw shaft therethrough for converting rotary movement of the screw shaft into linear movement of the movable carriage portion and the package roll carried thereby.

Additionally, in the preferred embodiment of this invention, the tension compensating means comprises a deflector plate mounted adjacent to and in advance of the traversing mechanism and has an outwardly bowed surface positioned in the path of travel of the thread to deflect the thread in such a manner as to equalize the length of its path of travel while it is being traversed by the traversing mechanism so as to compensate for variations in tension of the thread prior to reaching the traversing mechanism.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which

FIG. 1 is a perspective view of the winding apparatus and tension compensating means of this invention and showing a single thread being wound on one package roll thereof;

FIG. 2 is an enlarged perspective view of a portion of the apparatus of FIG. 1 illustrating the traversing mechanism and the tension compensating means;

FIG. 3 is a cross-sectional view through the tension compensating means of FIG. 2 taken generally along the line 3-3 of FIG. 2;

FIG. 4 is a slightly enlarged vertical sectional view taken substantially along the line 4-4 in FIG. 1;

FIG. 5 is an enlarged sectional detail of the top of the upper carriage assembly of the winding apparatus and taken generally at the arrow 5 of FIG. 4;

FIG. 6 is an enlarged sectional detail of the bottom of the carriage assembly of FIG. 5 and taken generally at the arrow 6 of FIG. 4;

FIG. 7 is a sectional view taken through the carriage assembly of FIGS. 5 and 6 and taken generally along the line 7-7 of FIG. 4; and

FIG. 8 is a sectional detail showing the ball screw and ball nut mechanism and taken generally along the line 8-8 of FIG. 7.

Referring now to the drawings, the specific form of winding apparatus in combination with a tension compensating means according to this invention is illustrated therein and generally referred to by the reference numeral 10. The thread winder 10 illustrated in the drawings is adapted to wind thread T received from a thread source into wound packages P, as illustrated in FIG. 1.

The winding apparatus 10 comprises a stationary, enclosed housing 12 of generally modular construction so that the winding apparatus 10 may be positioned individually or in banks or groups of such winders in a textile operation.

A generally cylindrical drive roll 14 is mounted for rotation on the housing 12 in a fixed position and extends generally horizontally outwardly therefrom, as may be seen in FIG. 1. The drive roll 14 may be constructed of a suitable smooth metal material or otherwise and is driven by a motor 15 mounted within the housing 12 on one wall of the housing by means of mounting plates 16, as shown in FIG. 4. The motor 15 includes an outwardly extending shaft 17 which carries
a suitable pulley 18 for receiving an endless belt 19. The endless belt 19 also passes around a pulley 20 carried by a rotatable shaft 21 which is suitably mounted in a fixed rotatable position in the housing 12 and extends outwardly therefrom and is connected with the drive roll 14 so that the motor 15 may rotate the drive roll 14 in the direction of the arrows in FIG. 1 through the above-described belt and pulley arrangement. The portion of the housing 12 through which the shaft 21 passes for connection with the drive roll 14 is suitably sealed, for the reasons to be discussed below.

The winding apparatus 10 further includes a traverse mechanism 25 mounted on the housing 12 and extending outwardly therefrom generally parallel with the drive roll 14 and on one side thereof, as shown in FIG. 1, for receiving the thread T from a thread source and for guiding the thread around the drive roll 14 to a package roll (described hereinafter), while reciprocating or traversing back and forth along a path of travel which is generally parallel with the longitudinal axis of the drive roll 14 for traversing the thread T, as indicated in phantom lines, onto the package P being wound by the apparatus 10. This traverse mechanism 25 includes a motor 26 suitably mounted within the housing 12 and having a drive shaft 27 extending therefrom and operatively connected with element 28 of the traverse mechanism 25 for operating same. The shaft 27 and traverse mechanism 25 also include suitable means for sealing the portion of the housing 12 through which the shaft 27 passes, for reasons to be discussed below. The detailed construction of the traverse mechanism 25 has not been illustrated in the drawings and inasmuch as these traverse mechanisms are conventional and well understood by those with ordinary skill in the art, further explanation herein is not necessary.

The winding apparatus 10 of this invention, as illustrated in the drawings, further includes a pair of freely rotatable, linearly movable package rolls 30 for carrying thread package cores C to form a wound package thereon. The package rolls 30 extend generally horizontally outwardly from the housing 12 and are generally parallel with the drive roll 14 on the other side thereof from the traverse mechanism 25 to be driven by the drive roll 14, in a manner described below. The package rolls 30 receive thread T from the traverse mechanism 25 for simultaneous or alternative winding on package cores C on both or one of the package rolls 30.

The package rolls 30 are disposed above and below each other, as shown in FIG. 1, and are linearly movable away from the drive roll 14 along inclined paths of travel which form upwardly extending and downwardly extending acute angles, respectively, with a horizontal plane through the drive roll 14, as shown in FIG. 1 so that each of the package rolls 30 may be alternately or simultaneously moved into frictional, peripheral, driving engagement with the drive roll 14 for simultaneously or alternatively winding thread T on both of the package rolls 30.

The package rolls 30 are generally of the expandable, self-contained, chuck member type which, as shown in FIG. 7, include bladder members 31 adapted to inflate and expand by the insertion of air from air line 32 on receiving of the package cores C and air brake means 33 for precluding rotation of the package rolls 30 before, after and during an initial or final winding operation by the insertion of air into the brake means 33 from air line 34. The specific details of the construction of these package rolls 30, per se, are given in U.S. Pat. No. 3,517,891, issued June 30, 1970 and assigned to the assignee of the present application. Reference may be had to that patent for a complete disclosure of the operation of these package rolls.

Associated with each of the package rolls 30 is a carriage assembly, generally designated by the reference numeral 40. These carriage assemblies are contained within the enclosed housing 12 and the carriage assembly for each of the package rolls 30 is substantially identically constructed, as may be seen in FIG. 4. FIGS. 5 and 6 are generally top plan views of the upper carriage assembly 40 of FIG. 4 and that carriage assembly will be described in detail below. Each carriage assembly will be given, where illustrated, like reference numerals inasmuch as like components are contained in each.

Each of the carriage assemblies 40 includes a stationary portion 42 which is generally rectangular and includes downwardly extending flange portions 42A around the outer periphery thereof and top plates 42B as may be seen in FIGS. 4, 5 and 6. It is noted that the bottom carriage assembly 40, as shown in FIG. 4, is reversed and the flange members 42A extend upwardly and the plate members 42B are bottom plates. The stationary carriage portion 42 is mounted in a fixed position on the housing 12 by means of bolts 43, as shown in FIGS. 5 and 6 particularly. The stationary carriage portion 42 includes longitudinally extending carriage rods 44 mounted in flange members 42A.

The carriage assemblies 40 further include movable portions 46 mounted on the stationary portion 42 and particularly the rods 44 thereof by any suitable bearings for reciprocating linear movement along the longitudinal axes of the stationary rods 44. The movable portion 46 of the carriage assembly 40 is secured to and carries the respective package rolls 30 for linear movement therewith, as may be seen in FIGS. 5 and 6. The package rolls 30 include suitable bearings for rotation therewith with respect to the movable carriage portions 46. The carriage assemblies 40 are generally disposed in the inclined paths of travel which the package rolls travel. Accordingly, the carriage assemblies 40 carry the package rolls 30 along their upwardly and downwardly inclined paths of travel toward and away from the drive roll 14.

The winding apparatus 10 further includes mechanisms contained within the housing 12 and operatively associated with each of the package rolls 30 for maintaining a desired predetermined pressure relationship between the drive roll 14 and the respective package rolls 30 and for linearly driving the respective package rolls 30.

Each of the mechanisms comprises a reversible, variable torque motor 50 mounted within the housing 12 on one wall thereof, as shown in FIG. 4. The torque motor 50 has an outwardly extending driven shaft 51 which is connected to one end of a universal joint 52 and the other end of the universal joint 52 is connected to and drives a ball screw shaft 53 having spiral, ball receiving grooves 54 therein. The ball screw shaft 53 is
suitably rotatably mounted in bearings 55 and 56 carried by the stationary carriage portion 42, as may be seen in FIG. 6. Accordingly, rotation of the torque motor 50 causes rotation of the ball screw shaft 53 through the bearings 55 and 56.

The movable carriage portion 46 has a ball nut 60 secured thereto, as shown in FIGS. 6 and 8. The ball nut 60 comprises a housing 61 containing a plurality of balls therein arranged in such a manner that the ball screw shaft 53 passes through the ball nut 60 and the balls 62 engage the grooves 54 so that rotary movement of the screw shaft will be converted into linear movement of the ball nut 60 and thereby cause linear movement of the movable carriage portion 46 and the respective package rolls 30 carried thereby. Accordingly, rotation of the torque motor 50 in opposite directions will cause opposite linear movement of the package rolls 30 toward and away from the drive roll 14 through the above-described connections.

Each of the mechanisms for driving the respective package rolls and for maintaining a predetermined pressure relationship includes a bi-directional damper apparatus 65 operatively connected with the ball screw shaft 53 and each comprising generally a torque brake 66 which may be of any suitable form and including an outwardly extending shaft 67 carrying a pulley 68. The pulley 68 carries a belt 69 which also passes around a pulley 70 mounted on the ball screw shaft 53. The bi-directional dampers 65 prohibit excessive acceleration of the movable carriage portions 46 and the respective package rolls 30 when being driven from one extreme linear position to the other. The dampers 65 also minimize any tendency toward vibration of the package rolls during the winding operation.

There is further provided a hydraulic shock absorber 75, as shown particularly in FIG. 6, for each of the carriage assemblies 40. These hydraulic shock absorbers 75 each comprises a cylinder 76 secured to a flange portion 42a of the fixed or stationary carriage portion 42 and a piston 77 extending from the other end thereof. The piston 77 includes an extending rod 78 which is fixed to the movable carriage portion 46. The cylinder 76 includes an adjustment knob 79. These shock absorbers 75, by the above arrangement, control the rate of contact between the drive roll 14 and the package rolls 30. There are also provided bumper type shock absorbers 82 secured to the fixed carriage portions 42, as shown in FIG. 6 and adapted to be contacted by an extension of the movable carriage portions 46 for buffering the travel of the package rolls 30 and the movable carriage portions 46 as they reach the end of their paths of travel away from the drive roll 14.

Due to the geometry of the upwardly extending and downwardly extending inclined paths of travel of the package rolls 30, which form acute angles with respect to the horizontal, forces are introduced which must be cancelled if proper package roll to drive roll predetermined pressure is maintained throughout the winding operation. Accordingly, compensating mechanisms 84 and 85 are provided for the upper package roll and carriage assembly and the lower package roll and carriage assembly, respectively. The upper package roll compensating mechanism 84, as best shown in FIG. 5, comprises a cased roller spring 86 carried by the stationary carriage portion 42 and having a cable 87 extending therefrom and attached to a counterbalance cam 88 also mounted on the stationary carriage portion 42. The counterbalance cam 88 includes another cable 89 extending therefrom and around guide pulleys 90 and 91 carried by stationary carriage portion 42. The other end of the cable 89 is secured to the movable carriage portion 46, as shown in FIG. 6.

The counterbalance cam profile 88 is determined by combining forces due to package weight increase, forces due to gravity, forces due to the change in tangent point between package and drive rolls as the wound package diameter increases, and forces due to the drive roll to package roll pressure reduction that is necessary.

The compensating mechanism 85 for the downwardly moving lower package roll and carriage assembly 40, as best shown in FIG. 4, comprises a constant force extension spring 95 having one end thereof secured to the housing 12 and the other end thereof attached to a cable 96 which passes around a guide pulley 97 mounted on the housing 12 and is attached at its other end to the movable carriage portion 46 of the lower carriage assembly 40.

As shown in FIG. 1, the winding apparatus housing 12 has slots therein for the linear travel of the upper and lower package rolls 30 which include sealing means for sealing off the interior of the housing 12 from the exterior thereof. Each of these sealing means for each of the package rolls comprises a belt 100, as shown particularly in FIGS. 6 and 7, which passes around rollers 101 and 102 at each end of the slots in the housing and has its ends attached to a cable 103 which passes around pulleys 104 (only one of which is shown in FIG. 7) to form an endless arrangement. The belt 100 is attached to and surrounds the connecting portion between the package roll 30 and the movable carriage portion 46 to move therewith as these mechanisms move in their linear path of travel. Suitable rubber seals may be mounted on the housing 12 for rubbing engagement with the belt 100 to complete the seal. Thus, the entire housing 12 is enclosed and sealed from a hostile environment that may surround the exterior of the winding apparatus 10 so as to protect the interior components of the housing 12.

Additionally, there is provided a solenoid operated latch mechanism 110 for the lower carriage assembly 40, as shown in FIG. 4, comprising a solenoid 111, a latch member 112 pivotally mounted on the stationary carriage portion 42 and connected to solenoid 111 to be controlled thereby, and a latch member 113 mounted in fixed position on the movable carriage portion 46. The latch mechanism 110 is adapted to latch the carriage portions 42 and 46 together at the position illustrated in FIG. 4 for doffing of a wound package P.

In accordance with this invention, the above-described winding apparatus 10 is combined with and includes means for compensating for variations in tension in the thread T being wound due to increases and decreases in the length of the path of travel of the thread T from the thread source to the package roll 30 caused by the traversing action of the traversing mechanism 25. This tension compensating means comprises a deflector plate 120 mounted on the housing 12 adjacent to and in advance of the traversing mechanism 25, as shown in FIGS. 1 and 2. The deflector plate 120
has an outwardly bowed surface 121, as may be seen in FIG. 2, positioned in the path of travel of the thread T to deflect the thread in such a manner as to equalize the length of its path of travel while it is being traversed by said traversing mechanism (see phantom line indications of the position of the thread T during the traversing action in FIG. 2) so as to compensate for variations in tension of the thread prior to reaching the traversing mechanism 25. The profile of the outwardly bowed surface 121 will be determined according to the path of travel of the thread T in a particular winding apparatus, as described above, so as to equalize the length of the path of travel of the thread T regardless of the position in which it is placed by the traversing mechanism 25.

By the above arrangement of the winding apparatus 10, the respective variable torque, reversible motors 50 can drive the package rolls 30 linearly toward and away from the drive roll 14 for start-up and doffing of packages P BY driving the movable carriage portions 46 in the desired direction through the ball screw shaft 53 and ball nut 60 and can hold the package rolls 30 and the thread cores C thereon in frictional, peripheral, driving engagement with the drive roll 14 and maintain predetermined pressure relationships between the rolls for thread winding by driving the movable carriage portions 46 so that the linear movement of the package rolls 30 away from the drive roll 14 during buildup of a thread package P will overcome the driving forces of the torque motors 50 and cause the torque motors to stall. Since the torque motors 50 are variable torque motors, the amount of torque applied thereby can be varied as desired to obtain the desired predetermined pressure relationship between drive roll and package rolls. Also, the device 120 will compensate for variations in tension in the thread T due to increases and decreases in the length of the path of travel of the thread T from the thread source to the package roll 30 caused by the traversing action of the traversing mechanism 25 by equalizing the length of the path of travel of the thread T.

Specifically, the winding apparatus 10 may be provided with any suitable control circuit and, while the details of such a control circuit will not be given herein or specifically described, an exemplary operation will be briefly described.

The winding apparatus 10 may include a control panel 130, as illustrated in FIG. 1, having buttons thereon for initiating the operation thereof. The three adjacent buttons at the top of control panel 130 are for controlling the upper package roll 30 and the three adjacent buttons at the bottom of control panel 130 and for controlling the lower package roll 30. The control circuit (not shown) includes suitable switches adapted to be operated by the movable carriage portion 46 of the carriage mechanism 40 and these switches are indicated in FIG. 6 and given the reference characters X, Y and Z.

Referring particularly to FIG. 1, when both package rolls 30 are in the retracted or doff position which is the linear position at the extreme end of the path of travel away from the drive roll 14, an operator will press the "START" button S1 on the control panel and adjust the speeds of the drive roll 14 and the traverse mechanism 25 from any suitable adjustments to the drive motors thereof. Empty package cores C are then placed on the package rolls 30.

The operator then depresses the "READY" button R for one or both of the package rolls 30. This energizes the latch solenoid 111 for the lower carriage assembly 40 to disengage the latch mechanism 110 and initiates operation of the torque motors 50 to move the package rolls 30 from the doff positions toward the drive roll 14. Also, air pressure from the package roll brake means 33 will be removed to allow rotation of the package rolls 30 and air pressure will be applied to the bladder members 31 for expanding the same and holding the cores C in fixed positions on the package rolls 30.

As the package rolls 30 reach the half-way point of their path of travel toward the drive roll 14, switch Z will be actuated by the movable carriage portion 46 to reduce the voltage on the upper torque motor only to slow down the travel of the downwardly moving upper package roll 30. When the package rolls 30 reach the drive roll 14, they will frictionally engage the drive roll 14 and accelerate to the desired winding speed.

The operator then depresses the "THREAD RUN" button TR, as shown in FIG. 1, for the desired package roll 30 upon which a winding operation is to be performed. Operation of this button will switch the voltage to the torque motor 50 to that preselected for the winding operation and will deenergize the latch solenoid 111 to allow the latch member 112 to drop back down into its lower position for again engaging the latch member 113 when the lower carriage portion 46 has again reached the doff position.

The wound package of thread then begins building on the cores C on the package rolls 30 which moves the package rolls 30 against the predetermined torque exerted by the motors 50 to stall the torque motors and maintain the predetermined pressure relationships therebetween. The voltage applied to the torque motors 50 may be varied during this winding operation to produce a variable torque, as desired.

As the packages P build on the package rolls 30 and the package rolls 30 reach the half-way point of their travel away from the drive roll 14, the switch Z will be engaged and reset.

After the package P has been completely formed and doffing is desired, the operator depresses the "DOFF" button D, as shown in FIG. 1, for the desired package roll and the torque motor voltage reverses polarity and drives the desired package roll 30 away from engagement with the drive roll 14 toward the doff position at the extreme end of its path of travel. When the package rolls 30 reach the doff position, switches X and Y are actuated which remove power from the torque motors 50 and allow the lower carriage to latch into position by the latch mechanism 110.

With the package rolls 30 in the doff position, suitable timers are initiated following which the air pressure to the package roll brake mechanism 33 will be supplied to brake the package rolls 30 and cause the same to stop rotating and air pressure will be removed from the bladders 31 to allow the the wound packages P to be removed from the package rolls 30. The above operation may then be repeated for one or both of the package rolls 30.

Thus, it may be seen that this invention has provided a winding apparatus including mechanisms for com-
pensating for variations in tension in the thread being wound and for satisfactorily and easily maintaining a desired predetermined pressure relationship between drive and package rolls for consistency in the winding operations thereof. In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

1. The combination of:
textile thread winding apparatus having a driven rotating drive roll, at least one freely rotatable package roll positioned on one side of said drive roll for engagement therewith to be driven thereby for the winding of thread and mounted for linear movement away from said drive roll as the thread package builds thereon, a thread traversing mechanism positioned on the other side of said drive roll for receiving the thread from a source and guiding the thread around said drive roll to said package roll while traversing the thread longitudinally of said drive roll, carriage means including a stationary portion and a movable portion carried by said stationary portion for reciprocating linear movement and being secured to and carrying said package roll for reciprocating linear movement therewith, and means for maintaining a desired predetermined pressure relationship between said drive roll and said package roll and for linearly driving said package roll and comprising a variable torque reversible motor, a screw shaft connected to and rotated by said torque motor and a nut secured to said movable carriage portion and receiving said screw shaft therethrough for converting rotary movement of said screw shaft into linear movement of said movable carriage portion and package roll carried thereby; and

means for compensating for variations in tension in the thread being wound due to increases and decreases in the length of the path of travel of the thread from the thread source to said package roll caused by the traversing action of said traversing mechanism.

2. The combination of:
textile thread winding apparatus having a driven rotating drive roll, at least one freely rotatable package roll positioned on one side of said drive roll for engagement therewith to be driven thereby for the winding of thread and mounted for linear movement away from said drive roll as the thread package builds thereon, a thread traversing mechanism positioned on the other side of said drive roll for receiving the thread from a source and guiding the thread around said drive roll to said package roll while traversing the thread longitudinally of said drive roll, carriage means including a stationary portion and a movable portion carried by said stationary portion for reciprocating linear movement and being secured to and carrying said package roll for reciprocating linear movement therewith, and means for maintaining a desired predetermined pressure relationship between said drive roll and said package roll and for linearly driving said package roll and comprising a variable torque reversible motor, a screw shaft connected to and rotated by said torque motor and a nut secured to said movable carriage portion and receiving said screw shaft therethrough for converting rotary movement of said screw shaft into linear movement of said movable carriage portion and package roll carried thereby; and

means for compensating for variations in tension in the thread being wound due to increases and decreases in the length of the path of travel of the thread from the thread source to said package roll caused by the traversing action of said traversing mechanism.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,690,576  Dated September 12, 1972

Inventor(s) George F. Schroeder

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 16, "threat" should be-thread--; Column 7, line 27, after "46" insert ---and the package rolls 30 in a direction toward the drive roll 14.

Signed and sealed this 13th day of February 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.  ROBERT GOTTSCHALK
Attesting Officer  Commissioner of Patents