Sept. 25, 1951 J. G. KERSHAW 2,568,960

WINDER

Filed Nov. 12, 1948 6 Sheets-Sheet 1

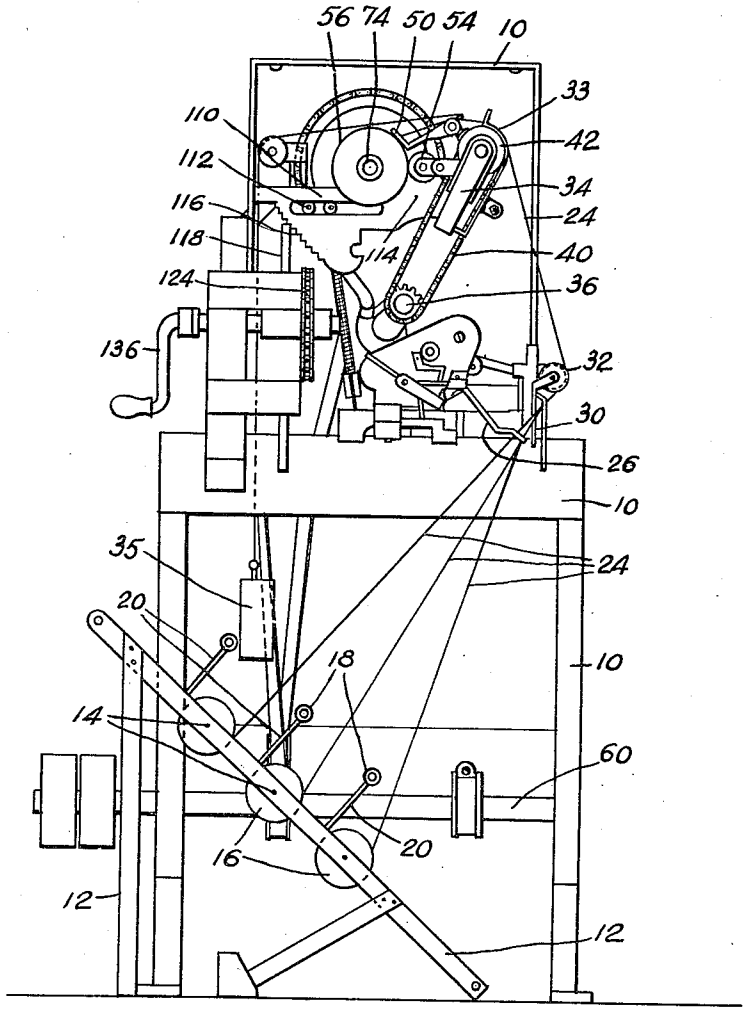


FIG. 1

INVENTOR.
JOHN GREEN KERSHAW
BY
ATTORNEY

Sept. 25, 1951 J. G. KERSHAW 2,568,960

WINDER

Filed Nov. 12, 1948 6 Sheets-Sheet 2

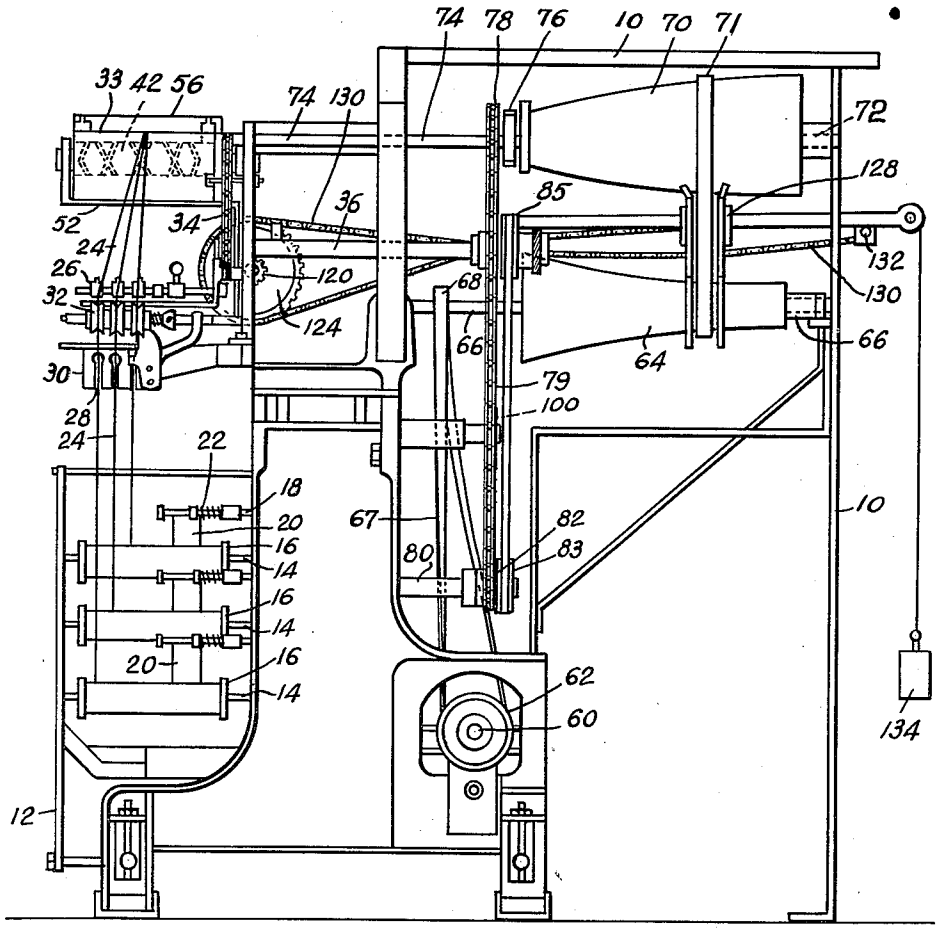


Fig. 2.

INVENTOR.
JOHN GREEN KERSHAW
BY
ATTORNEY

Sept. 25, 1951 J. G. KERSHAW 2,568,960

WINDER

Filed Nov. 12, 1948 6 Sheets-Sheet 3

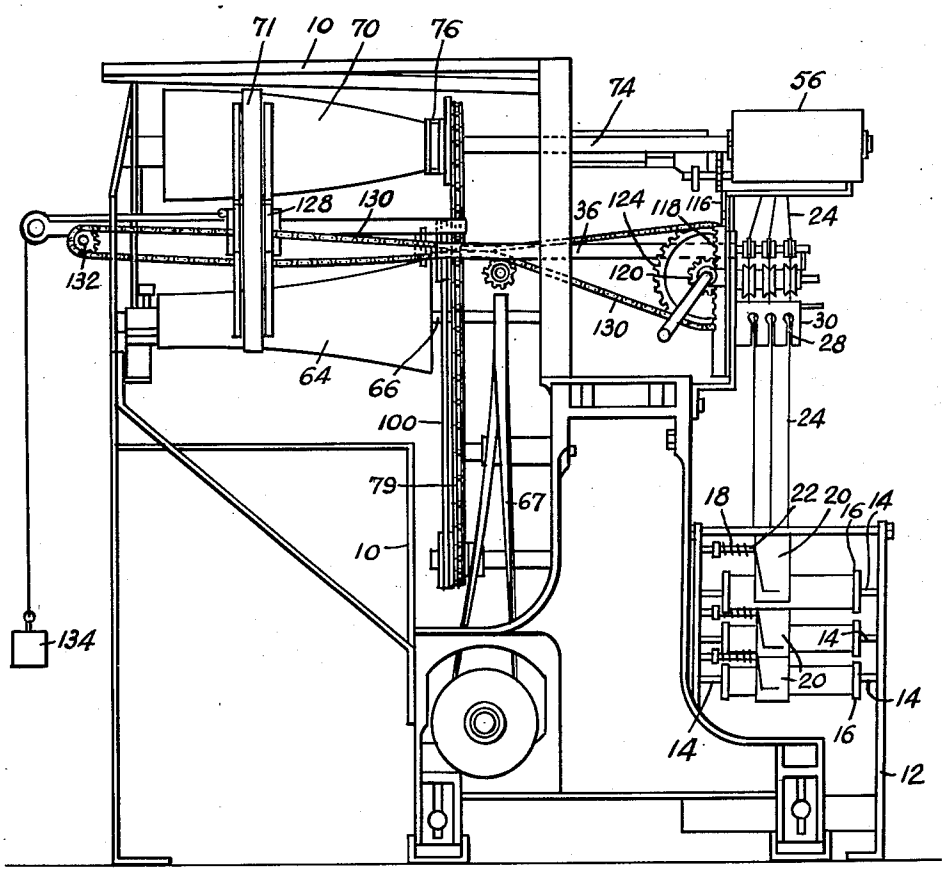


Fig. 3

INVENTOR.
JOHN GREEN KERSHAW
BY
ATTORNEY

Sept. 25, 1951 J. G. KERSHAW 2,568,960

WINDER

Filed Nov. 12, 1948 6 Sheets-Sheet 4

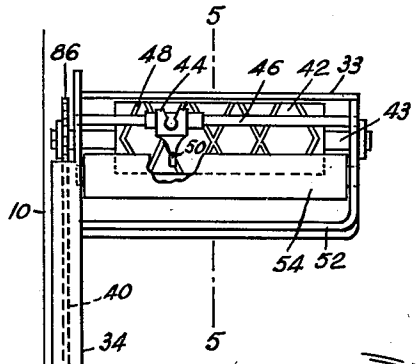


Fig. 4

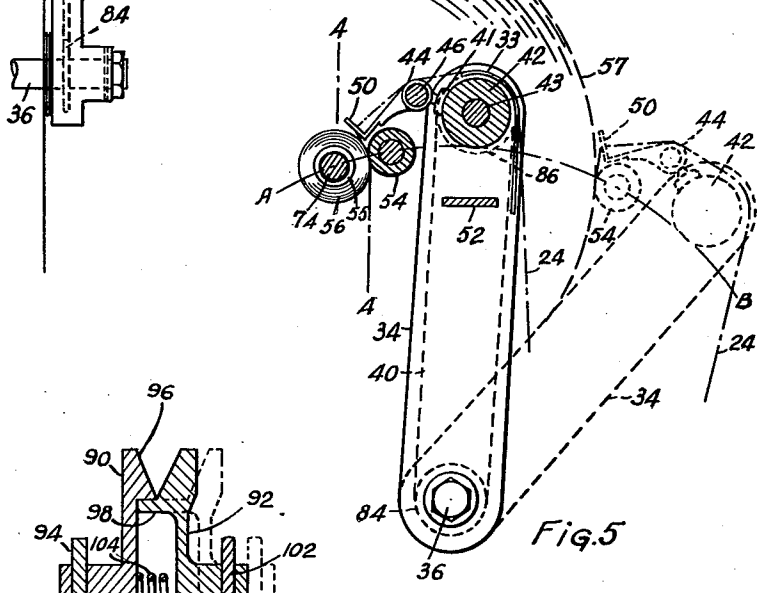


Fig. 5

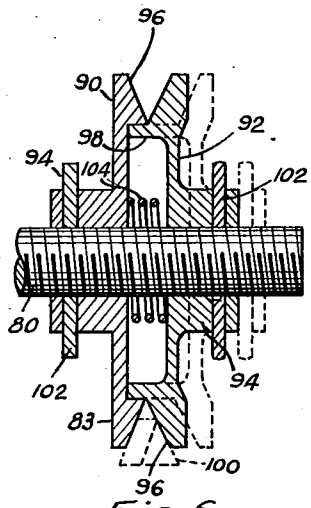


Fig. 6

INVENTOR.
JOHN GREEN KERSHAW
BY
ATTORNEY

Sept. 25, 1951 J. G. KERSHAW 2,568,960

WINDER

Filed Nov. 12, 1948 6 Sheets-Sheet 5

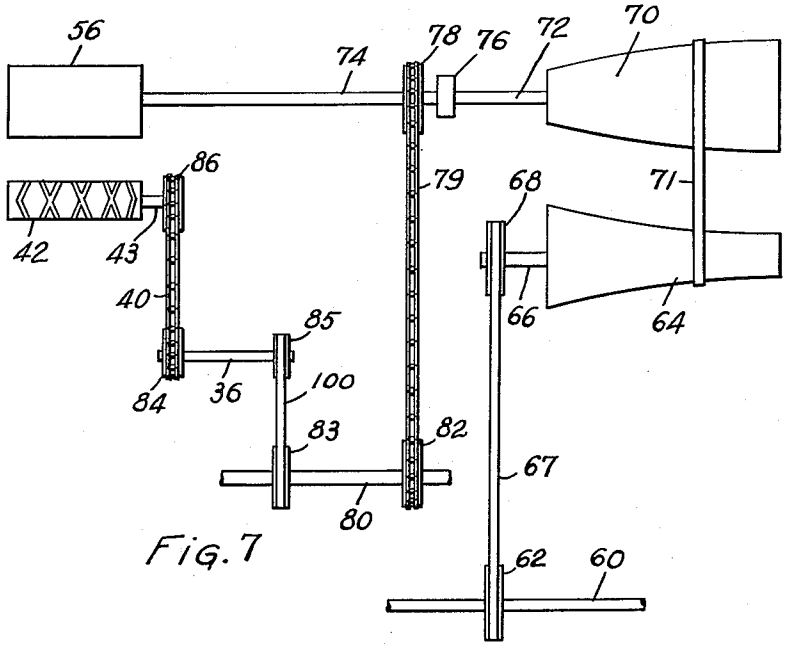


Fig. 7

INVENTOR.
JOHN GREEN KERSHAW
BY
ATTORNEY

Sept. 25, 1951 J. G. KERSHAW 2,568,960

WINDER

Filed Nov. 12, 1948 6 Sheets-Sheet 6

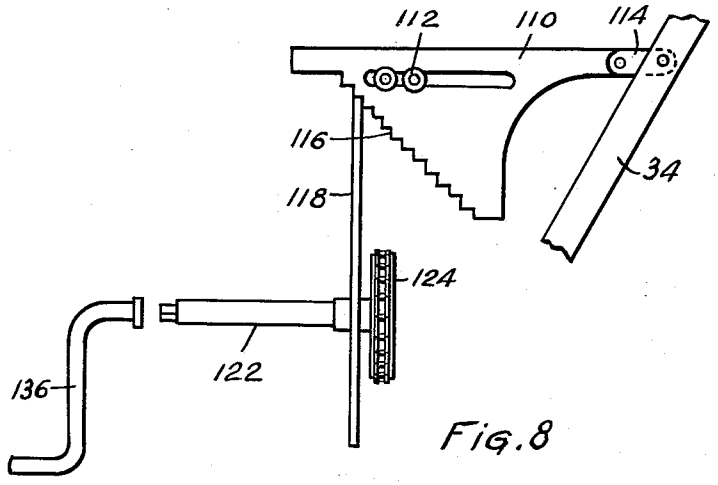


Fig. 8

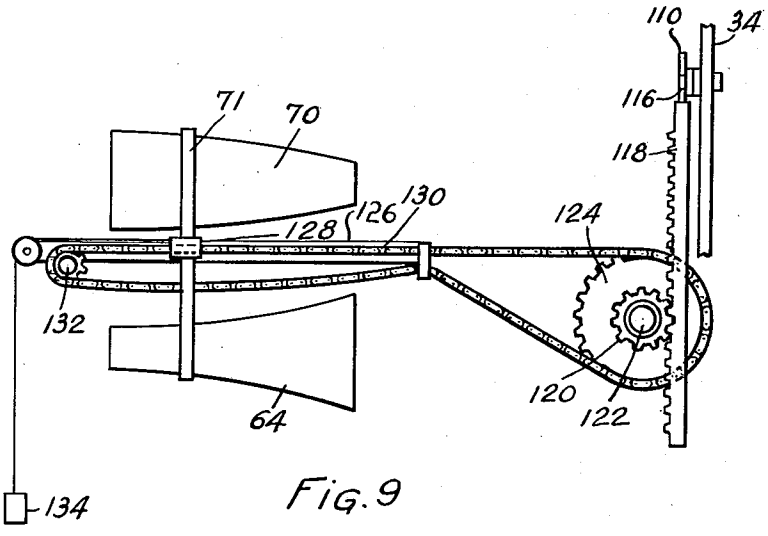


Fig. 9

INVENTOR.
JOHN GREEN KERSHAW
BY
ATTORNEY

Patented Sept. 25, 1951 2,568,960

UNITED STATES PATENT OFFICE

2,568,960

WINDER

John G. Kershaw, Oak Bay, Victoria, British Columbia, Canada, assignor to Drummondville Cotton Company Limited, Montreal, Quebec, Canada, a corporation of Canada

Application November 12, 1948, Serial No. 59,610

3 Claims. (Cl. 242—18)

1

Introduction

This invention relates to winders, and more particularly to a winder of the type adapted to lay at least three ends of ply yarn side by side on a winder tube to make a package, principally used in the manufacture of tire cord.

In winding packages of yarn in which a plurality of ends are adapted to be laid side by side difficulty has been encountered in maintaining even, equal and constant stretch on each separate strand of ply yarn. In a good tire cord, when tested by breaking under tension, all the yarn ends will be broken off evenly, and in a splintered break these ends will be broken off at different points. These splintered breaks are caused by unequal lengths of ply yarn being twisted into cord, and the unequality of the yarn is caused primarily by unequal tension on the ply yarn as it is being twisted.

It has been found that a principal cause of this unequal tension is in the normal positions of the supply spools of ply yarn as arranged in the twister creel. As these are generally set up in staggered relationship, one above the other, relative to the twister, the yarn from the nearest spool is the tightest and the yarn from the furthest away spool is the slackest and so on, so that each of the yarn lengths are twisted into the cord at a different tension.

When tire cord is twisted from a package on which a plurality of yarn lengths are laid side by side under equal tension, uneven or splintered breaks are substantially eliminated.

Still further, it has been found that in high speed machines of this type the laying on in the proper order of the yarn is of utmost importance. The initial sequence of the laying on process must be maintained throughout the entire package, first to maintain a solid package and secondly to maintain equal lengths of the strands as they are being wound. It has been found by test on a three ply package, that a reversal of the laying on order from 1–2–3 to 3–2–1 would develop in one thread unequal stretch and a longer length. In the intermediate state between the proper sequence and a complete reversal, the threads would tend to build up rather than lay on the package. In order to maintain the proper laying on sequence a definite ratio between the peripheral speed of the package and the traversing mechanism must be maintained, and it has been noted by test that a very slight variation of this ratio will reverse the sequence.

The present invention deals fundamentally

2

with the conditions described above and it aims to devise a thoroughly practical solution of the problems underlying them by providing a winding machine adapted to lay a plurality of ends side by side on a package under equal tension so as to provide a clean break as compared to a splintered break when the cord is tested by being broken under tension, and at the same time is adapted to run at a constant winding speed in order to maintain constant stretch.

In the following specification the word "package" is used in the general sense to apply to a mass of yarn wound on a winder tube, and the word "yarn" is employed to indicate material of a textile nature or otherwise.

Applicant's development

The applicant's invention is embodied in a winding machine which includes a winding spindle, means for rotating the spindle to wind the yarn thereon to form a package and a traversing mechanism for guiding the yarn onto the spindle. In accordance with the invention, the traversing mechanism includes means responsive to the growth and diameter of the package for varying the speed of the driving means and a drive from the spindle to the traversing mechanism adapted to maintain a constant ratio between the speed of the traversing mechanism and the peripheral speed of the package. A preferred driving means for the spindle includes a first elongated substantially conical pulley having a driving connection to the spindle shaft and having its axis parallel to the axis of another conical pulley with its conical surface reversed to that of the first pulley. The second pulley is driven from the first pulley by a belt which is adapted to be moved by a belt shifting arrangement along the length of the pulleys so that the speed of the rotation of the second pulley is increased or reduced depending upon the position of the belt. In accordance with this aspect of the invention, the belt is moved by the action of the traversing mechanism so that as the package grows, the second pulley is rotated slower consequently the axial speed of the winding spindle is reduced.

Preferably the traversing mechanism is pivotally mounted for swinging movement away from the spindle as the package grows. In accordance with a preferred arrangement, there is a notched plate pivotally attached to the traversing mechanism and slidably mounted on the winder frame. A gear is rotatably mounted on the frame and a straight toothed rack engaged with the gear is

adapted to engage in the notches in the plate. Means are provided to normally urge the rack into engagement with the plate. A sprocket gear is in direct connection with the gear and a chain in meshed engagement with the sprocket gear. The chain is workably connected to the belt shifting means and there is means urging the belt towards the deep end of the second conical pulley so that as the package increases in diameter, the traversing mechanism in moving away from the spindle moves the notched plate and allows the rack to shift to subsequent notches thereby allowing the belt driving the second conical pulley from the first conical pulley to shift transversally a given distance along the length of the pulleys thereby varying the speed of the fixed axis spindle in direct relationship to the diameter of the package.

A preferred arrangement for drivably connecting the spindle and the traversing mechanism is as follows. There is a sprocket gear fixably mounted on the drive shaft of the spindle, a secondary shaft, a sprocket gear mounted on one end of the secondary shaft, a chain drive connecting the gears, an adjustable V-belt pulley mounted on the secondary shaft, a stub shaft mounted for rotation, a V-pulley mounted on said stub shaft, a V-belt workably connected between said two V-pulleys to drive the stub shaft from said secondary shaft, a gear mounted for rotation with the stub shaft, a shaft mounting the scroll of said traversing mechanism, a gear on said shaft and a chain workably connecting the two gears so that the scroll is driven from the stub shaft.

It is also desirable, in accordance with the invention, to mount the supply spools equidistant from the spindle. For this purpose, the applicant prefers to employ a frame and mounts the spools on horizontal shafts mounted on the frame so that their axis is parallel with and equidstant from the first point of contact of the yarn with the periphery of the winding spool. Preferably, braking means is provided to act on the supply spools to provide tension upon the end being drawn off, this means desirably including a braking face so that equal tension may be provided on each spool.

The traversing mechanism is preferably pivotally mounted and includes a pivotally mounted bracket, a traversing roll mounted on the bracket, a driven shaft forming the pivotal axis of the bracket, means for driving the traversing roll from the shaft, a helical traversing scroll in the periphery of the traversing roll, a yarn guide eye mounted on the bracket. The guide eye is traversed in an oscillatory motion by a follower engaging in the helical scroll on the periphery of the traversing roll. This provides accurate and high speed traversing and develops a firm evenly wound package.

A further phase of the applicant's invention resides in the governing of the speed ratio between the winding spindle and the traversing roll. For instance in winding, with a package speed of 2400 R. P. M. with a 1 to 5 minus traversing stroke, a very slight variation of the speed ratio between traversing and winding will reverse the "laying on" order of the strands. To accomplish this speed ratio adjustment the applicant has designed the V-belt drive between the package drive shaft and the traversing drive shaft to be adjustable. One of the V drive pulleys is adjustable in effective diameter acted upon by the V belt, thus allowing for sufficient adjustment in the relative speed of the package and the traversing mechanism to secure the proper ratio of speed.

A further phase of the invention resides in the applicant's use of a clutch, adapted to engage and disengage the power source from the package and traversing guide eye mechanism drive, thus allowing the operator or the automatic stop mechanism to stop and start the package and traversing mechanism without adjustment to the speed regulating mechanism or the stopping of the main driving source. Also, the clutch may be connected to the pivotal traversing guide eye assembly to stop the winding when the package has reached its desired size.

Detailed description

The invention resides in the novel construction, adaptation and combination of parts as described in detail with reference to the accompanying drawings in which:

Figure 1 is a "front" elevation of a winder showin a preferred form the applicant's development.

Figure 2 is a "side" elevation of the winder illustrated in Figure 1 taken from the right side.

Figure 3 is a side elevation of the winder illustrated in Figures 1 and 2 taken from the left side of Figure 1.

Figure 4 is an enlarged side elevation of a proposed embodiment of the traversing mechanism taken on the line 4—4, Figure 5.

Figure 5 is an end section of the traversing mechanism as illustrated in Figure 4 taken on the line 5—5, Figure 4.

Figure 6 is a cross section taken through the adjustable V belt pulley which is adapted to adjust the ratio of speed between the traversing mechanism and the package.

Figure 7 is a diagrammatic illustration showing the driving cycle throughout the winder.

Figure 8 is a diagrammatic illustration of the preferred arrangement of the notched plate and bar of the speed control mechanism.

Figure 9 is a diagrammatic illustration of the speed control arrangement.

With particular reference to the drawings the applicant's preferred form of apparatus consists of a suitable supporting framework 10, upon which are mounted the various parts comprising the winder. In order that the structure and functions of the various portions of the apparatus making up the complete winder may be understood clearly, each of these portions will now be described in separate detail.

Spool rack and braking means

A mounting for individual spools upon which the ends are individually wound is used in the form of a rack consisting of a frame 12 attached to the front of the winder frame 10, having mounted thereon a plurality of disconnectable idler shafts 14 adapted to receive yarn holding spools 16. Stub shafts 18 situated adjacent each of the idler shafts are each adapted to carry a brake member which by choice may be a plate 20 which is urged, by a spring 22, into contact with either the material on the spool or the spool itself. The shafts 14 are so placed in the frame 12 so that they are equidistant from a winder spindle (74) to be spoken of later. The spool frame 12 may be adapted to accommodate as many spools as there are ends to be wound, but for purposes of description, the preferred structure illustrated and described is adapted to accommodate three spools.

"Drop arm" electric stop motion for individual ends

Each of the ends **24** drawn from the spools **16** are adapted to pass through the eye or guide of individual pivotally mounted drop arms **26** each of which is supported by one of the ends **24** and allowed to drop when the support is removed by breakage or exhaustion of the supply of the yarn or thread **24**. Mechanism well known to the trade is actuated by the dropping of any one of these arms **26** to stop the traversing mechanism and winding spindle in order to repair or replenish the supply of yarn. Further description of this stop motion is deemed unnecessary, other than that in the preferred structure the applicant has applied the stop motion to operate a clutch (**76**) disengaging the traversing mechanism and the winder spindle from the driving means, which will be detailed later.

End concentrating guide

To guide the plurality of ends **24** toward a traversing guide eye (**50**) they are passed through individual guide slots **28** in the guide plate **30**. The ends **24** are then guided between individual resilient split wheel guides **32**. It has been found advantageous to keep the ends **24** separated until reaching the traversing guide eye **50** and therefore multiple slots **28** and guide wheels **32** are provided.

Driven traversing mechanism

The ends **24** are then led over a flat guiding surface which is formed by the casing **33** of the traversing mechanism and through the driven traversing eye **50** which is adapted to remain a definite and constant distance from the periphery of the package being wound.

The traversing mechanism comprises a driven roll **42** upon which is inscribed a scroll **48** forming a double helical endless track. The shaft **43** upon which the roll **42** is mounted for rotation is supported for pivotal movement on a frame **52** mounted on the arm **34**. A drive is effected between the driven shaft **36** and the roll shaft **43** by means of sprockets **86** and **84** mounted respectively on the shafts **36—43** and a connecting chain drive **40**. The arm **34** is pivotally mounted on the driving shaft **36**, thereby allowing the traversing mechanism to move towards and away from the winding shaft **74** which is adapted to carry a winding spool **55** upon which a package **56** is to be wound. A counterweight **35** may be used to urge said traversing mechanism towards said package. The pivotal motion of the traversing mechanism is illustrated in Figure 5 by showing in full lines its position on a newly started package **56**, and its position in broken lines **57** as the package has increased in diameter. The important feature in this construction is to maintain the traversing eye **50** at the same relative position to the circumference of the package as the diameter of the package increases as illustrated from **56** to **57**. This, along with the other features of speed control, as later described, produces a package having uniform characteristics throughout, and has been achieved by mounting an idler guide roll **54** on the traversing mechanism guide in close proximity to the traversing eye **50**. Said idler roll **54** is adapted to roll against the circumference of the package and as the package **56** grows in diameter the traversing mechanism is pivoted on the axis of shaft **36** forming an arc A—B as illustrated in Figure 5. However, in order to maintain the guide eye **50** in the same relative position to the circumference of the package through its growth, a continuation of the arc AB inscribed by the axis of the guide roll **54** must cut the axis of the winder shaft **74**. A follower **41** is seated in and adapted to follow the endless scroll **48** on the roll **42** and is pivotally mounted to the body **44** of the guide eye **50**. The body **44** is slidably mounted on a rod **46**, which is supported by the frame **52**, to guide the eye **50** in traversing in back and forth motion parallel to the axis of the package **56—57**.

The drive and speed control mechanism

The driving mechanism of the preferred structure comprises a main drive shaft **60**, which is driven by a source of power, and upon which is mounted a pulley **62**. One of a pair **64—70** of oppositely disposed substantially conical sheaves, namely **64**, is mounted on a shaft **66** having a pulley **68** mounted thereon, and is rotated by the belt drive **67** between pulleys **62—68**. The second of said conical sheaves namely **70**, is mounted on a shaft **72** and is driven by a belt connection **71** from cone **64**. A shaft **74** co-axial with said shaft **72** is adapted for engagement and disengagement with shaft **72** by a friction clutch **76**. The other end of shaft **74** is adapted to form a winding spindle upon which a removable winder tube **55** is placed to wind the package **56** on. Driving connection is made between shaft **74** and a stub shaft **80** by means of chain gears **78** and **82** mounted on the respective shafts, by chain drive **79**. Driving connection is made from said stub shaft **80** to a second stub shaft **36** upon which shaft (**36**) the traversing assembly is pivotally mounted, and driven by the rotary motion of the shaft **36**. In order to maintain a definite calculated ratio between the speed of the package **56** and the traversing mechanism an adjustable V pulley **83** is provided on the shaft **80**. (Detail of adjustable pulley described fully later.) A standard V pulley **85** situated on shaft **36** and a V belt **100** between the two pulleys, constitutes a drive between the first stub shaft **80** and the second stub shaft **36**. A chain drive between the stub shaft **36** and the shaft **43** upon which the traversing scroll **42** is mounted is supplied by a pair of gears **84** and **86** mounted on their respective shafts and connected by a chain drive **40**. Thus, a positive drive is supplied between the stub shaft **36** and the scroll **42**.

The package **56** and the scroll roll **42** are thus driven individually from the main driven shaft **60**, the speed of both the package and the scroll being varied by the position of the belt **71** on the cones **64—70**. A further adjustment is possible in the ratio of speed between the package and the scroll by the adjustment of the V pulley **83**. The rotation of the scroll and the package may be stopped or started by the use of the clutch **76** without stopping the main power drive **60**.

In a case where individual motor drive is employed for each winder, the existing machines may be used including the conical feed regulator. However, in the case of a single motor per unit, it may be found advantageous to eliminate the conical speed regulators and control the speed of the driving motor by means of a rheostat or like equipment. Under such conditions the motor could be either directly or belt connected to the shaft **72**, and a link connection made between either the rod **118**, the chain mechanism **126**, or any other point such as the gears **120** or **124** to control the rheostat. Such

a construction is easily within the skill of a mechanic and therefore further detail is not deemed necessary in this specification.

The Adjustable V Pulley (83)

To secure the proper ratio of speed between the traversing mechanism (scroll) and the package, a very fine adjustment is required. To provide this the applicant has devised a means whereby the effective perimeter of one V pulley (83) may be varied.

Referring particularly to Fig. 6 of the drawings the pulley comprises a pair of component disc-like members 90—92, each having a hub portion 94 keyed or otherwise slidably mounted for a rotation with the shaft 80, and each having an inner beveled face adjacent to the peripheral edge, the opposed faces of the two portions forming a V. A flange 98 on one of the disc-like members is adapted to mate with a recessed portion of the other to permit widening of the V without fully separating the two members 90—92. In this way the V belt 100 is permitted to ride closer or further away from the shaft 80 thus decreasing or increasing the speed of the V belt at the will of the operator, by changing the effective diameter or circumference of the pulley seat 96—96 upon which the V belt 100 bears. For adjustment purposes, as an example, the hubs 94 of the disc member 90—92 may be threaded onto the shaft 80 and locking nuts 102 threadably mounted on each side of the composite pulley to limit the depth of the V. A spring 104 may be positioned between the members 90—92 to maintain the pulley at its adjusted extreme. Many other ways of mounting this pulley for lateral adjustment are within the skill of the average mechanic and therefore further details are not considered necessary. However, it will be understood from this drive and pulley disclosure that a fine adjustment is necessary and made possible, by the adjustable pulley, on the speed ratio between the package and the traversing mechanism.

The package speed control

To guide the peripheral speed of the package by its wound diameter, the applicant has devised a speed regulator acted upon by the diameter of the package and controlling the position of the belt 71 driving between the cones 64—70 (see detail of Figures 8 and 9). This regulator consists of a substantially triangular plate 110 which by choice is slidably mounted on the frame 10 at 112, and is pivotally connected by means of an arm 114, which may be an integral part of the plate 110, to the pivotally mounted traverse mechanism arm 34 or other suitable part. One edge of the plate 110 is stepped by a series of notches 116 which are adapted to control the movement of a toothed rack 118. Said rack 118 is urged into engagement with the stepped edge of the plate 110 by the rack's meshed engagement with a gear 120 keyed to a shaft 122. Also keyed to said shaft 122 is a sprocket gear 124. An "endless" chain 130 in meshed engagement with said sprocket 124 is connected to a belt shifter 128 which is slidably mounted on a bar 126 and adapted to act on belt 71 driving the cone 70 from cone 64. Said "endless" chain 130 is adapted to idle over an idler gear 132, and the shifter 128 is counterweighed by weight 134, thereby urging said rack 118 into contact with the notched edge 116 of the plate 110. The compensating weight 134 is so designed to provide only a slight tension on the belt shifting apparatus 128, thus when the rack 118 is released from one tooth section to the next, an even, smooth timing of the belt 71 is effected, thereby causing an almost continuous decrease in the peripheral speed of the package. Therefore, it will be seen that a direct control of the position of the belt 71 is achieved through the chain rack and plate controlled by diameter of the package. A handle 136 is detachably mounted on the shaft 122 to manually move the belt 71 back to the "high speed" position on the cones, before the start of a fresh package.

Advantages

After the machine had passed its experimental stage, a test machine was actually put into production on a mill floor and both operators and management were convinced of its excellent possibilities as to improvement in quality and economic aspects.

Briefly, some of the advantage may be outlined as follows:

The production of a first-class solid package even at both ends, resulting partially from the yarn being under equal tension throughout the length of the package.

The winding of the package with the two, three or more plies or ends wound on the same package under the same tension does away with splinter breaks. (Test in the lab of the proving mill has proven this.)

Quicker creeling time on cable twisters, as one large package (ten pounds) would be handled rather than two or three smaller type spools as wound before. The larger spools also decrease in number the twister spools needed for this winding and also lessen the weight greatly on the frame when creeling.

Further advantages of this type of winder which are reflected in the production capacity of a mill, is the size of the machine compared to the conventional winders. From the report of the test mill, 50% more machinery could be installed for the same floor space. In addition to this, the increased speed of the machine, which tests show to be approximately 2400 R. P. M. as compared to the conventional machine at 700 R. P. M., greatly increases the production of a conventional mill. Furthermore, technical layout and production advantages are achieved as for example in the use with M-twisters and shoe thread twisters.

If multiple end wind is used, 50% more machinery can be placed in the same area. Creels for packages with two or more laid ends would be in the middle of the twister and not at the side, thus the spindles in a pair of frames could be facing each other.

Summing up, the advantages of the machine briefly are as follows:

A machine capable of making a—

(1) Solid package of side by side yarn,
(2) A machine capable of laying three ends of ply yarn onto a winder tube (in a ten pound package ready for the cable twisting machine),
(3) A new way of making tire cord,
(4) A novel traverse and laying on mechanism,
(5) A novel mechanism for maintaining a constant maximum peripheral speed of the package as the yarn is wound on,
(6) A machine capable of winding a multiple end onto a package under constant tension at high speed,

(7) Fewer spools to handle, reduction in space per production unit, increased production per unit, and the advantage in layout.

I claim:

1. A winding machine, comprising, a frame, a winding spindle having a fixed axis mounted on said frame, means for rotating the spindle to wind yarn thereon to form a package, a traversing mechanism including a guide eye for guiding yarn on to said spindle, speed varying means connected to said spindle rotating means, said traversing mechanism being pivotally mounted for movement away from the spindle as the package grows, a notched plate pivotally attached to said traversing mechanism and slidably mounted on said winder frame, a gear rotatably mounted on said frame, a toothed rack engaged with said gear, said toothed rack being adapted to engage in the notches in said notched plate, means for urging said toothed rack into engagement with said plate, a sprocket gear in direct connection with said first named gear, a chain in meshed engagement with said sprocket gear, said chain being workably connected to said speed varying means, whereby as the package increases in diameter said traversing mechanism in moving away from the package spindle moves said notched plate allowing said toothed rack to shift to subsequent notches thereby varying the speed of the fixed axis spindle in direct relationship to the diameter of the package.

2. A winding machine comprising a frame, a winding spindle mounted on said frame, means for rotating said spindle to wind yarn thereon to form a package, a traversing mechanism for guiding the yarn on the spindle, means responsive to the growth in diameter of the package for varying the speed of said driving means, said traversing mechanism being pivotally mounted and including a pivotally mounted bracket, a traversing roll mounted on said bracket, a driven shaft forming the pivotal axis of said bracket, driving means between said driving shaft and said winding spindle means for driving said traversing roll from said shaft, a helical traversing scroll on the periphery of said traversing roll, a yarn guide eye mounted on said bracket, means workably connecting said guide eye to the scroll of said roll to traverse said guide eye in a reciprocating motion the length of the package to be wound, a guide roll adapted to contact the periphery of the yarn package, the radial arc of the axis of said guide roll formed by the pivoting of said bracket being adapted to pass through the axis of said yarn package, thereby maintaining the yarn guide eye at a fixed distance from the periphery of said package as yarn is wound on.

3. A winder as claimed in claim 2, including a plurality of supply spools mounted on said frame, said supply spools being rotatably mounted on horizontal shafts, a fixed plate having a plurality of spaced apart thread guide openings therein and a plurality of resilient split wheel guides mounted on said frame in parallel relationship with and between said supply spools and said fixed axis winding spindle, whereby individual thread ends are maintained in spaced apart relationship until they reach the guide eye of said traversing mechanism.

JOHN G. KERSHAW.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
510,352	Logan	Dec. 5, 1893
668,241	Wardwell	Feb. 19, 1901
833,374	Detre	Oct. 16, 1906
2,140,555	Satterlee	Dec. 20, 1938

FOREIGN PATENTS

Number	Country	Date
214,642	Germany	Oct. 14, 1909
426,568	Germany	Mar. 12, 1926
781,640	France	Feb. 25, 1935
802,849	France	June 22, 1936