June 14, 1960 O. V. DRTINA 2,940,244

YARN TWISTING AND PACKAGE-CONING APPARATUS

Filed Nov. 27, 1956 5 Sheets-Sheet 1

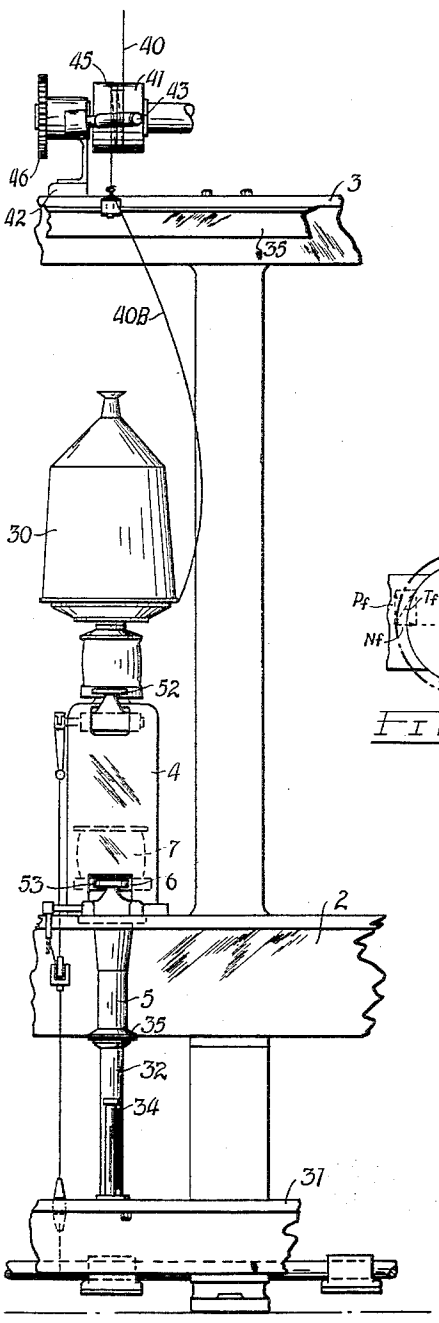


FIG 2

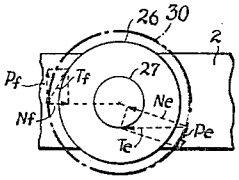


FIG 3

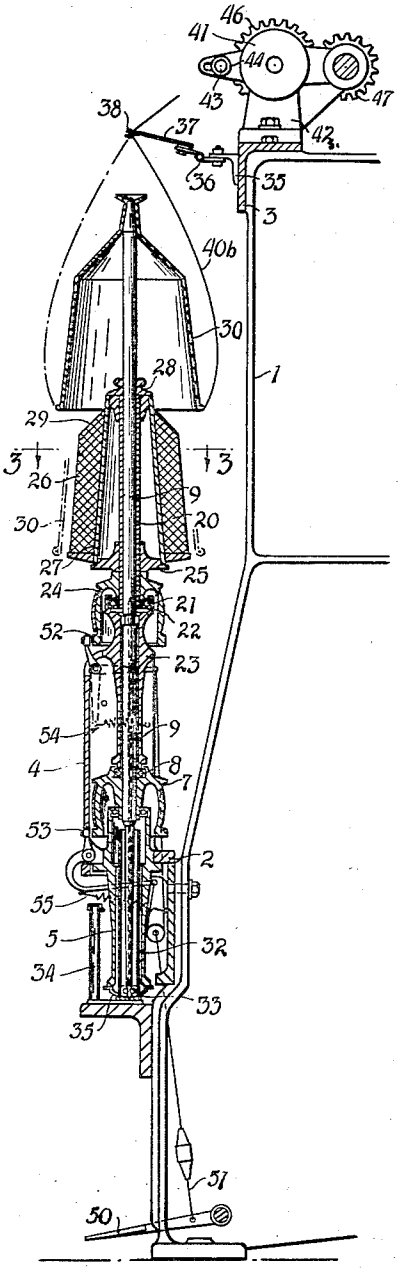


FIG 1

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YARN TWISTING AND PACKAGE-CONING APPARATUS

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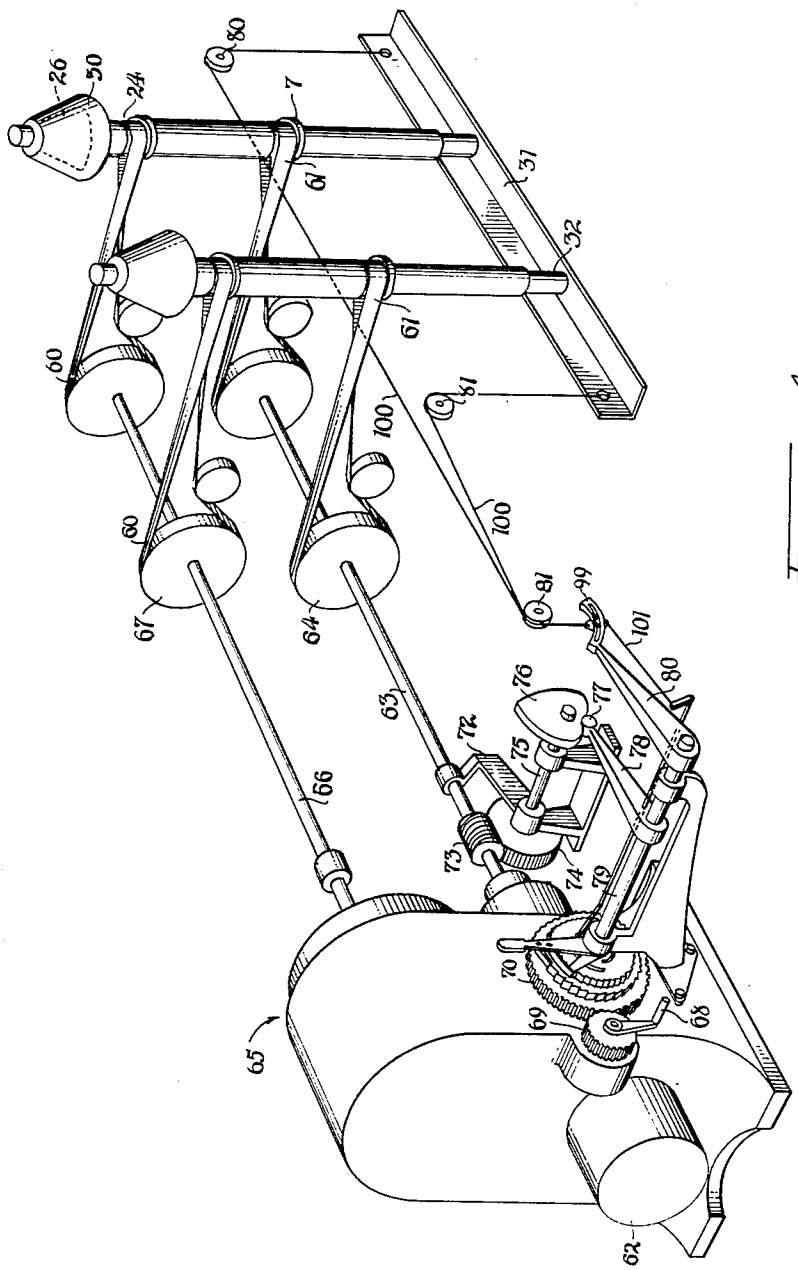


FIG 4

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YARN TWISTING AND PACKAGE-CONING APPARATUS

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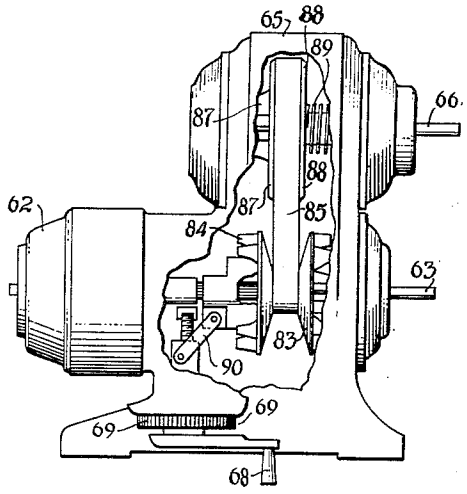


FIG 5

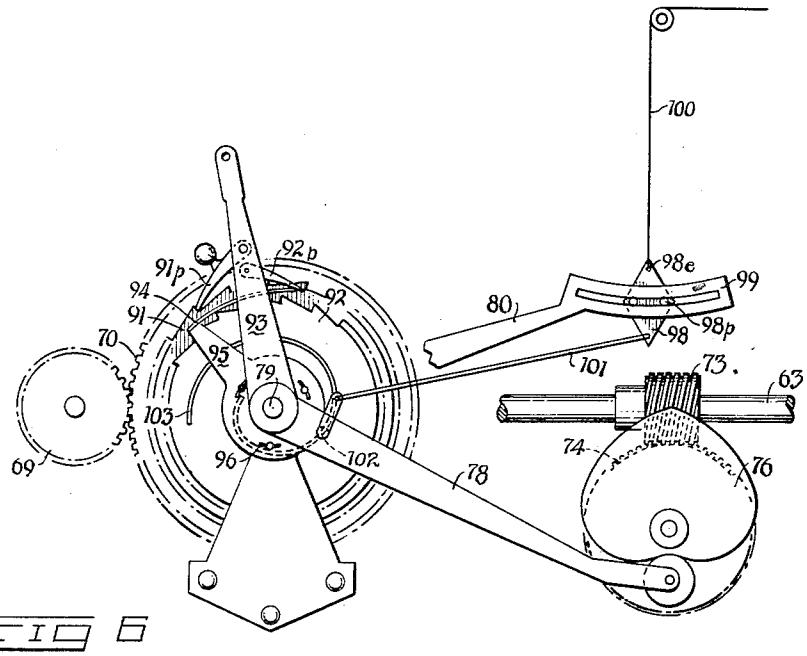


FIG 6

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YARN TWISTING AND PACKAGE-CONING APPARATUS

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FIG. 8.

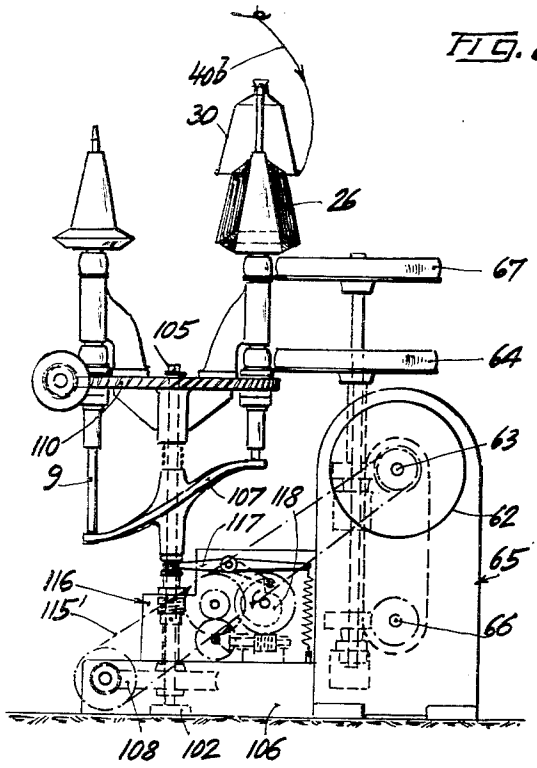
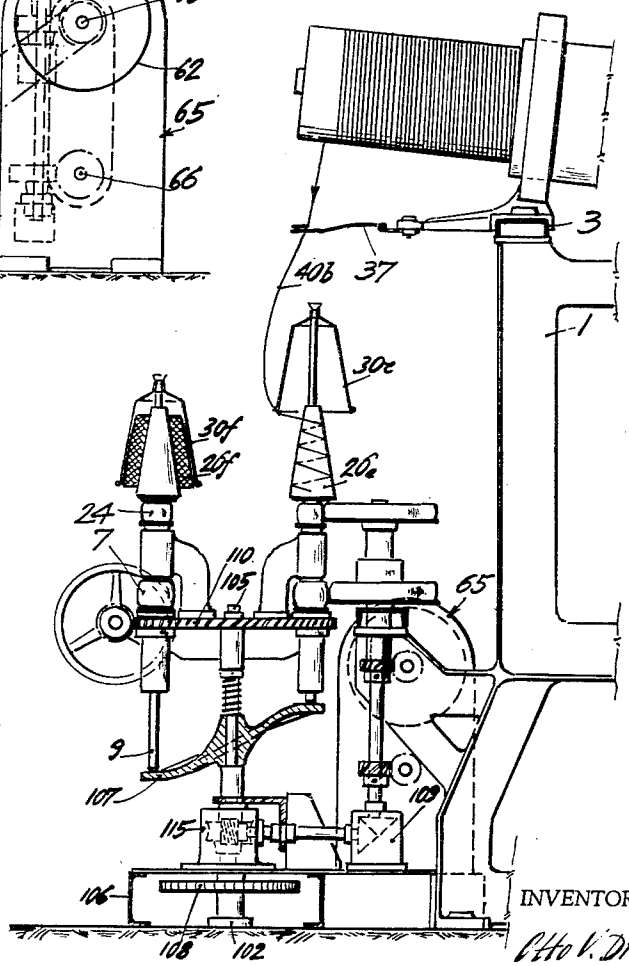


FIG. 7.



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YARN TWISTING AND PACKAGE-CONING APPARATUS

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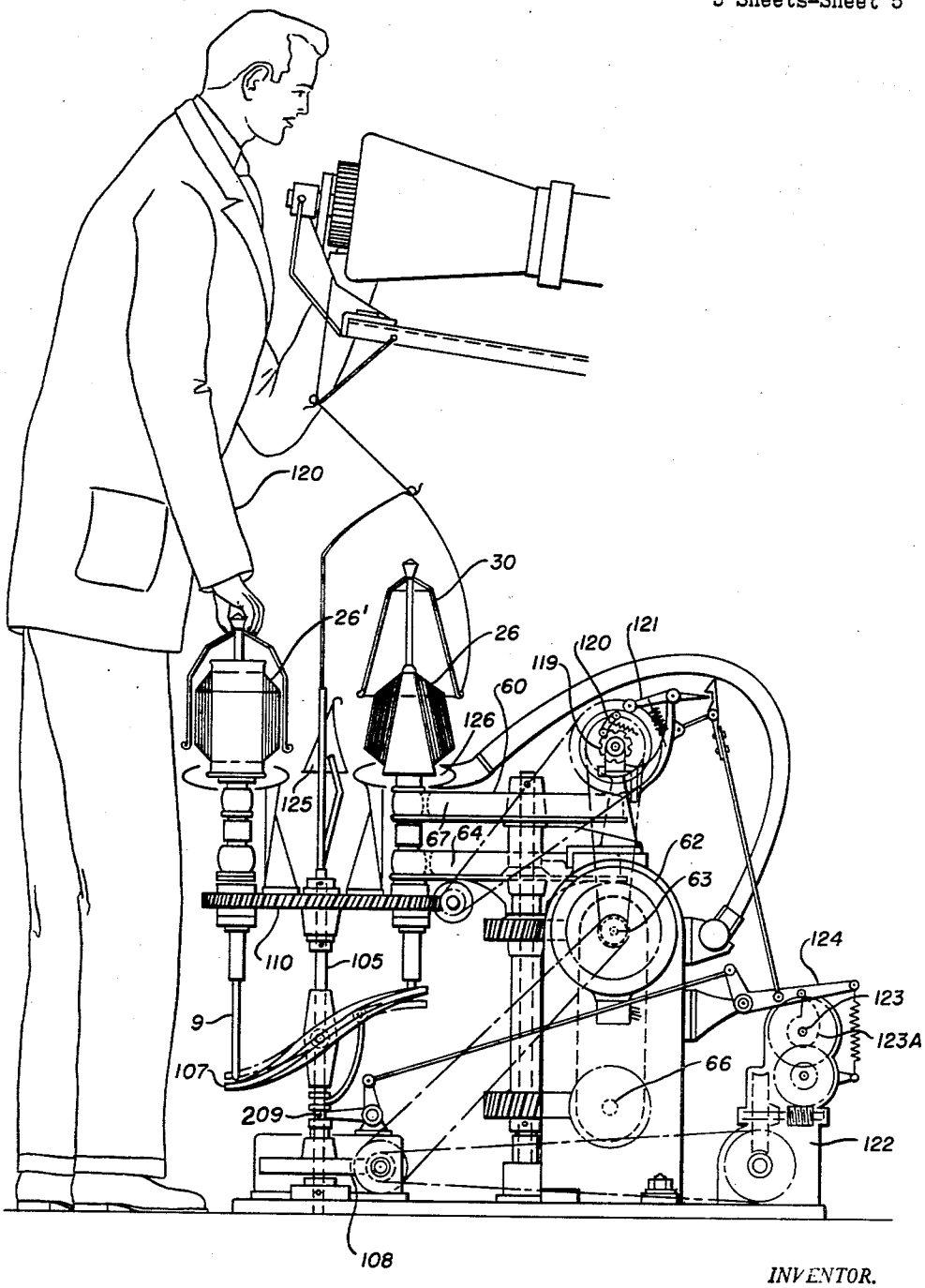


FIG. 9

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United States Patent Office 2,940,244 Patented June 14, 1960

2,940,244

YARN TWISTING AND PACKAGE-CONING APPARATUS

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Filed Nov. 27, 1956, Ser. No. 624,649

6 Claims. (Cl. 57—98)

This application is a continuation-in-part of my co-pending application Serial No. 539,577, filed October 10, 1955, and now abandoned and for Twister-Coner Spindle, With Yarn-Traverse Means, Mechanically Rotated Twister Coner, and Cap Drive Apparatus.

The present invention relates generally to twisting spindles with means for traversing synthetic yarns, and the like on same to form a package.

Heretofore, a common form of arrangement for twisting and packaging artificial material yarn uses a cylindrical bobbin mounted on a vertical axis for rotation and surrounded by a ring carrying a wire loop called the traveller, rotating freely about the bobbin. A free end of the yarn is passed through the loop and then wrapped around the bobbin and as the bobbin is rotated, the yarn wraps around the bobbin and moves with the traveller. The ring traverses axially up and down the cylinder so that the yarn is wrapped around the cylinder from one end to the other back and forth and twisted simultaneously. Among the disadvantages of such prior arrangements is that the traveller wears out and needs replacement as often as once a day, and, further, the yarn on the cylindrical bobbin has to be rewound by an additional step known as coning in order that the yarn may be easily rewound from the package. Further disadvantages arise due to complexities of initial threading and slow operative speeds necessitated by large strains imposed upon the yarn.

It has been known in the past to use a top cap for traversing, eliminating the ring and traveller and enabling the use of higher twisting speeds but with prior cap traverse there has been excessive friction of yarn causing breakage as well as excessive wear of the cap periphery.

It is an object of the present invention to provide simple means for overcoming the above mentioned difficulties.

Another object is to provide apparatus which will eliminate coning as an additional separate operation.

Another object is to provide a novel twisting spindle with rotating cap to insure easier threading while lessening yarn friction by correlating the speed of cap rotation with the speed of the spindle.

Broadly stated, the present invention meets these and other objects by providing a twisting spindle which not only simultaneously affords coning, but is combined with traverse means (cap, ring, or whatever) mechanically rotated with the speed relationships so selected as to assure minimal drag of work material around the traverse means and minimal tension during the twisting. This is accomplished by reducing a component of force influencing the tension in yarn, as hereafter explained, by having peripheral speed of package equal to so-called twisting speed (e.g., speed at which yarn is fed) plus peripheral speed of the cap (or other traverse means). At the same time r.p.m. of work windup or packaging spindle are varied to compensate for coning as well as buildup while

preserving the above mentioned desirable relationship.

Other objects and advantages will become apparent and the invention may be better understood from consideration of the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a side elevational view, partly in section, of a portion of a twister frame having a package-coning spindle surrounded by a cap with means for separately driving coner and cap in accordance with the invention;

Fig. 2 is a front elevation of the apparatus of Fig. 1 but with the cap and associated parts shown in a lower position;

Fig. 3 is a cross-sectional view of the spindle just above the package as taken along the lines 3—3 of Fig. 1;

Fig. 4 is a diagrammatic view of apparatus according to the invention but shown in connection with two twisting and coning spindles;

Fig. 5 is an elevation view, partly broken away, to show the operation of a conventional V-belt variable drive;

Fig. 6 is a detail of a portion of the apparatus shown in Fig. 4 and for driving the speed adjustment system of the V-belt variable drive;

Fig. 7 is a side elevation view of apparatus incorporating modifications;

Fig. 8 is an elevation of apparatus viewed as in Fig. 7 but showing other details for producing yarn packages of certain shape and as described and claimed in this application;

Fig. 9 is a side elevation of a modification of such apparatus.

Referring first to Figs. 1 and 2, I have shown a main frame stand 1 with a conventional spindle rail 2 and a more or less conventional top angle-iron bracket 3. Although but one spindle is shown in the drawing, it will be understood by those in the art that the rails 2 and 3 (and the rail 31 hereafter to be described), as shown with broken away ends in Fig. 2, may extend a distance sufficient to accommodate many spindles. At each such location a stationary bracket 4 is bolted to the rail for supporting the novel rotating cap and twisting and spindle apparatus of the invention. Secured with respect to bracket 4 is a downwardly extending housing 5 having a journal bearing 6 in which a cap rotating pulley 7 is axially held against bearing 6 by an upper bearing 8. The bore of pulley 7 is provided with splines designed to mate with corresponding splines on an axially movable cap rotating shaft 9.

Loosely journalled around shaft 9 is a package spindle sleeve 20 provided with a ball bearing 21 securely held by a ring 22 associated with an upper collar portion 23 of the stationary bracket 4. A coning spindle drive pulley 24 is mounted to rotate the sleeve 20 as by being keyed thereto. Pulley 24 also drives a cone support disc 25 for positive drive of a yarn package 26 thereon. If desired a paper cone 27 may be used in conventional manner to assure cone buildup and to prevent the yarn from falling off the cone shaped package. A centering knob 28 may be secured to sleeve 20 to center the package 26 (or paper cone 27) and hold it against the disc 25.

In order that the yarn wil be wrapped around the cone from one end to the other back and forth, traverse mechanism for repeatedly elevating and lowering a cap twister 30 includes means such as the rail 31 shown made of angle-iron to provide vertical traverse motion, for example of six inches, and usable to also provide a top taper 29 on package 26. Mounted for vertical movement with rail 31 is a vertically extending tube 32. Preferably the tube is mounted in such manner as to enable slight adjustment of cap height with respect to

height of package spindle. The apparatus may be provided with a bottom bearing 33 and may be provided with a lubricating oil fill pipe 34. Tube 32 is mounted for reciprocal movement into and through the stationary housing 5, and at the point where the tube 32 enters the support 5 a drip-proof seal 35 may be included. The upper end of the tube 32 supports the lower end of the axially movable cap rotating shaft 9.

At each spindle location (of which only one is shown in Figs. 1 and 2) there is a more or less conventional pig-tail device which may comprise an angle holder 36 secured with respect to the frame to provide for easy replenishing of package.

Work material such as yarn 40 is fed at uniform speed (except at starting) from a delivery roll 41 rotatably mounted in a bracket 42 securely fastened to the angle-iron bracket 3. On the bracket 42 there may be a more or less conventional pin 43 with a rotatable sleeve 44 with several turns 45 of threads or yarn wound around drum 41 and roller 43 for a positive grip of the material and the feed thereto to the spindle. Drum 41 is driven by spur gearing 46, 47 assumed power driven at constant speed, while pin roller 44 is free to rotate as determined by the wind of material around the drum and roller.

For the purpose of easy exchange of packages, a foot operated brake mechanism may, as shown in Fig. 2, comprise a foot pedal 50, cable 51, and a brake shoe 52 operating on the upper pulley 24, and a brake shoe 53 operating on the lower pulley 7 with springs 54, 55, respectively, operative to hold the brakes normally in open position.

A principal object of the present invention is to minimize the drag of the yarn around the edge of the traverse means and to do this I find it necessary to correlate the r.p.m. speed of the cone spindle with the linear feed speed of the yarn and correlate these speeds with the speed of the yarn cap in a relationship which will become more clear as the description proceeds. One aspect of this relationship is minimizing the components of forces effecting the tension in the yarn. Thus as seen in Fig. 3 where 26 is the package and the dashed circle represents the outline of the cap 30 vertically movable from the position shown in solid lines in Fig. 1 down to the position as shown by the dashed lines at 30 in Fig. 1, I have shown force diagrams in which N_e represents a normal or radial component of wind-up force determining the amount of friction over the edge of the cap when the package is empty as the wind is just starting with T_e representing a tangential resultant force which is the amount of tension in the yarn with this empty (*e*) cone. Similarly, but with a different starting point, N_f and T_f, respectively, indicate the radial and tangential forces where T_f is the resultant tangential force which is the tension in the yarn with a full (*f*) cone. I have found that with proper co-relationship of speed of cap with respect to speed of package and speed of yarn feed, as hereafter explained, each of the tangential or yarn tension forces divides up into the radial vectors N_e or N_f plus a right angle vector P_e—P_f which may be thought of as a circumferential force at the lip of the cap and which formerly had to be produced in the yarn. But with the present invention these circumferential vectors are minimized by mechanical movement of the cap to reduce excessive strains particularly at the time of empty bobbin. Of course the radial tension is equal to the square root of the resultant pull on the yarn squared minus the circumferential component squared, and as will hereafter become apparent I select a relationship of speed of cap and speed of cone so as to practically reduce this circumferential component to zero and thereby minimize resultant pull on the yarn.

During operation, the package cone 26 is driven as previously explained by the upper pulley 24, for example from one of several belts 60 as shown in Fig. 4. Meanwhile, each upper cap 30 is driven by a lower pulley 7, and as seen in Fig. 4, this may be through the medium of one of several lower belts 61. For the purpose of dsecription it is assumed that a motor 62 drives the shaft 63 at constant speed to operate pulleys 64, belts 61, pulleys 7, and hence caps 30 at constant speed, and meanwhile the same shaft 63 through the medium of a somewhat conventional V-belt variable drive indicated generally at 65, drives a shaft 66 and consequently pulleys 67, belts 60, pulleys 24, and packages 26 at an adjustably varied speed.

As explained in detail in connection with Fig. 5, the speed of shaft 66 is adjusted by the turning of a hand crank 68 or mechanically by the turning of an attached pinion gear 69 through the medium of a spur gear 70 which in turn is controlled by a cam operated compensation as hereafter explained in connection with the description of Fig. 6. In general this constitutes the traverse mechanism which has a framework 72. A worm 73 secured to rotate with the constant speed shaft 63 drives a pinion 74 which through a shaft 75 in turn drives a suitably shaped traverse cam 76. Cam 76, which is shown heart-shaped, engages a cam-follower 77 mounted at one end of an arm 78 having its other end fixed rigidly on a shaft 79. On the same shaft 79 there is also mounted an arm 80 which through a suitable movement hereafter to be explained transmits traverse movement through cables 100 passing over sheaves 81 to the traverse angle beam 31. As already explained in connection with Figs. 1 and 2, this in turn controls vertical movement of supports 32 and cap lifting shaft 9 at each spindle location.

Referring now to Fig. 5, I have shown a known V-belt variable speed drive which forms no part of the present invention except in connection with other apparatus and as one of several available means for performing speed variations selectively, manually, or automatically. This drive indicated generally at 65 utilizes the motor 62 to drive the constant speed shaft 63. Shaft 63 carries an axially fixed pulley 83 and an axially movable pulley 84. The pulleys have conical inner surfaces for mating against a V-belt 85 which drives a correspondingly shaped pair of pulleys on variable speed shaft 66, one of these pulleys 87 being axially fixed, and the other 88 being yieldable axially but normally biased in by a compression spring 89. In accordance with the present invention the only addition to standard apparatus of this nature is the spur gear 69 beneath the handle 68. Preferably the handle is engaged through the means of pawls (not shown) so that it will not rotate when the apparatus is being driven by the spur gear 69 but in any event some means is provided for either the handle 68 or the gear 69 driving a linkage indicated generally at 90 and operable to change the spacing between pulleys 83—84 hence the effective diameter for the V-belt with respect to shaft 63 and hence the effective diameter for the V-belt with respect to the variable speed output shaft 66.

Referring now to Fig. 6 I have shown in detail the particular mechanism which gives variation in speed in conformity with traverse and shape of cone as well as buildup and other factors. In general this depends upon the fact that when the yarn is wound on the smaller diameter of the cone, the r.p.m. speed of the cone is increased, and vice versa, in order to afford constant speed of the balloon 40*b* (see Figs. 1 and 2) which is formed in accordance with conventional practice. Also, for increasing diameter of the package (at any particular point along the cone) as layers of yarn are wound up, the r.p.m. speed of the cone is decreased by the apparatus of Fig. 6. For this combined regulation a system of two ratchets 91 and 92 are arranged oppositly and fixed with respect to the gear 70. A gravity operated pawl 91*p* engages into the teeth of ratchet 91 and a pawl 92*p* is adapted to engage into the teeth of the ratchet 92.

These pawls are both mounted upon an arm **93** which is fixed for rotation with the shaft **79** so that arm **93** oscillates in unison with arms **78** and **80** (see Fig. 4). Since the ratchets **91** and **92** are mounted firmly with respect to the spur gear **70**, the variable speed upper shaft **66** is slowed and speeded up according to cam influenced movement initiated by cam **75** driven at constant speed. This influences the traverse movement of angle-iron beam **31**. The shape of traversing cam **76** actuating a rocking movement of arm **93** is such as to compensate for the difference in diameters during coning whereas additional means are provided for compensating for increased diameter of package with buildup and to do this I have shown means for introducing a retarding movement for the shaft **79** and this means takes the form of a segment **94** covering a part of the ratchet **92**. Segment **94** is fixed on a relatively stationary arm **95** but with provision for manually providing slight annular adjustment through the means of adjusting slots **96**. In operation when the pawl **92***p* comes up over the segment **94** on its movement to the left it comes out of engagement with the ratchet **92** for some distance and on its way back starts to move the ratchet some interval later. This permits the arm **93** to advance to the right without advancing the spur gear **70** any steps to the right. The resultant movement may be one step counterclockwise for each traverse, or whatever is desired, but at any rate each turn to the left not compensated for by a corresponding turn to the right causes gradual slowdown of the variable speed shaft **66**, and consequently slows down the speed of the packages to compensate for buildup thereupon. If the package is to have a square top corner no other means need be provided, but if, as shown in Figs. 1 and 2, the package is to be provided with a tapered top it is necessary to provide some means for top end shortening of the traverse at different points for each layer during buildup. To accomplish this I have provided a segment **98** having one end secured to the cable **100** and having its other end connected to a rod **101**. This segment **98** has two pins **98***p* supported in a bracket **99**, supported by arm **80** so as to be movable with respect thereto as an eccentric to affect the distance at which rail **31** will reverse the traverse from up to down. Cable **100** and rod **101** may be fastened to the eccentric riding segment **98** by eyelets in the latter as shown, and to provide proper traverse movement to form a cone shaped package (as shown in Fig. 1). The far end of rod **101** has a roller **102** movable in an Archimedes spiral **103** cut in the ratchet disc **92**.

In operation the mechanism may be brought to a starting position by using the hand crank **68** to raise the speed of the variable speed shaft **66** sufficiently to compensate for the reduced diameter presented by an empty bobbin. Additionally, the segment **98** must be in proper position and then as the conical package increases its diameter, the cable attaching eyelet **98***e* slowly transfers itself to the left decreasing the stroke of the cap **30** and properly shaping the buildup of yarn on the package.

It has already been stated that the cam mechanism can be cranked back to a starting position by hand, but this is not always desirable and is sometimes impossible, for example in connection with continuous spinning machines where it is important to make changeovers to new empty spools as fast as possible. In such case an arrangement as shown in Fig. 7 can be used. In Fig. 7 there is shown a quick changing spindle revolving mechanism which allows a spindle with a full package **26***f* (together with its cap **30***f*, cap lifting shaft **9** and other associated apparatus) to be quickly moved from operative (driven) position at the right and to be replaced with an empty spindle **26***e* and its associated cap **30***e*. The revolving mechanism comprises a vertical shaft **105** secured with respect to a base frame **106**. Instead of the rail **31** (of Figs. 1 and 2) the revolving mechanism has a traversing cam **107** for long traverse and which

is sleeve mounted to be driven as by a motorized variable speed drive **65** through gears located, for example, in housings **109** and **115**. Spur gears **108** may be used to interconnect a plurality of such spindle-units. Another set of gears which may be assumed mounted on the vertical shaft extending upwards out of gear box **109** at the proper speed drives a cap and spindle mounted on revolvable plate **110**. For the exchange of empty for full packages, a 180° turn may be used and this may be performed automatically while at the same time adjustable speed mechanism somewhat as shown in Figs. 4 and 6 is reset to starting position. Additional mechanism as shown in Fig. 8 may properly adjust the whole apparatus to provide a short traverse change to provide a tapered top and like tapered bottom to each package or, as shown in Fig. 9, while the motor driven shaft **63** drives one belt **69** and the vari-drive output shaft **66** drives another for one package **26** and cap **30**, a human operator **120** is about to remove a full package **26'** of different configuration. Here the revolver plate takes the form of a helical gear **110**. Concentric with its axis of rotation, and mounted on the same post **105** is the cam **107** which, as it rotates, traverses the rotating caps through their extended rods **9**. Cam **107** may be rotated through a sleeve from a worm and gear **108**, and in order to be able to get packages with tapered ends the cam is additionally rocked by a lever **209** so that its stroke ends will be varied.

The rotating caps and twisting spindles **26** are driven by two belt drives through pulleys **64** and **67**, one of which has a constant speed of rotation. From the same motor shaft may be driven worm and gear **108** and top shaft **119** on which could be mounted a jaw clutch mechanism **120** which, when engaged by lever **121**, is able to make one full 360° turn and then stop. For rendering automatic operation, a timing device **122** may be introduced and driven by a chain drive from the shaft of worm and gear **108** and have a number of reducing stages to provide a final speed of shaft **123** of one revolution per formation of package. An Archimedes spiral cam **123A** may operate from the same shaft to operate lever **124** connected to **209** and **121** in the manner shown in Fig. 9.

In order to sever the end of yarn of already finished package, a knife **125** may be provided to cut the yarn as the package swings by on the revolver plate **110**. For catching and holding severed yarn, a circular cup-shaped nozzle **126** can be provided with a vacuum applied thereto by an exhaust fan (not shown). Thus when a package is full, the jaw clutch **120** is started and makes one revolution, and this is transmitted to cause the revolver **110** to make a 180° turn, and as the full package comes out of the twisting position the yarn is severed. Yarn ends sucked into the cup **126** cause yarn to come into contact with the rotating cap (of the empty spool just put in place), and as it is wrapped around the rotating empty spool it is automatically caught for takeup. Simultaneously lever **209** is raised, causing cam **107** to resume maximum stroke corresponding to starting length of traverse, and the traverse motion is gradually diminished as cam on shaft **123** turns its 360° when the new package will be fully formed and the cycle repeated.

To summarize operation it may be said that it is desired that cap speed be sufficient with respect to the speed of package so that the yarn-balloon will always be moving around the circumference of the cap, only very slowly but enough to prevent the cutting into the metal by the yarn as happens when yarn runs over a same position. To this end it is preferable that the circumferential component of forces (see P_e and P_f in Fig. 3) which according to some of the prior art had to be produced by the yarn itself are done away with to large extent by mechanical movement of the cap with consequent decrease of strain upon the yarn particularly at time of empty bobbin.

Formulawise, the desired relations may be set up as follows:

(1)

r.p.m. of package

$$= \frac{\text{peripheral speed at windup diam. of package}}{\pi \times \text{diameter at windup}}$$

where peripheral speed of windup may be expressed in feet per minute;

(2)

Peripheral speed of balloon
=peripheral speed of windup diam. of pkg.
−linear speed of feed

where linear speed of feed or so-called twisting speed is the constant feed speed of the yarn as determined by the positive drive top roll;

(3)

r.p.m. of cap
≅r.p.m. of ballon (preferably cap r.p.m. not exactly tbe same as r.p.m. of ballon or a groove would be worn in the cap);

(4)

r.p.m. of cap

$$= \frac{\text{peripheral speed at windup diameter} - \text{linear speed of feed}}{\pi \times \text{diameter at windup}}$$

Of course the cap will always have a lower speed than the package, otherwise the yarn could not wind onto the package;

(5)

$$\text{Turns per inch} = \frac{\text{r.p.m. of spindle (package)}}{\text{speed of yarn in inches per minute}}$$

As already pointed out friction and tension are thereby reduced, twisting is performed correctly, and higher speeds of operation are possible because of reduced tensions, and at the same time it is possible to combine twisting and coning in a single apparatus.

The arrangement shown in Fig. 8 is basically the same as that of Fig. 7, but in Fig. 8 a device indicated generally at **116** is used for the gradual lifting of caps. In order to obtain the tapered package top and tapered bottom already mentioned, the traverse cam **107** is provided with a short additional traverse, moving very slowly, as may be caused for example by a double arm **117** engaging into a bottom part of cam **107** which is thus spring biased upward except as actuated by a slowly rotating cam **118** making only one revolution per formation of package and driven, for example, through worm gears and spur gears from a vertical sleeve extending down from cam **107**.

While I have described arrangements providing a constant cap speed, the speed of the cap could be varied instead of, or in addition to, varying the speed of the packaging cone. For while I have illustrated and described particular embodiments, various modifications may obviously be made without departing from the true spirit and scope of the invention intended to be defined in the appended claims.

I claim:

1. Apparatus for the processing of synthetic yarns and comprising means for feeding yarn at a constant speed, a package spindle having a yarn receiving bobbin arranged to receive yarn in the shape of a cone, said spindle being mounted for rotation about a vertical axis below the yarn feeding means, a concentric cap rotatable around the same axis as the cone and reciprocal vertically to traverse the cone with its lower edge, and means for rotating cap and cone in a predetermined relative speed-varying relationship such that a balloon formed above the traverse cap has slightly more angular velocity than the angular velocity of the cap all the time during formation of cone-shaped yarn package, said means including a cam operated ratchet mechanism for varying the angular velocity of the cone to accommodate variant diameters at windup during cone traverse and also during buildup of the yarn in layers upon the cone.

2. Apparatus in claim 1 further characterized by speed varying means for one of the drives including a speed setting gear and a compound ratchet arranged with one toothed ratchet and associated pawl for driving the gear in one direction and an oppositely toothed ratchet and associated pawl for driving the gear in the opposite direction, and means for rendering one of said pawl and ratchet combinations inoperative for a portion of angular traverse of the pawl with respect to teeth of the associated ratchet so the gear, besides its rocking motion in unison with traverse to provide uniform peripheral speed according to instantaneous position on the cone, turns one step each traverse to slow down the speed of the package as it is being built up.

3. Yarn twisting and tapered top package coning apparatus comprising in combination: a source of rotative power; a variable speed drive operable from the source of power and having a constant speed output shaft, a variable speed output shaft, and a speed adjustment input comprising a toothed pinion; contour cam means operable from said output shaft; pawl and ratchet means for driving the speed adjustment pinion from operation of said cam contour means; a lever arm associated with the pawl and ratchet means and carrying a bracket having an arcuate slot, a segment having a portion operable along said slot responsive to positioning of said lever arm in turn responsive to operation of the cam contour means and further through an Archimedes spiral responsive to positioning of the pawl and ratchet means; cable means connected at one end to the segment; a traverse setting means connected to the other end of the cable means; a package spindle rotatable about a vertical axis; a rotatable traverse means positioned vertically with respect to the spindle and connected to be moved vertically by said traverse setting means; and means for rotating spindle and traverse means each from a different one of the two variable speed drive output shafts.

4. Yarn twisting and package-coning apparatus comprising an eyelet pigtail, two rotatable spindles each for building up a conical package, two caps, one arranged concentric with each of the spindles for independent rotation, turntable means for rotating either one or the other of the spindles with associated cap under the pigtail, said turntable means comprising a quick-changing revolver carrying spindles and caps around an axis and comprising a traversing cam coaxially mounted for rotation around the center of rotation of said revolver and arranged with rotation to vary the heights of the caps, means for imparting to said cam its rotary motion, a short additional traverse device to form a tapered end of the conical package, and turning means for said revolver.

5. Yarn twisting and package-coning apparatus as in claim 4 further having a driving mechanism for driving spindle and cap below the pigtail while imparting variable speed as between driven package and driven cap mounted on the quick-changing revolver, said driving mechanism being timed according to denier twisted and including a timing device making one turn per formation of package and giving in proper interval an impulse for automatic turn 180° with simultaneous reset of the traversing cam and the variable drive mechanism to starting position.

6. Yarn twisting and package forming apparatus comprising two rotatable spindles for building up a tapered package, two caps each arranged concentric with a different one of the spindles and arranged for independent rotation, revolver means comprising a revolver plate carrying the spindles and caps around an axis, a vertical height-of-cap-adjusting relatively long traverse means

comprising a cam plate arranged concentric with the revolver plate and arranged to cause reciprocal traverse of the cap with respect to the package for ordinary build-up layer by layer, and a vertical height of cap adjusting relatively short additional traverse means arranged to act on said cam plate to cause variable traverse of the cap

with respect to the package for forming tapered ends for both end of the package.

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