Jan. 5, 1960 C. H. DOHERTY 2,919,865

TANDEM WINDUP

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FIG. 2.

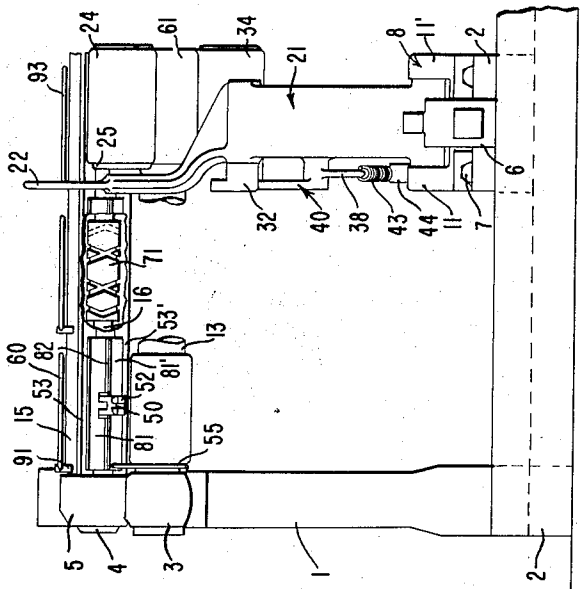
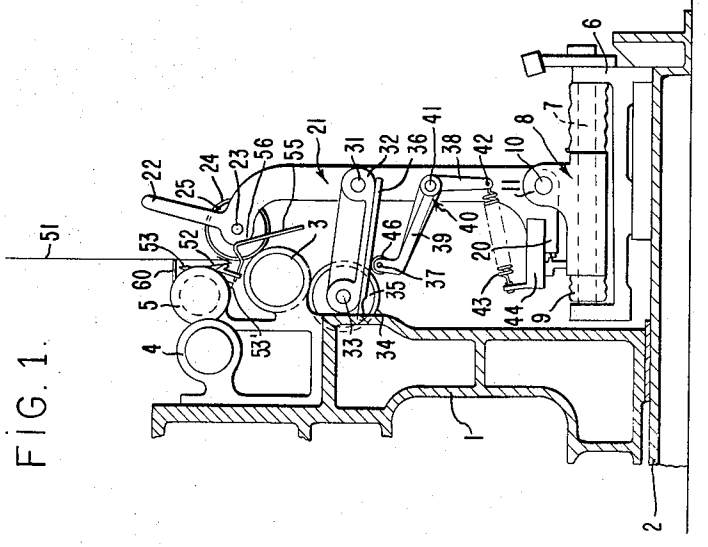



FIG. 1.




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FIG. 4.

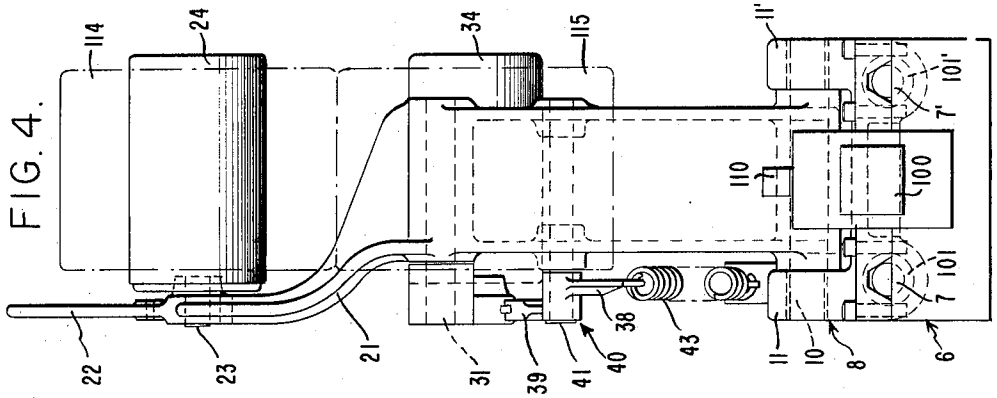
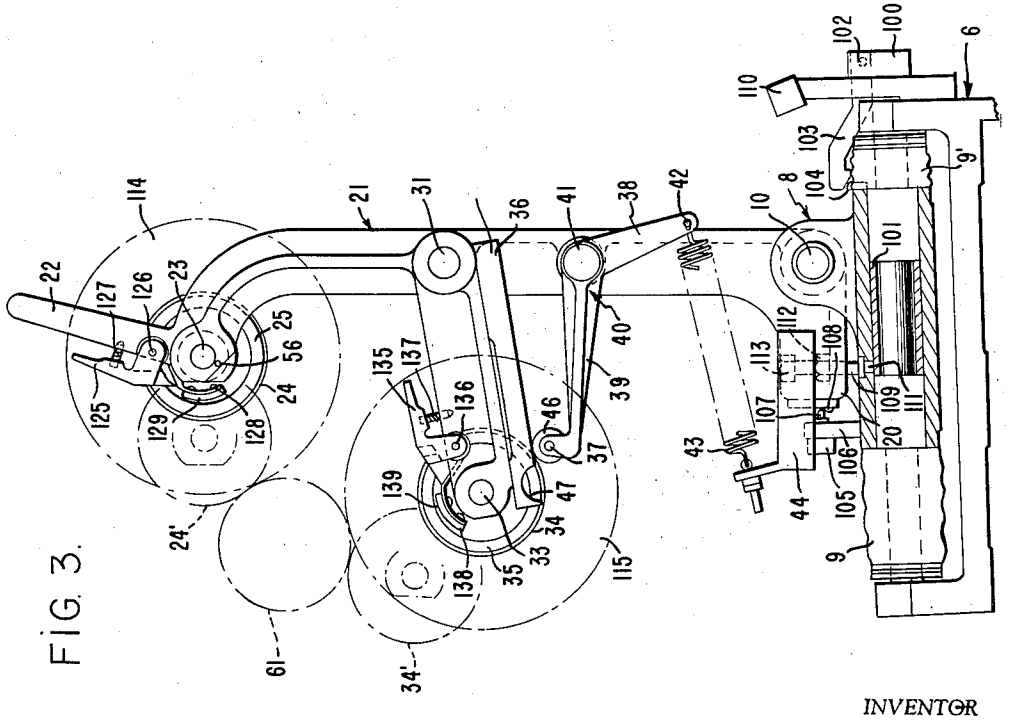



FIG. 3.




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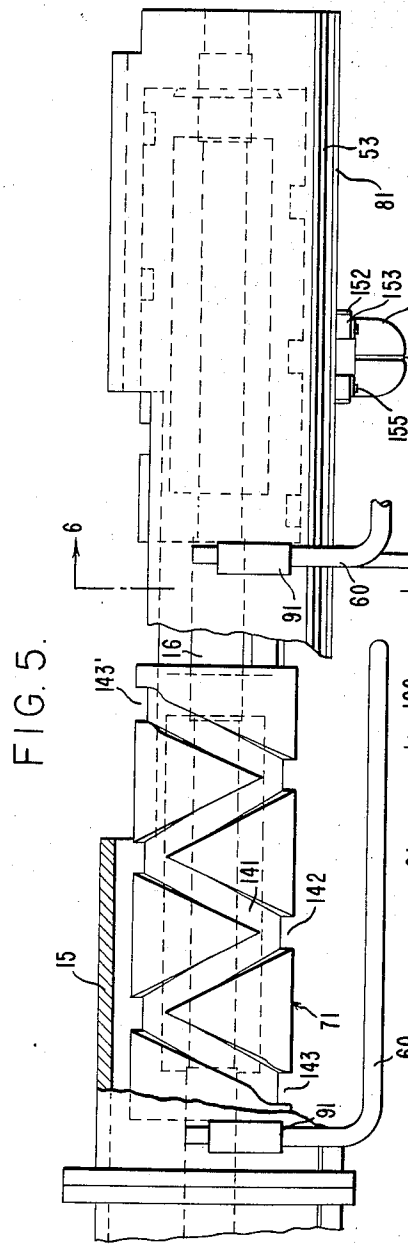



FIG. 5.

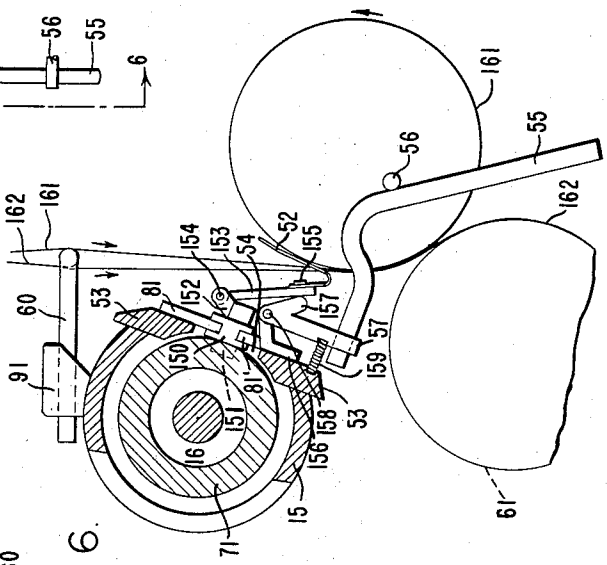



FIG. 6.

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United States Patent Office 2,919,865 Patented Jan. 5, 1960



2,919,865

# TANDEM WINDUP

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9 Claims. (Cl. 242—35.5)

This invention relates to winding of yarn into packages, concerning particularly a tandem windup system.

In production of some synthetic filaments, notably those prepared for evaporative or "dry" spinning (e.g., cellulose acetate), the resultant continuous filament yarn may be wound directly into package form at the spinning machine for subsequent shipment to a convertor for fabrication into textile or industrial products. For convenient unwinding, the package should have essentially uniform density, and the surface should be smooth and even, free of protruding loops, bulging, or dishing. Of late, manufacturing economy has been favored by multiple ending of the output from individual spinning cells, with suitable arrangement of a plurality of windup positions for each, as in a tandem arrangement, one above the other. More economical increased spinning speeds have led to correspondingly larger packages, which are desirable to reduce frequency of doffing at the production site and of knotting or tying-in at the convertor's mill. Large packages are more difficult to handle in the close quarters about a spinning machine, and their bulk increases the difficulty of ensuring uniformity throughout.

A primary object of the present invention is improved winding of yarn packages in tandem. An object is more uniform formation of large yarn packages. Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

Figure 1 is a side elevation of apparatus of this invention. Figure 2 is a front elevation of the apparatus of Figure 1, including several like winding units, all but one being partly cut away for clarity of the showing. Figure 3 is a side elevation showing a portion of the apparatus of Figure 1 in greater detail. Figure 4 is a front elevation of the apparatus of Figure 3. Figure 5 is a plan view of a portion of the apparatus of Figure 2, partly cut away for clarity of the showing. Figure 6 is a sectional elevation taken midway of the apparatus of Figure 5, with yarn added.

In general, the objects of the present invention are accomplished by forming a plurality of yarns into a like plurality of packages, comprising leading a pair of yarns downward toward a tandem winding position, in which two windup packages are driven at upper and lower locations by contact with a rotating drive roll; separating the yarns to space them apart in a direction transverse to the roll axis; traversing the yarn simultaneously with a substantially constant and minimum length of yarn between the guide and the surface of the upper package; contacting the surface of the first package with both yarns, one slightly before the other; passing the yarns between the nip of the upper package and the drive roll; winding the first yarn about and onto the upper package; passing the second yarn about the drive roll and between the nip of the lower package and the drive roll; and winding the second yarn about and onto



the lower package. The invention contemplates use of a drive roll rotatably mounted on a fixed axis, a supporting arm reciprocably mounted with respect to the roll axis, a first spindle rotatably mounted on the arm at a level above the roll axis and adapted to support a yarn-receiving bobbin in driving contact with the roll at one extreme of reciprocation of the supporting arm, a swing arm pivotally mounted on the supporting arm at a level below the roll axis, a spindle rotatably mounted on the swing arm and adapted to support a yarn-receiving bobbin, and means for urging the swing arm about the pivot point to bring the bobbin carried thereby into driving contact with the roll at the same extreme of reciprocation of the supporting arm.

Figures 1 and 2 show the major apparatus elements of this invention in relationship to one another and to associated elements, as viewed from the side (or end) and from the front, respectively. Upstanding frame **1** carried on footing **2** supports end-cap **3** for drive-roll shaft **13**, as well as housing end-cap **4** for a jack shaft (not shown) and end **5** of cam box **15**, which encloses cam shaft **16**. The cam shaft and the jack shaft are located on approximately the same level, with the cam shaft slightly above and moderately to the right in Figure 1 (in front in Figure 2). The drive-roll shaft is located below the cam shaft and nearer to the viewer in Figure 2.

Also supported on the footing is base **6** between whose ends extend glide rods **7** (only one visible, in broken lines) upon which is mounted carriage **8** on linear ball bearings. Boots **9** and **9'** enclose left and right ends, respectively of the indicated glide rod. Pivotally mounted on pin **10**, which extends through left and right ears **11** and **11'** of the carriage, is main supporting arm **21**, which rises generally vertically from the lower or L-end **20** and, after a slight arch, terminates at the top in handle **22**. At the base of the handle, the arm mounts spindle **23**, which supports bobbin **24** on chuck **25**. About midway up the supporting arm is pivot pin **31** for swing arm **32**. The other end of the swing arm mounts spindle **33**, which carries bobbin **34** upon chuck **35**. Below the swing-arm pivot in the supporting arm is pivot pin **41** for presser arm **40**; lower end **38** of the presser arm is attached by tension spring **43** through eye **42** to bracket **44** attached to the supporting arm, and upper end **39** curves upward to support pin **37** for cam roller **46**, which is urged thereby against cam plate **36** affixed to the lower edge of the swing arm.

Threadline **51** is indicated extending vertically (from above the apparatus) past separator rod **60** to yarn traverse guide **52**, and through slot **50** thereof (visible in Figure 2). Gaging rod **55** carried at one end on support **57** is shown in contact at the other end with pin **56**, which protrudes from the main supporting arm near the location of the spindle for the upper bobbin.

Figure 2 shows from the front the appearance of three winding units or "positions" like that shown from the side or end in Figure 1, the elements in two of these being deleted to greater or lesser extent in order to illustrate the relationship of the various elements more clearly. At the right, a complete single unit appears, showing portions of the base, main supporting arm, presser arm and loading spring, swing arm, and empty top and bottom bobbins with drive roll **61** intervening. The main supporting arm, with its base and the supported elements, is omitted from both the other positions. Drive-roll shaft **13** is broken at the middle of the three positions, and at the extreme left it disappears into the housing after passing through a like drive roll.

Centered immediately above the drive roll at the left-hand position is the traverse guide (**52**). Extending to either side from behind the guide are upper and lower

guide strips 81 and 81', which are affixed to the front faces of upper and lower cover plates 53 and 53', separated by opening 54 shown in Fig. 6, on the front of the cam housing. The slider (not visible in this view) upon which the traverse guide is mounted is carried slidably in horizontal race 82 formed between the upper and lower guide strips.

In the middle position the traversing elements also are cut away to reveal slotted cam barrel 71 supported on cam shaft 16, which is visible for a short extent at both sides inside the housing. Above cam box 15 is separator rod 60 (each of the three positions) mounted upon bracket 91, which is attached to the camshaft housing.

Figure 3 shows the supporting arm and attached elements from the side, as in Figure 1, but in considerably greater detail. The carriage upon which the arm rides is cut away to show internal bearing spacer sleeve 101 surrounding rod 7, along which the carriage is free to slide on two linear ball bearings per rod. The bearings are not shown. Pivoted on pin 102 in pad 100 at one end of the base is latch 103, which engages tooth 104, located at the top rear end of the carriage, when the carriage is fully withdrawn to the right end (the front) of the supporting rods, which end is at a slightly higher level than the other so that gravity biases the main arm toward the drive roll. The illustrated position of the carriage and elements supported thereby is determined by full yarn packages 114 and 115 on the upper and lower bobbins respectively, the drive roll being suggested in broken lines. Shown for purpose of comparison is the position of the bobbins alone when empty, indicated as 24' and 34', supported in contact with the drive roll by the arms. Also visible in this view is semicircular opening 47 near the end of the cam plate for the swing arm, which roller 46 on the presser arm 40 engages when the arm is depressed manually.

Cylinder 105 is supported by flange 106 at the left end of the carriage; spring loaded plunger 107 extends from the cylinder into contact with triangular boss 108, which extends from the L-end of the main arm. Cap screw 109 extends below the front end of the arm to rest upon insert 111 in the carriage. The cap screw is adjusted by its head 113 and locked in place by nut 112. The plunger 107 is depressible to permit the entire main arm to be pivoted back to rest against resilient stop 110, in which position the packages have adequate doffing clearance.

Details of the conventional braking mechanism for both chucks are visible in this view, although omitted from Figure 1 for clarity. Upper and lower brake handles 125 and 135, pivoted on pins 126 and 136, are located on the main arm and the swing arm, respectively. Compression springs 127 and 137 between the respective handles and arms bias the brakes in the "off" position, holding shoes 128 and 138 back to keep brake linings 129 and 139 out of contact with the inside wall of the respective chucks.

Figure 4 is a front elevation corresponding to the side elevation of Figure 3. This front view shows right glide rod 7', as well as previously visible rod 7. Shown in broken lines are corresponding sleeves 101 and 101' fitted inside the carriage. The bobbins appear fully loaded, and the suggested alternate positions of the bobbin and the drive roll itself are omitted from this view for clarity. Illustrated details of the construction of the main supporting arm, the carriage, and the base are self-explanatory.

Figure 5 shows details of the traversing mechanism in plan view, at two winding positions, the left of which is cut away to reveal the conventional cam barrel inside the cam box; cam slot 141 has four cross-overs 142, two on each side of the barrel between reversal points 143 and 143' at opposite ends of the path. Also visible, mounted on top of the box, is bracket 91 (both locations) from which extends the separator arm, the arm in the right-hand location being broken away to reveal traverse guide 52 carried on slider 150. The upper cam cover plate and



guide strips (53 and 31, respectively) are visible along the front edge of the housing in the right-hand position. Also extending forward there from the housing beneath the separator arm is gaging rod 55, which rests against pin 56 (whose support is not included in this view).

The traverse mechanism appears in greater detail in Figure 6, which shows it in side elevation, partly in section. Shown in section are the cam housing and the cam barrel, as well as the upper and lower covers. Slider 150 has attached to it follower 151, which fits at the left or rear into the cam slot; on the outside, it carries bracket 152 for guide support 153, which is mounted pivotally thereon by pin 154. Rivets 155 (one visible in Figure 6, two in Figure 5) located in the guide support, hold guide 52 close to the peripheral surface of the upper package (represented here by broken line).

The distance of the guide from the package is controlled by means of linkage between the gaging rod and the guide support. Gaging bracket 156 attached to the face of the lower cam cover supports angled arm 157, through one end of which passes the upper end of the gaging rod; the angled arm is pivotally mounted on the bracket by pin 158, and its shorter end rests against the back of the guide support. Spring 159 recessed in the face of the lower cam cover and in the back of the angled arm biases the gaging rod into contact with stop pin 56 on the main supporting arm.

Yarn paths 161 and 162 diverge about the portion of the separator rod perpendicular to the view and, although convergent below the rod, are still spaced from one another at passage through the slot of the traverse guide. Path 161 contacts the surface of the top package slightly before path 162, and both pass between the nip of the top package and the drive roll, whereupon path 162 continues about the drive roll to pass between the nip of the drive roll and the lower package (not shown in this view).

Operation of this apparatus is readily understood. When both bobbins at winding position become full, as shown in Figures 3 and 4, the two yarns are broken and withdrawn just below the separator rod by an operator using an aspirating device or "sucker gun" which maintains them under tension, usually sending the oncoming yarn to waste during the doffing interval. The swing arm is depressed manually until the roller catches in the hollow in the cam plate, and the main supporting arm is withdrawn manually along the glide rods until the latch engages to hold it. Then an additional pull upon the handle of the supporting arm depresses the piston at the end of the arm and tips the entire arm assembly backward to rest against the doffing stop with the packages completely free of the drive roll and held apart from one another. A slight squeeze on each brake handle stops the package rotation. The full packages then are unchucked and replaced by empty bobbins.

The apparatus is now ready to begin a new winding cycle. The main supporting arm is lifted to the upright position in which it is held by engagement with the depressible piston and the swing arm is lifted to release the cam roller. The latch is released to allow the entire assembly to slide completely forward, at which stage the bobbins occupy the positions (against the drive roll) shown in broken lines in Figure 3. The two yarn ends for this winding position still are being drawn off by the previously mentioned sucker gun, and it is most convenient to string them up in succession onto the empty bobbins. With a portable sucker gun, the operator picks up from the stationary gun the yarn intended for the lower bobbin, i.e., the one that passes on the far side (rear) of the separator rod; he withdraws the main supporting arm slightly and replaces it to permit the yarn to be introduced between the upper bobbin and the drive roll and, after so doing, inserts the end of the sucker gun into the end of the bottom bobbin, whereupon the yarn breaks and wraps around the bottom bobbin. Then the other yarn is picked up in like

manner by means of the sucker gun, whose end is inserted similarly into the end of the upper bobbin; this breaks the yarn and begins winding it about the upper bobbin as desired.

Of course, at the initial string-up, the yarns are separated about the separator rod and introduced in the slot of the traverse guide with the desired orientation as shown most clearly by the yarn paths in Figure 6. At all times, the traverse guide reciprocates along the package at a slight distance from the surface through movement of the attached cam follower in the slot of the rotating barrel cam. By conventional drive means, the cam barrel is rotated at varying speed so as to eliminate any patterning of the yarn laid on the surface of the package, which in its most objectionable form would produce a ribbon-like surface irregularity.

As the packages build-up in size, the supporting arm, which is on a slight incline, tends to rest more heavily against the drive roll. As the lower package increases in size, the spring connected to the presser arm is stretched considerably, increasing the force exerted against the swing arm and balancing the increasing weight of that package. It is actually desirable that the force between each package and the drive roll decrease slightly with increase in package size so as to avoid bulging of the side walls of the package. According to this invention, the desired result is accomplished by mounting the lower package undershot beneath the drive roll. During the winding, the axis of the bottom package passes forward and downward about the drive-roll axis with buildup in the size of the package; reaction between the lower package and the drive roll increasingly opposes the tendency of the entire assembly to slide down the glide rods, as the component of force between lower package and drive roll increases in a direction parallel to the glide rods. At the same time, the angle (above the horizontal) at which the top package rests against the drive roll, decreases somewhat and tends to reduce the force of the upper package normal to the drive roll.

As an example, in the winding of 150 denier yarn composed of cellulose acetate, the following relationships of contact pressures (force units) versus package diameter were obtained in the winding of an eight-pound package.

*Table*

| Package Diameter (Inches) | Contact Pressure (Oz.) | |
|---|---|---|
| | Upper Pkg. | Lower Pkg. |
| 4 (empty) | 26 | 18 |
| 5 | 24 | 20 |
| 5¾ | 22 | 22 |
| 6⅜ | 20 | 20 |
| 6⅞ | 17 | 21 |
| 7⅜ | 18 | 18 |
| 7⅞ | 18 | 19 |
| 8⅜ | 18 | 19 |
| 8⅞ | 18 | 19 |
| 9¼ | 18 | 16 |

Slightly higher pressures are desirable in the winding of yarns of lighter denier. This invention has proved its value in the winding of yarns as light as 50 denier and as heavy as 300 denier into packages weighing upwards of eight pounds at speeds as high as 600 yards per minute. The physical properties and other quality characteristics of yarn so wound are comparable in all respects to those similar yarns wound up on equipment previously obtainable.

The straight-walled ribbonless packages obtained by the practice of this invention represent a notable improvement over the results of earlier methods. This benefit is attributable primarily to the substantial constancy of clearance (at a practicable minimum) between the traverse guide and the surface of the top package, which ensures constant maximum conversion of traverse stroke to package width throughout the entire package formation by keeping to a practical minimum the length of yarn between traverse guide and upper cake.

The continuity of winding is improved according to this invention by laying the yarn for the upper package onto the package surface before the yarn for the lower package contacts the surface. This avoids the trapping of the second yarn, which has been a problem in previous tandem winding methods. The several advantages operating in the described manner are cumulative in their effect, and the full benefit of such operation will become strikingly apparent to one who undertakes to practice the present invention.

The claimed invention:

1. Process of forming a plurality of yarns into a like plurality of packages, comprising leading a pair of yarns downward toward a tandem winding position, in which two windup packages are driven at upper and lower locations by contact with a rotating drive roll; separating the yarns to space them apart in a direction transverse to the roll axis; traversing the yarns simultaneously at substantially constant clearance from the surface of the upper package; contacting the surface of the first package with both yarns, one slightly before the other; passing the yarns between the nip of the upper package and the drive roll; winding the first yarn about and onto the upper package; passing the second yarn about the drive roll and between the nip of the lower package and the drive roll; and winding the second yarn about and onto the lower package.

2. Process comprising surface-driving two cylindrical yarn-receiving packages located at different levels with their respective ends substantially aligned and their curved outer surfaces in contact with the corresponding surface of a rotating drive roll, traversing two yarns simultaneously along the upper package, bringing the yarns one after the other into superimposed non-slipping contact with the package surface, passing both yarns through the nip of the drive roll and the upper package, winding about and onto the upper package the first yarn to contact the package, passing the other yarn on about the drive roll and through the nip of the drive roll and the lower package, and winding that other yarn about and onto the lower package.

3. Apparatus for winding yarn into packages, comprising a drive roll rotatably mounted on a fixed axis, a supporting arm reciprocably mounted with respect to the roll axis, a first spindle rotatably mounted on the arm at a level above the roll axis and adapted to support a yarn-receiving bobbin in driving contact with the roll at one extreme of reciprocation of the supporting arm, a swing arm pivotally mounted on the supporting arm at a level below the roll axis, a spindle rotatably mounted on the swing arm and adapted to support a yarn-receiving bobbin, and means for urging the swing arm about the pivot point to bring the bobbin carried thereby upward into driving contact with the roll.

4. The apparatus of claim 3 plus means for traversing the yarn immediately before contact with the surface of a package formed by yarn wound onto the first yarn-receiving bobbin and nearby separator means located before the traversing means and adapted to space two yarns apart from one another to ensure that one contacts the surface of the yarn package before the other.

5. The apparatus of claim 3 plus traverse means including a traversing element located at a constant distance from the roll axis, a fixed support for the traversing element, a yarn guide mounted pivotally on the traversing element, a gaging element mounted pivotally on the fixed support and adapted to contact the reciprocable supporting arm, and linkage between the yarn guide and the gaging element responsive to the buildup of yarn in a yarn package formed on the yarn-receiving bobbin and adapted to adjust the distance of the yarn guide from the

surface of the yarn package, whereby the traversing element is located at substantially constant distance from the package surface regardless of the amount of yarn on the bobbin.

6. Apparatus comprising a roll adapted to rotate yarn packages by surface-driving contact therewith, means for mounting the drive roll rotatably on a fixed axis, a reciprocable glide arm adapted to mount an upper bobbin-supporting spindle for rotation about an axis parallel to and above the drive-roll axis, a fixed base carrying means for mounting the glide arm for limited movement over a path in a plane perpendicular to the drive-roll axis, the mounting means being adapted to urge the glide arm to one end of the path near the drive-roll axis, a swing arm pivotally mounted on the glide arm and adapted to mount a lower bobbin-supporting spindle for rotation about an axis parallel to and below the drive-roll axis, spring means for urging the spindle-supporting end of the swing arm toward the drive roll, traverse means including a traversing element located at a constant distance from the drive-roll axis, a fixed support for the traversing element, a yarn guide mounted pivotally on the traversing element, a gaging element mounted pivotally on the fixed support and adapted to contact the reciprocable spindle-supporting glide arm, and linkage between the yarn guide and the gaging element responsive to the buildup of yarn in a yarn package formed on a yarn-receiving bobbin mounted on said upper bobbin-supporting spindle and adapted to adjust the distance of the yarn guide from the surface of the yarn package, whereby the traversing element is located at substantially constant distance from the package surface regardless of the amount of yarn on the bobbin, and nearby separator means located before the traversing means and adapted to space two yarns apart from one another to ensure that one contacts the surface of the yarn package before the other.

7. In a process of winding a pair of yarns into separate packages in tandem by common surface contact with a rotating drive roll, the improvement comprising spacing the pair of yarns apart and bringing the yarns one after the other into contact with the first package surface.

8. Apparatus for winding yarn into packages, comprising a drive roll rotatably mounted on a fixed axis, a supporting arm reciprocably mounted with respect to the roll axis, a first spindle rotatably mounted on the arm at a level above the roll axis and adapted to support a yarn-receiving bobbin in driving contact with the roll at one extreme of reciprocation of the supporting arm, a swing arm pivotally mounted on the supporting arm at a level below the roll axis, a spindle rotatably mounted on the swing arm and adapted to support a yarn-receiving bobbin, and means for urging the swing arm about the pivot point to bring the bobbin carried thereby upward into driving contact with the roll, means for traversing the yarn immediately before contact with the surface of a package formed by yarn wound onto the first yarn-receiving bobbin and nearby separator means adapted to space two yarns apart from one another to ensure that one contacts the surface of the yarn package before the other.

9. Apparatus for winding yarn into packages comprising a supporting arm reciprocably mounted with respect to the roll axis, a rotatably mounted drive roll, a supporting arm reciprocably mounted with respect to the roll axis, a spindle rotatably mounted on the arm at a level above the roll axis, a yarn receiving bobbin mounted on said spindle and in driving contact with the roll at one extreme of reciprocation of the supporting arm, traverse means including a traversing element located at a constant distance from the roll axis, a support for the traversing element, a yarn guide mounted pivotally on the traversing element, a gauge element mounted pivotally on the first support and adapted to contact the reciprocable supporting arm, and linkage between the yarn guide and the gaging element responsive to the build-up of yarn in a yarn package formed on the yarn-receiving bobbin and adapted to adjust the distance of the yarn guide from the surface of the yarn package, whereby the traversing element is located at substantially constant distance from the package surface regardless of the amount of yarn on the bobbin.

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