

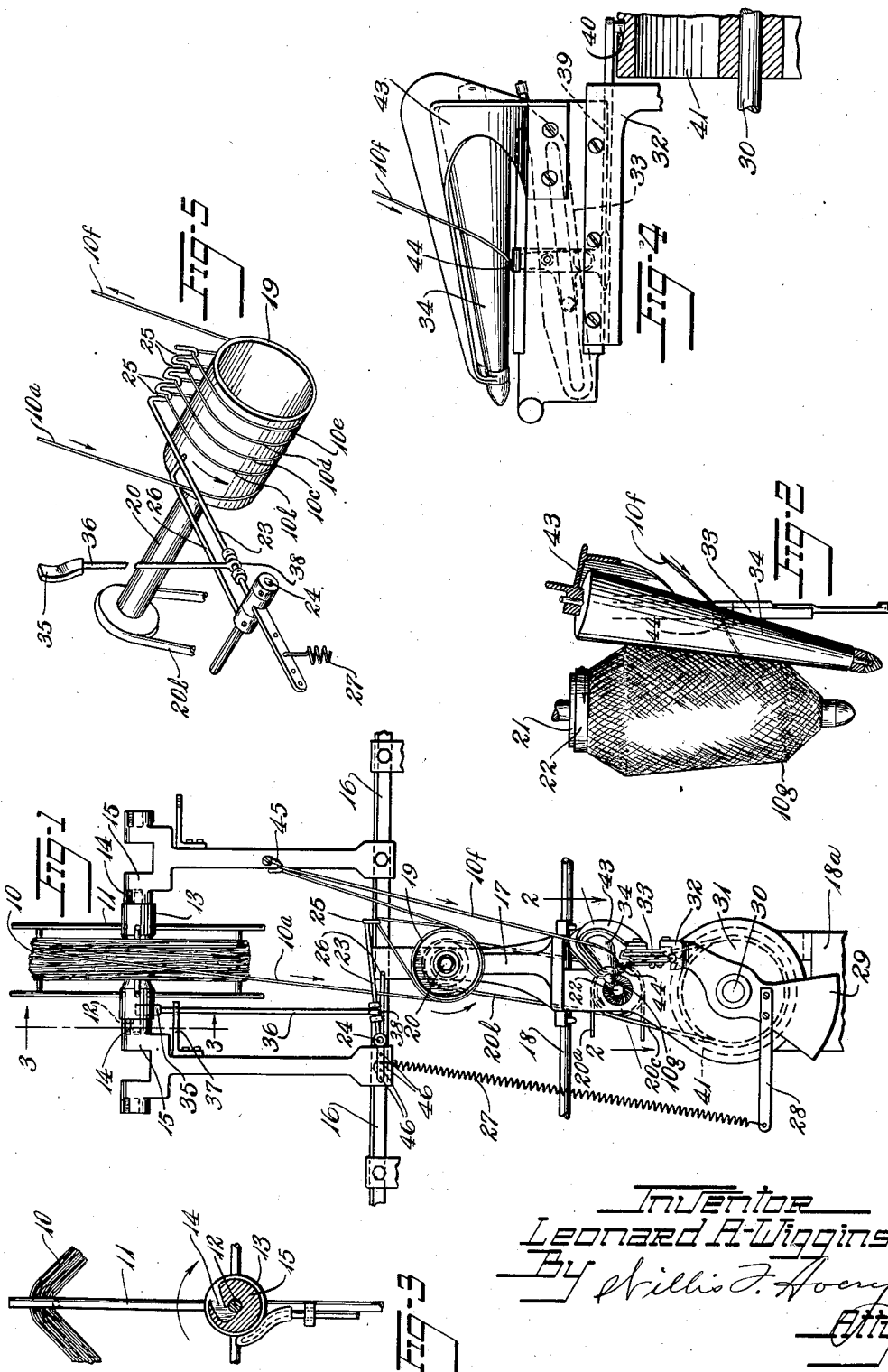
Jan. 6, 1942.

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2,269,299

WINDING APPARATUS

Filed Jan. 25, 1941



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UNITED STATES PATENT OFFICE

2,269,299

WINDING APPARATUS

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Application January 25, 1941, Serial No. 375,959

15 Claims. (Cl. 242—45)

This invention relates to the winding of thread, yarn, etc., and especially to apparatus for the winding of elastic yarn into packages.

Heretofore, attempts to provide means for winding elastic yarn into conical packages for shipping and further handling have presented the difficulty, among others, that the elastic yarn has been subjected to considerable tension in being pulled from a skein which has frequently resulted in an objectionable stretched disposition of the elastic yarn in a package of the same as subsequently wound. This undesirable stressing of the yarn has sometimes resulted in loss of stretchability and loss of strength in the yarn. Not only has the elastic yarn been undesirably stretched as wound, but a further objection has been that frequently the degree of stretch of the yarn in a package has varied irregularly throughout the package which has often resulted in undesirable erratic movements of the yarn as the package has been unwound for weaving or other subsequent operations.

The chief objects of the invention are to provide for winding yarn or the like in a manner to control the amount of tension in the wound material; to provide, in the case of elastic yarn, for winding it with little or no tension; to provide means adapted to wind elastic yarn into package form in a manner such that the stresses in the strands of yarn of the package are relatively small and uniformly distributed through the package; to provide for uniformity of winding; to provide compactness in the package, and to provide for economy and convenience of manufacture and operation.

These and further objects will be apparent from the following description, reference being had to the accompanying drawing in which:

Fig. 1 is a front elevation of apparatus, constructed in accordance with and embodying the invention, in its preferred form.

Fig. 2 is a section on an enlarged scale taken along the line 2—2 of Fig. 1.

Fig. 3 is a section on an enlarged scale taken along the line 3—3 of Fig. 1.

Fig. 4 is a side elevation on an enlarged scale showing details of construction of a portion of the apparatus.

Fig. 5 is a perspective view on an enlarged scale showing details of construction of a portion of the apparatus.

Apparatus constructed in accordance with the invention is shown in Fig. 1 of the drawing in assembly. The apparatus is adapted to pull elastic yarn from a skein or the like, or in some

cases directly from a spinning machine, if desired, and wind the yarn on a core under conditions of relatively slight and substantially uniform tension, or substantially no tension.

A skein 10 of elastic yarn, or other stretchable material is mounted on a swift 11 which is mounted as shown in Fig. 3 on a shaft 12 of a swift hub 13 held rotatably in slots 14, 14 of a pair of swift-supporting arms 15, 15. The arms 15, 15 are mounted on a supporting rod 16 which is supported by an upright bracket 17 mounted on one or more tie-rods 18, all supported upon a suitable framework of which a portion of a mounting pedestal 18a is shown in Fig. 1.

A pull-off roll 19, of metal or other suitable material adapted to provide a smooth, wear-resistant surface, is mounted on a shaft 20 supported by the bracket 17. The roll 19 is disposed in a position such that the elastic yarn to be wound may be disposed in looped relation about the same in at least one loop, but preferably a plurality of loops, for example, four as shown in Fig. 5. When the pull-off roll 19 is rotated, the elastic yarn looped thereabout is pulled from the skein 10 under tension and the yarn ordinarily is stretched in this operation.

A spindle 21, as shown in Fig. 2, upon which a core 22 may be mounted to receive the yarn, is rotated by suitable driving means 20a and the pull-off roll 19 is preferably rotated in synchronism therewith by means of an interconnected drive 20b and at a speed greater than the speed of the spindle 21. The cumulative effect of the friction between the loops 10b, 10c, 10d, and 10e and the surface of the pull-off roll 19 pulls the yarn from the skein 10 and the loops from 10b to 10e exert progressively less pull as the relatively smooth surface of the roll allows slippage of the yarn thereon as the tension is relaxed so that the last loop 10e, and preceeding loops 10d, 10c, 10b to a progressively lesser degree are, in effect, pushed around the roll and therefrom and are subjected only to the relatively slight tension in the reach 10f of the yarn provided by the more slowly rotated spindle 21.

An arm member 23, pivoted at the pin 24, incorporates a series of spaced-apart yarn guides 25, 25 at one end thereof which may be bent from the wire or rod material of the arm member 23 as shown. Alternatively, the arm member may be of heavier construction than the wire shown in the drawing and the yarn guides may be in the form of a roller, slots, eyelets, or other suitable guiding means. The guides 25, 25 are

adapted to retain loops 10b, 10c, 10d, 10e of the yarn at spaced-apart positions without interference, the number of guides provided being in accordance with the number of loops desired. A finger-like member 26, fixed to the pin 24, may be desirable to further guide the elastic yarn onto the pull-off roll 19 and to prevent the arm member 23 from being pulled into contact with the pull-off roll 19.

Movement of the pivoted arm member 23 is controlled by a spring 27, or other suitable resilient member, connected to the arm member 23 in a manner such as to urge the yarn guides 25, 25 of the arm member 23 in a direction away from the pull-off roll 19. The spring 27 is attached at its other end by means of a spring arm 28 to a counterweight 29 pivotally mounted on a shaft 30 supported by a cam casing 31. A bracket 32 adapted to hold slidably a traverse mechanism 33 and a pressure roll 34, more fully described hereinafter, is constructed integral with the pivoted counterweight 29.

A braking member 35 is operatively connected with the pivoted arm member 23 by means of a brake arm 36 the movement of which is defined by a guiding bracket 37 and a movable connection 38 with the arm member 23. The braking member 35 may comprise a piece of rubber-like material, fabric, etc., secured to the brake arm 36 and adapted to engage the swift hub 13 in braking contact.

The pivoted arm member 23 and the brake member 35 provide compensating means for changes in tension in the yarn. An increase in the resistance of the yarn to being pulled from the skein 10 will result in an increase in the tension in the reach 10a of the yarn and this increased tension tends to pull the pivoted arm member 23 into closer relation to the pull-off roll 19, thereby increasing the length of yarn in contact with the roll and increasing the friction therebetween in a manner such that a greater amount of pull is applied to the yarn to overcome the increased resistance while simultaneously the braking member 35 is removed a relatively slight distance from the swift hub 13 and the braking action on the swift 11 is reduced, thereby directly reducing the resistance of the swift 11 and skein 10 to rotation, and consequently reducing the resistance of the yarn to being pulled from the skein 10.

Also, if the resistance of the yarn in the skein 10 to pulling is reduced, or if the speed of rotation of the swift 11 increases undesirably, the reduction in tension in the yarn coming off the skein 10 permits movement of the spring-controlled, pivoted arm member 23 to a position relatively farther away from the roll 19 so that the amount of pull exerted on the yarn, which is in this case excessive, is reduced by reducing the length of yarn in contact with the roll 19 and at the same time the braking member 35 is moved into closer braking contact with the swift hub 13 and the speed of rotation of the hub 13 is reduced.

The compensating means, provided by the spring-controlled, pivoted arm member 23 and the braking member 35 operatively connected therewith, is desirable, because as a package 10g of yarn is wound, the diameter is increased so that the speed of the surface of the package 10g is increased. An increase in the speed of the reach 10f of the yarn being wound increases objectionably the tension in the yarn and conse-

quently the amount of stretch in the yarn as wound 10g is increased objectionably.

The compensating means provide that when the traverse mechanism 33 is moved in a path away from the spindle as the diameter of the package 10g increases, the spring arm 28 moves in a manner such that the tension in the spring 27 is slowly released and the pivoted arm member 23 is allowed to rotate at a relatively slow and substantially uniform rate about the pin 24 so that the guides 25, 25 of the arm 23 move toward the roll 19 increasing the length of yarn contacting the roll 19 and the amount of friction therebetween and consequently the pull on the yarn is increased while the brake member 35 is gradually pulled away from the swift hub 13 so that the braking action on the swift 11 is slowly decreased and the speed of rotation of the swift 11 is increased to compensate for the increased speed of the portion of the yarn being wound and to maintain the tension therein at a relatively small value.

The traverse mechanism 33 is operated through a slide 39 and a roller 40 of a cam 41 mounted on a shaft 30, as indicated in Fig. 4.

The pressure roll 34, as mentioned hereinabove, is preferably of conical shape so that its surface may contact uniformly the preferred conical package form 10g as shown in Fig. 2 of the drawing. The pressure roll 34 is preferably constructed of metal, plastic or other suitable material adapted to provide a smooth, wear-resistant surface. The pressure roll 34 may be rotatably mounted in a frame member 43 adapted to be bolted or otherwise suitably fastened to the traverse mechanism 33 so that the pressure roll 34 is continually in contact with the surface of the package of yarn as it is wound, and being operatively connected with the traverse mechanism 33, positions a yarn guiding eyelet 44 of the traverse mechanism 33 at a substantially constant, spaced distance from the surface of the yarn package 10g for all diameters of the package 10g, thereby increasing the uniformity and neatness of the package 10g, as wound.

The pressure roll 34 may be mounted in any other suitable manner adapted to position it in contact with the surface of the package 10g, but it is desirable that the pressure roll 34 be held, as by the force of the counterweight 29, lightly but firmly against the surface of the yarn package 10g as shown in Fig. 2 and that the yarn passes around a part circumference of the pressure roll 34 and through the slidably mounted guiding eyelet 44 onto the package 10g where it is urged into place on the package 10g by the contacting pressure roll 34 under the desired amount of tension, which amount is relatively very slight, in most cases. The pressure roll 34 is rotated by the yarn passing thereover and by contact with the package 10g. The conical pressure roll 34 is desirably positioned so that the axes of the roll 34 and the preferred conical package form intersect to further ensure a uniformly wound package.

The amount of the circumference of the pressure roll 34 about which the yarn may pass is in part determined by a pigtail guide 45 through which the yarn travels. The pigtail guide 45 may be mounted in any suitable manner, as for example, on a swift arm 15, as shown in Fig. 1, and positioned in relation to the pull-off roll 19 and the pressure roll 34 as desired, but preferably in a manner approximating the position as

shown, in order that the yarn may travel substantially free from possible interference with working parts and other obstructions.

In the operation of the apparatus of the invention, a skein 10 of elastic yarn, rubber thread, or other resilient filamentary material to be packaged is mounted on a swift 11 and the free end of the yarn, thread etc. is looped about the pull-off roll 19 and yarn guides 25, 25 the desired number of times. From the pull-off roll 19 the yarn is passed over one or more pigtail guides, as 45, from the pigtail guide 45 about a part circumference of the pressure roll 34, through the guiding eyelet 44 of the traverse mechanism 33 and is attached to a package core 22 mounted on the spindle 21. The power driven pull-off roll 19 pulls the yarn from the skein 10, reduces or eliminates objectionable stretch in the yarn and delivers it under conditions of only slight tension to the conical package core 22 through the guide button 44 of the traverse mechanism.

The pressure roll 34 presses lightly but firmly against the surface of the package 10g and rolls down the coned yarn to provide a neatly wound yarn package 10g, the strands of which are under conditions of relatively slight and substantially uniform stress.

The braking member 35, operatively connected with the spring-controlled, pivoted arm member 23, is adapted to be moved by the varying pull of the loops of yarn 10b, 10c, 10d and 10e on the yarn guides 25, 25 in a manner such that the braking action on the swift 11 is changed as desired to compensate for changes in tension in the reach 10a of the yarn leaving the skein 10.

The pull-off roll 19, the spindle 21 and the cam 41 are preferably driven from a single source of power and in synchronism, as for example, by belts 20a, 20b and 20c, and the spindle 21 may be driven at any speed desired less than the speed of the pull-off roll 19. A spindle speed of approximately one-third that of the pull-off roll 19 has been found to be satisfactory in many cases.

The tension in the yarn may be adjusted, if desired, by varying the tension in the spring 27 which may be provided by a choice of spring connections, as the holes 46, 46 in the pivoted arm member 23 and by providing for mounting the bracket 17 in a manner to be slidably adjustable on the supporting rod 16 and the tie rod 18. Also, the number of loops of yarn, as 10b, 10c, 10d, 10e, about the pull-off roll may be used advantageously in providing the amount of tension desired in the yarn as wound 10g. The greater the number of loops employed, the less will be the tension in the yarn 10f leaving the pull-off roll 19. It is possible with the apparatus of the invention, by employing a sufficient number of loops, as 10b, 10c, 10d, 10e, of the yarn about the pull-off roll 19, to supply yarn at the delivery end for winding, as at 10f, under conditions of substantially no tension, if desired. The more extensive the frictional surface contact of the yarn on the pull-off roll 19, the greater will be the assurance that the tension of the yarn will be completely relaxed by contraction during its passage along the roll 19 before the yarn reaches the delivery reach 10f to the winding package.

The apparatus may be supported at the desired working height as by means of a suitable mounting pedestal 18a. The supporting rod 16 and the tie-rods 18 may be extended, the mounting pedestal 18a may be rigidly attached by means of cross-frame members to additional

pedestals and the swift arms 15 made dual, as they are shown in the drawing, so that similar units of the apparatus may be mounted in series for convenience of operation.

The apparatus as herein described is especially desirable for the winding of elastic yarn, elastic thread and other elastic filamentary materials, but features of the invention are advantageous also for the winding of yarn, thread, etc., of more limited stretchability or elasticity. The term "yarn," as herein employed, is intended to include cord, thread and the like, as well as materials more commonly referred to as yarn, including materials of low as well as high stretchability. Yarn of high stretchability, such for example as covered rubber thread, is referred to herein more specifically as "elastic yarn".

Variations may be made without departing from the scope of the invention as it is defined by the following claims.

I claim:

1. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means for pulling the yarn under tension from the let-off mechanism and having surface means comprising spaced-apart relatively movable elements disposed to engage the yarn for pulling the yarn under tension and releasing the tension by progressive contraction of the yarn to deliver the yarn at a reduced tension for the winding operation, means for driving the pulling means, and means interconnecting the let-off mechanism with said movable elements for control of the let-off mechanism in accordance with the condition of tension of the yarn at said pulling means.

2. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means for pulling the yarn under tension from the let-off mechanism, said last-named means including a series of spaced-apart surface portions disposed to engage the yarn successively in looped form, means for varying the distance between at least some of said surface portions to vary the loop size, and driving means associated with the pulling means for pulling the yarn under tension from said let-off mechanism and delivering the yarn at a reduced tension for the winding operation.

3. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means for pulling the yarn under tension from the let-off mechanism, said last-named means including a rotatable member intermediate the let-off mechanism and the winding means having a surface disposed to receive the yarn in a series of spaced-apart loops and to engage the same by extensive frictional surface contact for pulling the yarn from said let-off mechanism under tension and releasing the tension by progressive contraction of the yarn during such frictional surface contact to deliver the yarn at a reduced tension for the winding operation, means for driving said rotatable member, and means for varying the size of said loops to compensate for variations in tension of the yarn reaching said loops.

4. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off

mechanism and the winding means for pulling the yarn under tension from the let-off mechanism and delivering said yarn under reduced tension for the winding operation, and means associated with said let-off mechanism operatively connected with the winding means for controlling the rate of supply of yarn from said let-off mechanism in accordance with the rate of delivery of the same to said winding means to maintain substantially uniform tension in the yarn as it is wound.

5. Apparatus for winding yarn into package form, said apparatus comprising yarn let-off mechanism, means for pulling the yarn under tension from said let-off mechanism and delivering the yarn under reduced tension for the winding operation, means for winding the yarn into package form, and means for guiding the yarn onto the winding means, the guiding means comprising a member disposed to contact the surface of the package for positioning the guiding means to operate in determinate positional relation to the surface of the package.

6. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for pulling the yarn under tension from said let-off mechanism and delivering the yarn under reduced tension for the winding operation, means for winding the yarn into conical package form, means for guiding the yarn onto the winding means, the guiding means comprising a freely-rotatable, conical roller disposed to contact the surface of the package as it is wound for positioning the guiding means a substantially constant, spaced distance from said surface as the package is wound.

7. Apparatus as described in claim 6, in which said conical roller is mounted in such relation to the conical package that the axes thereof intersect each other.

8. Apparatus for winding yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off mechanism and the winding means for pulling the yarn under tension from the let-off mechanism and delivering the yarn under reduced tension for the winding operation and comprising a member including yarn guides disposed to receive the yarn in looped form, said member being movable to shorten the looped portion and having means for yieldably resisting such movement to vary the looped portion in accordance with variations in tension in the yarn as it is pulled from the let-off mechanism for compensating for such variations in tension to deliver the yarn under substantially uniform tension for the winding operation.

9. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off mechanism and the winding means for pulling the yarn under tension from the let-off mechanism and delivering said yarn under reduced tension for the winding operation, means for compensating variations in tension in the yarn, the compensating means comprising a member which includes a series of spaced-apart yarn guides disposed to receive the yarn therein and mounted for movement by yarn pressure in accordance with said variations in tension, and means operatively connected with said member for controlling the rate of supply of yarn from the let-

off mechanism in accordance with the variations in tension to deliver the yarn at substantially uniform tension.

10. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off mechanism and the winding means for pulling the yarn under tension from the let-off mechanism and delivering said yarn under reduced tension for the winding operation, said last-named means including a rotatable member having a surface disposed to receive the yarn in a series of spaced-apart loops and to engage the same by extensive frictional surface contact for pulling the yarn from said let-off mechanism under tension and releasing the tension by progressive contraction of the yarn during such frictional surface contact to deliver the yarn at a reduced tension for the winding operation, means for driving said rotatable member, means for compensating variations in tension in the yarn, the compensating means comprising a member which includes a series of spaced-apart yarn guides disposed to receive the yarn therein, and is movable in accordance with said variations in tension, and means operatively connected with said member for controlling the rate of supply of yarn from the let-off mechanism in accordance with the variations in tension to deliver the yarn substantially free of such variations.

11. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off mechanism and the winding means for pulling the yarn under tension from the let-off mechanism and delivering said yarn under reduced tension for the winding operation, said last-named means including a series of spaced-apart surface portions disposed to engage the yarn successively and driving means for pulling the yarn under tension from said let-off mechanism and delivering the yarn at a reduced tension for the winding operation, means for guiding the yarn onto the winding means, the guiding means comprising a member disposed to contact the surface of the package for positioning the guiding means to operate in determinate positional relation to the surface of the package, means associated with said let-off mechanism operatively connected with the winding means for controlling the rate of supply of yarn from said let-off mechanism in accordance with the rate of delivery of the same to said winding means to maintain substantially uniform tension in the yarn as it is wound, and means comprising a member including yarn guides disposed to receive the yarn, and movable in accordance with variations in tension in the yarn as it is pulled from the let-off mechanism for compensating for such variations in tension to deliver the yarn under substantially uniform tension for the winding operation.

12. Apparatus for winding elastic yarn into conical package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into conical package form, means intermediate the let-off mechanism and the winding means for pulling the yarn under tension from the let-off mechanism and delivering said yarn under reduced tension for the winding operation, said last-named means including a rotatable member having a surface disposed to receive the yarn in a series of spaced-apart loops and to

engage the same by extensive frictional surface contact for pulling the yarn from said let-off mechanism under tension and releasing the tension by progressive contraction of the yarn during such frictional surface contact to deliver the yarn at a reduced tension for the winding operation, means for driving said rotatable member, means for guiding the yarn onto said winding means, the guiding means comprising a freely-rotatable, conical roller disposed to contact the surface of the conical package as it is wound for positioning the guiding means a substantially constant spaced distance from said surface as the package is wound, said conical roller being mounted in such relation to the conical package that the axes thereof intersect each other, means associated with said let-off mechanism and operatively connected with the winding means for controlling the rate of supply of yarn from said let-off mechanism in accordance with the rate of delivery of the same to said winding means to maintain substantially uniform tension in the yarn as it is wound, and means for compensating for variations in tension in the yarn, the compensating means comprising a member which includes a series of spaced-apart yarn guides disposed to receive the yarn therein, said member being movable in accordance with said variations in tension to deliver the yarn substantially free of such variations.

13. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off mechanism and the winding means for pulling the yarn from the let-off mechanism and delivering the yarn for the winding operation, means for guiding the yarn onto the winding

means, the guiding means comprising a member movable in accordance with the build-up of the package, means at the pulling means for varying the tension of the yarn, and means connecting the tension-varying means with said movable member of the guiding means for controlling tension of the yarn at the pulling means to deliver yarn to the package at substantially uniform tension during the build-up of the yarn on the package.

14. Apparatus as defined in claim 13 in which the means connecting the tension-varying means with said movable member of the guiding means comprises a spring under tension.

15. Apparatus for winding elastic yarn into package form, said apparatus comprising yarn let-off mechanism, means for winding the yarn into package form, means intermediate the let-off mechanism and the winding means for pulling the yarn from the let-off mechanism and delivering the yarn for the winding operation, means for guiding the yarn onto the winding means, the guiding means comprising a member movable in accordance with the build-up of the package, said pulling means comprising a drum and an element spaced therefrom for engagement of the yarn in looped form about the drum and element, said element being movable with respect to the drum to vary the extent of surface contact of the yarn upon said drum, and means connecting said movable member of the guiding means and the movable element of said pulling means for varying the extent of surface contact of the yarn upon said drum in accordance with the build-up of said package to deliver yarn to the package at substantially uniform tension.

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