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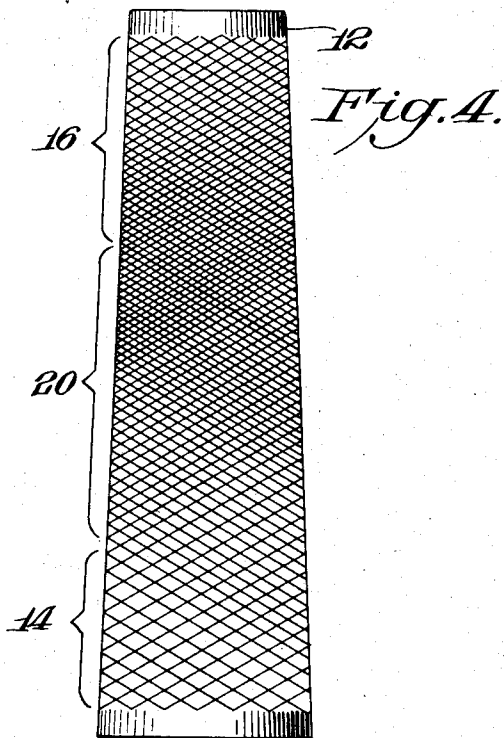
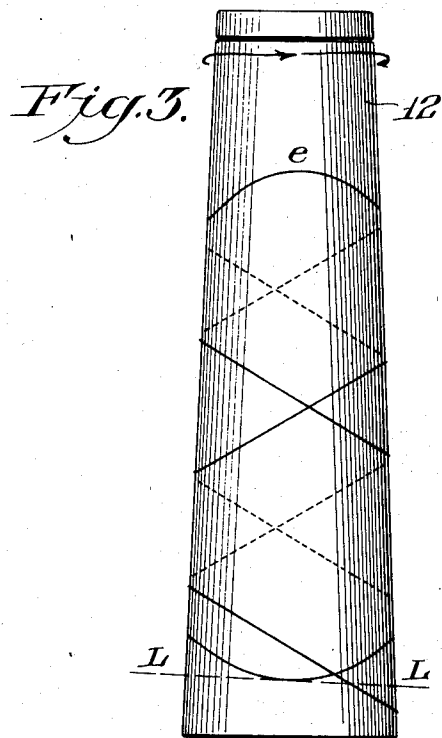
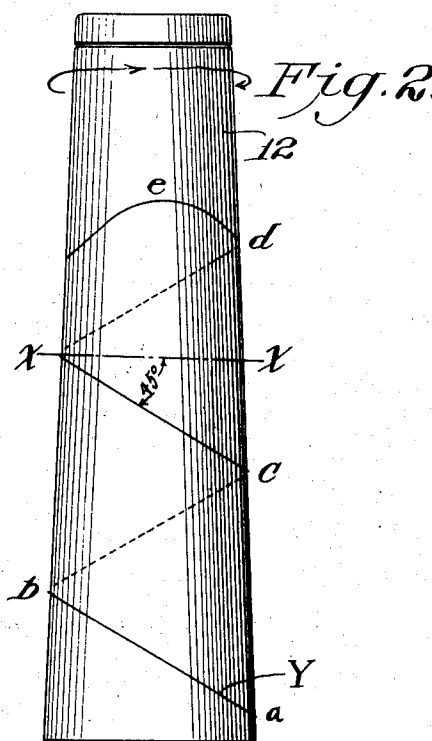
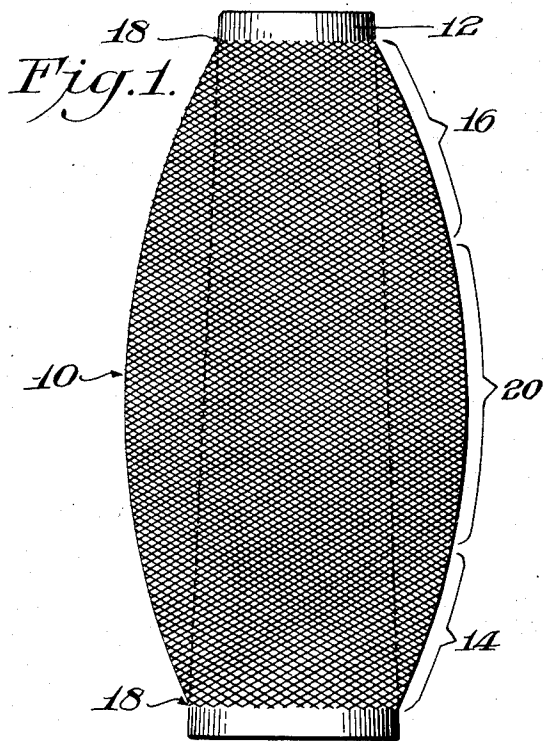
W. A. SEEM ET AL

2,301,713

YARN PACKAGE AND METHOD OF WINDING SAME

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2 Sheets-Sheet 1



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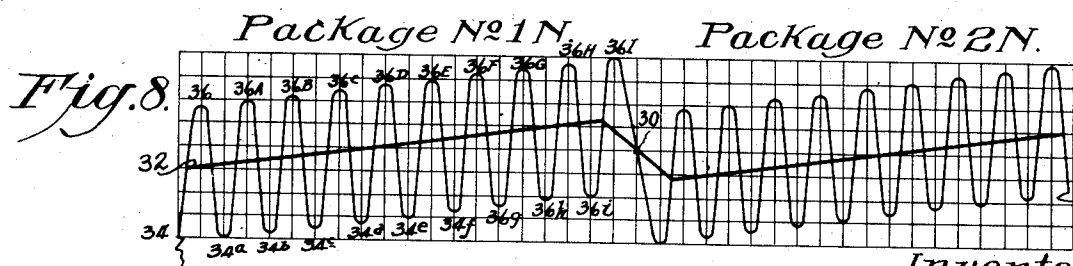
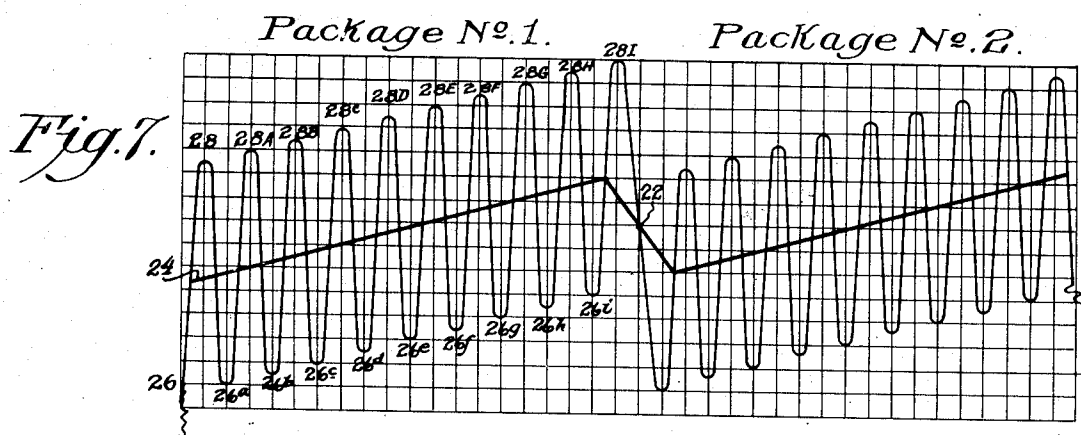
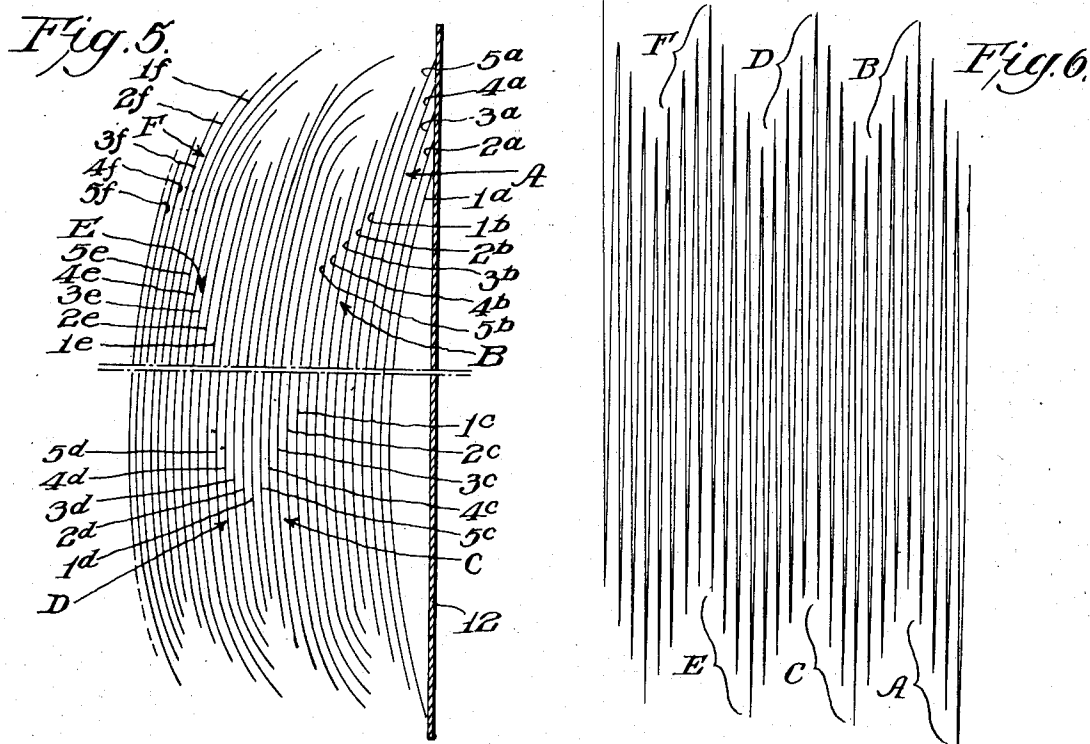
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YARN PACKAGE AND METHOD OF WINDING SAME

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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YARN PACKAGE AND METHOD OF WINDING
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Application January 4, 1940, Serial No. 312,348

12 Claims. (Cl. 242-159)

The present invention generally relates to yarn or strand material packages, and the method of winding the same, this application being a continuation in part of our co-pending application Serial Number 266,347, filed April 6, 1939. The invention pertains, more particularly, to taper end headless packages containing strand material, which is to be wound so that it will deliver more freely and evenly in unwinding it over the end with a more uniform tension and with less liability of the yarn being strained or broken.

The invention is moreover characterized in the provision of a delivery package constructed of a plurality of groups of wound yarn layers, the layers in every other group progressing toward the apex or delivery end of the package, and the layers of every intermediate group progressing toward the base of the package, whereby the layers of one group overlap the layers of the preceding group, and thereby mutually act to protect each other against sloughing and shifting, such sloughing and shifting being further prevented by providing the ends of the package with a 22.5 degree, or less, slope.

It is also an important object of the invention to produce a delivery package wound so that convolutions of yarn are so spaced in relation to the preceding layers that the normal tendency of the wraps to slough off in unravelling is eliminated.

To accomplish this, we have discovered that with the exception of the extreme ends of the yarn package, each yarn layer must be wound progressively and in such a manner that the start of each layer is spaced not more than four times the diameter of the yarn being wound from the start of each preceding layer. For example, in winding on a machine of the type shown and described in our co-pending application aforesaid a yarn measuring .005 inch in diameter, the auxiliary traverse stroke moves the main traverse stroke in timed relation so that the start of each main traverse stroke is .02 inch from the start of each preceding traverse stroke, and the yarn is wound accordingly.

Another important feature of the invention resides in spacing the progressively wound yarn layers substantially further apart at the extreme ends of the yarn package than in all but these portions of the package, so as to minimize piling of the yarn at the extreme ends of each auxiliary traverse stroke, thereby obtaining a yarn package with the taper ends sloping to a feather edge. The yarn package comprising this feather edge cannot slough off and minimizes any obstruction

in the form of piled yarn, to free delivery of the yarn from the base. This is particularly important when the yarn is intermittently unwound from the package, since the yarn often drops below the base of the yarn package when unwinding is interrupted, and when unwinding is resumed, the yarn will tend to catch on any obstruction, especially near the base of said package. This feather edge makes possible the attainment of a package of maximum diameter before the critical angle of 22.5 degrees is reached at the tapered ends, thus minimizing sloughing.

A further feature of the invention resides in the winding of the convolutions of yarn so that the angle formed between the axis of the package and the convolutions of wound yarn does not exceed 45 degrees. We have discovered that a package wound in such a manner that the angle formed between the axis sloughing off when unwinding and due to handling is greatly reduced over a similar package wherein said angle is more than 45 degrees. We have also found that in the normal use of yarn packages frictional contact due to handling or shipping frequently dislodges convolutions of yarn from their normal position, thus requiring the removal of such distorted convolutions before starting the normal unwinding. We have discovered that when the angle hereinbefore mentioned is less than 45 degrees, fewer convolutions are distorted and far less convolutions must be removed before the package is put into its normal condition before unwinding.

Another feature of the invention resides in maintaining a ratio of not less than 1 to 1, nor greater than 5 to 1, between the main and auxiliary cams which respectively govern the length of the main traverse stroke and that of the auxiliary traverse stroke in winding a taper end headless yarn package upon a machine such as shown in our co-pending application aforesaid. Such a ratio insures proper positioning of the yarn layers. If a ratio greater than 5 to 1 is used, the critical angle is reached on a smaller diameter with the result that less yarn must be wound on the package. If a ratio of less than 1 to 1 is used, the yarn layers are so positioned that any convolutions distorted from any cause are very difficult to remove and it is difficult to remove them without distorting and disturbing other convolutions of yarn.

An important feature of the invention resides in the provision of a method whereby all knots are placed readily, and without loss of time, on the tapered portion at the delivery end of the package so as to prevent the yarn when unravel-

ling from coming into undue contact with the knots.

The detrimental effects of undue frictional contact between the unravelling thread and a knot are split filaments, elongation of the yarn, and breakage of the yarn. In the case of knitting, tight stitches and press-offs occur.

Another feature of the invention provides a method for winding or producing a package in such a manner so as to make possible the checking and/or correction of improper twist on either, or both sides of any knots, and the prevention of improper twist adjacent to any knots put into the yarn during the winding of said packages. Heretofore, when, in coning yarn, an end would break requiring the tying of a knot in the yarn, it was practically impossible to obtain uniform twist on both sides of the knot. Usually yarn already twisted is drawn from the cone and tied to untwisted yarn from delivery spools. It has been conclusively proven that, regardless of the skill of the operator, resumption of the movement of the thread cannot be accomplished without imparting improper twist to the thread on either or both sides of the knot. Lack of uniformity of twist at the knot detracts from the quality and appearance of woven or knitted fabric. Bad work thus caused manifests itself in the form of "shiners," hard twist, lack of strength, too great an affinity for dye in slack twist, and improper penetration in hard twist. Crepeing power of the yarn at this point is also impaired.

It is also a most important feature of the invention to provide a method of winding a yarn package whereby less tension and less tension variations occur than in the winding of a conventional package. It has been the practice for synthetic yarn producers when delivering yarn such as rayon in cone form to deliver same on a package containing up to three pounds of yarn. It is a known fact that yarn next to the paper container has been subjected to less tensile stress than the yarn from the outside of the package. The tension on the yarn is intermittent with the greatest tension applied at the ends of the package. This intermittent tension progressively increases as the package builds up, resulting in the greatest tension on the outside of the package. The reason for this intermittent and progressive tension is the acute angle formed by the thread and the thread guide, and at the guide immediately prior to said guide. These variable in tensions are greatest when the traverse is at the extreme ends of its movement. Another reason for this variation in tension is the increase in diameter of package which, in turn, increases the thread speed, thereby affecting the tension. The taper ends of a package built in accordance with this invention make possible a compensation for increased tension normally occurring at the extreme ends of conventional packages due to the increased friction between the thread and thread guides caused by the acute angles formed by the thread at the guide immediately prior to the thread guide. In the winding of a conventional package, these angles are not substantially different than those formed when winding the package constructed in accordance with this invention, but because of the tapered ends of the package constructed in accordance with the invention, the thread speed is reduced, thus compensating for increased tension which would otherwise occur. In the winding of a conventional package, the tension variations are intermittent. However, this intermittency increases

progressively so that the tension on the yarn nearest to the foundation core is substantially less than on the yarn furthest away from the core. In the winding of a package in accordance with the invention, the extremes in variation are less for the reasons given above, but the maximum and minimum tensions occur intermittently and there is no substantial difference in the degree of intermittency between the tension of yarn nearest the core of the package as compared to the tension on yarn from the outside of the package. The above is more fully described herein with reference to Figures 7 and 8.

Another feature of the invention resides in the method of producing a package so that the subsequent layers of yarn wound onto this package continually cover the entire surface; thus in the winding thereof, all exposed surfaces are continually renewed.

The exposed yarn layers on the package are kept in a condition corresponding to the temperature and humidity of the room. The effect of oxidation is not as noticeable in this type of package. The correction of this resides in the novel method of winding the package with overlapping layers of yarn and a continuous exposure of new yarn surfaces which counteract the effect of oxidation and aid in retaining a constant moisture content within the package. A further advantage of the progressive wind and structural features of the improved package makes possible uniform conditioning or setting of twist. If, for any reason, the yarn is oversteamed, over-conditioned, or brittle on the surface of the package, this can very readily be removed and need not affect more than the outside layers of the package. In conventional type cones the condition mentioned above would necessitate rewinding or wasting the yarn on said cones. The yarn wound on our improved delivery package can be more uniformly conditioned and, in unravelling from the package, is kept in equilibrium with the humidity of the room. Formation of mildew is prevented because the base of the package in position on the knitting machine cannot absorb an excessive amount of moisture; also because the yarn ends are further away from the water pan. The continual renewal of yarn surfaces when unravelling from our package eliminates the collection of dirt, dust, and other foreign matter and greatly reduces the possible detrimental effects of oxidation. Insects, such as buffalo beetles, do not get a chance to attack our improved package, because the yarn unravelling is continually moving over the entire surface of the package and renewing it by exposing subsequent layers. If an insect did set on the package, it would be brushed off by the unravelling yarn. Buffalo beetles have been known to attack the base of conventional cones and eat their way up through to the surface. These cones were completely ruined and had to be thrown out as silk waste. The advantage of our improved package in respect to the renewal of surfaces (hereinbefore mentioned) makes the package ideally suited to the full-fashioned knitting industry by preventing three carrier lines and other defects. Damaged ends on the outside of our improved package do not necessitate rewinding as with the conventional cones. The damaged layers are easily removed from the outside and the unravelling may be continued without interruption.

In delivering yarn overend from the conventional type of cone, it very often catches at the base. This is caused by underwinding, and usu-

ally breaks the thread before it can pull away and resume delivery. These underwinds do not occur on our improved delivery package, by virtue of the more gradual taper at the base. Even if the yarn does fall to the base, it can immediately resume delivery without any perceptible increase in tension.

In winding the conventional type cones with or without taper ends, the layers of yarn muss and shift very easily on soft cones and, to a lesser extent, on hard cones. This is caused by the reciprocating motion of the button guide in constant contact and pressure with the body of the yarn package. This makes it exceedingly difficult to produce a good soft cone. This condition is not possible on our improved package because the yarn guide is removed from the immediate surface of it and is substantially spaced therefrom. Another noticeable feature of our package is the absence of mussed winds when the natural convolutions of the yarn are disturbed in placing knots.

In order that the invention and its application may be understood by persons skilled in the art, we have in the accompanying drawings and in the detailed description based thereupon, set out a possible embodiment of the invention. In these drawings, wherein like characters of reference will designate corresponding parts throughout:

Figure 1 is a face elevation of a taper end headless delivery package, built in accordance with the present invention;

Figure 2 is a diagrammatic illustration of the initial convolutions of yarn wound about the foundation core during the forward movement of the main traverse stroke;

Figure 3 represents the second layer of yarn wound upon the foundation core during the return movement of the main traverse stroke;

Figure 4 illustrates the completed initial groups of one layer of yarn wound upon the foundation core;

Figure 5 diagrammatically illustrates, on an enlarged scale, the relation of the groups of yarn layers about the foundation core;

Figure 6 is a diagrammatic representation of traverse movements for winding the yarn in its successive overlapping groups of layers;

Figure 7 graphically illustrates the intermittent tension to which a yarn is subjected to in winding two conventional cone packages tied together;

Figure 8 graphically illustrates the intermittent tension to which a yarn is subjected to in winding packages in accordance with the present invention.

With more particular reference to the drawings, we have shown in Figure 1 a taper end delivery package 10 constructed in accordance with the present invention. The package 10 is wound preferably about a tubular supporting body 12, foundation core or support such as a paper tube or cone. This package has a tapering configuration at each end. The gradually increasing lower end portion 14 is known as the base; the gradually increasing upper end portion 14 is known as the apex or nose. The provision of feather edges 18 is a very important feature of our invention. The convolutions of yarn at these extreme ends are spaced slightly further apart than in any other part of the package. This causes the substantially uniform taper at each end to gently slope to a fine edge, always leaving just one convolution of yarn exposed at the extreme ends. This eliminates

5 piling of yarn at the points 18 when the guide traversing yarn onto the package "dwells" at the extreme ends of its stroke in reversing its motion. The characteristic shape and formation of the package is had because of the particular relation of the successive superposed layers of yarn in the manner to be described hereinafter.

In Figure 2, we have illustrated the initial convolutions of yarn wound about the foundation core 12 during the first forward movement of the yarn guide with the core 12 revolving in the direction indicated by the arrows. We have discovered that the angle must not exceed 45 degrees to produce the best results. This angle is subtended between the main axis X—X of the package and the yarn convolutions as indicated in said Figure 2. As shown in Figure 2, the axis X—X is transversal of the package, that is, it extends transversely of the length of the package. In winding yarn Y about the foundation core, a represents the starting point. The length of yarn Y between a and b represents one half convolution of yarn, whereas a, b, and c represent a full convolution or "wind." Following through from a to e, the yarn is wound about the core with about two and one-fourth convolutions or "winds" to one complete forward movement of the yarn guide. At e the traverse movement is reversed in Figure 3, and describes a path about the foundation core reciprocal to the movement described in Figure 2, but not quite reaching the point indicated vertically along L—L because of the auxiliary traverse action. Here it can be seen that the convolutions of yarn are progressively wound and stepped forward toward the apex or nose of the package, as illustrated in Figure 4, until the yarn has covered the winding surface of the core.

In Figure 4, is illustrated one complete group of layers detailing the confinement of yarn to the center 20 of the package. The yarn is mostly confined to the area at the center 20 because it is the most traversed section of the entire section.

Figures 5 and 6 illustrate the traverse movements. The yarn layers are assembled into overlapping groups A, B, C, D, E, and F, each group consisting of sets of layers, being respectively designated as 1a, 2a, 3a, 4a, 5a; 1b, 2b, 3b, 4b, 5b; 1c, 2c, 3c, 4c, 5c; 1d, 2d, 3d, 4d, 5d; 1e, 2e, 3e, 4e, 5e; and 1f, 2f, 3f, 4f, 5f. It is to be noted particularly that the layer sets in the spaced groups A, C, and E progress toward the nose of the package whereas the layer sets in the intermediate groups B, D, and F progress toward the base of the package. In this manner, it will be appreciated that the successive layer sets of one group overlap the successive layer sets of the preceding group, thereby covering, interlocking, and protecting the convolutions against sloughing. Of course, it is to be understood that the number of layers in each set, the number of sets in each group, and the number of groups in each package are much more numerous than represented in these figures, but the relation shown will be sufficient for clear understanding of the general construction of the package. The progressive overlapping of layer sets alternately toward the nose and base of the package are the essential features which impart the gradually increasing upper end portion and gradually reducing lower end portion, and the feather edges 18, as represented in Figure 1. With reference to Figure 5, the relative position of the superposed layers of yarn can be seen to be of substantially

the same length, but start and stop at different points along the foundation core.

Figure 7 graphically illustrates the intermittent tension to which a yarn is subjected to in the winding of conventional cone packages. The tension on yarn from two packages is represented in this graph, these being tied together at the knot 22. The heavy line 24 indicates the average tension for both packages. In winding yarn onto package No. 1, the point 26 represents the minimum tension of twelve grams taken at a point where the yarn is traversed on the package midway between the ends of said package. This tension is on the first layer of yarn nearest to the foundation core at the center of the package. As the traverse advances to the right, the tension is increased to fifteen grams at the extreme end of its movement at point 28; here the traverse reverses its motion to the left, and the tension is reduced to the point 26a at the center of the package; continuing its motion to the left, the tension is increased to the point 28a at the extreme end of its movement to the left. Again reversing its motion to the right, the tension is reduced to 26b upon reaching the center of the package. From the foregoing explanations and illustrations, it will be noted that the tension increases gradually in winding these packages until the last layer of yarn on the outside of the package is reached and the tension reaches its maximum at this point 28i. Here the yarn of maximum tension from the first package is tied at 22 to yarn of minimum tension from the second package, which depresses the average tension curve 24 from eighteen grams to thirteen grams. Fabric knitted or woven from such yarns will exhibit a marked contrast between the extremes in tension.

Figure 8 graphically illustrates the intermittent tension to which a yarn is subjected to in building our improved package. Yarn tension from two packages is represented in this graph, these being tied together at the knot 30. The heavy line 32 indicates the average tension for both packages. In the process of winding yarn onto package No. 1N, the point 34 represents the minimum tension of twelve grams taken at a point where the yarn is traversed on the package midway between the ends. This tension is on the first layer of yarn nearest to the foundation core at the center of the package. As the yarn is wound, guided by the traverse moving to the right, the tension is increased to thirteen grams at the extreme end of its movement at point 36. Here the traverse reverses its motion to the left, and the tension is reduced to the point 34a at the center of the package. Continuing its motion to the left, the tension is increased to the point 36a at the extreme end of its movement to the left. Again reversing its motion to the right, the tension is reduced to the point 34b upon reaching the center of the package.

Thus the tension variations in two layers of yarn, or two complete cycles of traverse motion is observed. It is to be understood that the number of complete cycles of tension variations are much more numerous than represented between the point 34 and the knot 30 of package No. 1N. The actual difference in tension between each cycle is hardly perceptible, but this cycle repeated a great number of times soon builds the package, and the final result of tension increase is quite noticeable when the extreme of tension

on the yarn from both packages are tied together and knitted or woven into fabric. Here it is to be noted that by comparison of the graph of Figure 8 with the graph of Figure 7, our improved package, as will appear from Figure 8, contains yarn wound with less tension variations, and the average tension line 32 is more constant throughout the package. Yarn of maximum tension of package No. 1N is tied to yarn of maximum tension of package No. 2N to indicate the slight degree of difference in average tension. Fabric knitted or woven from the yarn subjected to tension indicated in Figure 8 will not show much more contrast between these extremes in tension.

In concluding, it is to be understood that the particular wind, shape, and formation of the package herein illustrated and described is capable of certain modifications without departing from the gist of the invention. Accordingly, any modifications coming within the scope of the subjoined claims are to be considered within the spirit of the invention.

What we claim is:

1. A tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction, and the layers in every intermediate group progressing in the opposite direction, each layer in said groups having substantially the same length, but starting and ending at different points along the length of the package; the convolutions of the progressively wound yarn layers being spaced substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.
2. In the method of winding a tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction, and the layers in every intermediate group progressing in the opposite direction, each layer in said groups having substantially the same length, but starting and ending at different points along the length of the package; spacing the convolutions of the progressively wound yarn layers substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.
3. A tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction, and the layers in every intermediate group progressing in the opposite direction, each layer in said groups having substantially the same length, but starting and ending at different points along the length of the package; the convolutions of wound yarn forming an angle of not more than forty-five degrees with the transversal axis of the package, and being spaced substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.
4. In the method of winding a tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every

other group progressing in one direction, and the layers in every intermediate group progressing in the opposite direction, each layer in said groups having substantially the same length, but starting and ending at different points along the length of the package; forming the convolutions of wound yarn to extend on an angle of not more than 45 degrees with the transversal axis of the package, and spacing said convolutions substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.

5. In a yarn package wherein the yarn is intended to be ravelled over one end portion, successive layers of yarn wraps, the wraps in each layer being spaced further apart at the end portions of the package than in the intermediate portion thereof, and the wraps at said one end portion over which the yarn is to be ravelled being spaced closer to each other than the wraps at the other end portion.

6. A tapered end headless package consisting of a plurality of associated yarn layers progressively overlapping in controlled relationship in one direction, then in the other direction, to impart to said package tapered ends extending on a slant of not more than 22.5 degrees, the convolutions of the progressively wound yarn layers being spaced substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.

7. A tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction and the layers in every intermediate group progressing in the opposite direction, each layer in said groups having substantially the same length, but starting and ending at different points along the length of the package, the start of each of said layers being spaced not more than four times the diameter of the yarn being wound from the start of each preceding layer, the convolutions of the progressively wound yarn layers being spaced substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.

8. In the method of winding a tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction, and the layers in every intermediate group progressing in the opposite direction, each layer in said groups having substantially the same length, but starting and ending at different points along the length of the package; starting each of said layers at a point spaced not more than four times the diameter of the yarn being wound from the

start of the preceding layer; and spacing the convolutions of the progressively wound yarn layers substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.

9. A tapered end headless package consisting of a plurality of wound yarn layers, the convolutions of the wound yarn layers being spaced substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.

10. In the method of winding a tapered end headless package consisting of a plurality of wound yarn layers, the step of spacing the convolutions of the progressively wound layers substantially further apart at the extreme end portions of the yarn package than in the remaining portions of the package so as to minimize piling of the yarn at the extreme ends of the package, thereby obtaining a yarn package with the tapered ends sloping to a feather edge.

11. A tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction and the layers in every intermediate group progressing in the opposite direction, the convolutions of the wound yarn layers in each group being spaced further apart at the extreme end portions of the package than at the remaining portions thereof so as to minimize piling of the yarn at the extreme ends of the package, and each layer having substantially the same length but starting and ending at different points along the length of the package in approximately the following proportions: with a yarn measuring .005 in diameter, the start of each layer being spaced .02 inch from the start of the preceding layer.

12. In the method of winding a tapered end headless package consisting of a plurality of groups of wound yarn layers, the layers in every other group progressing in one direction and the layers in every intermediate group progressing in the opposite direction, each layer in said groups being substantially the same length but starting and ending at different points along the length of the package: the steps of spacing the convolutions of the wound yarn layers in each group further apart at the extreme end portions of the package than at the remaining portions thereof so as to minimize piling of the yarn at the extreme ends of the package, and starting each layer at a point spaced from the start of the preceding layer in approximately the following proportions: with a yarn measuring .005 in diameter starting each layer at a distance measuring .02" from the start of the preceding layer.

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