This invention relates to the winding of yarns, and is of particular importance with reference to the packaging of continuous filament yarns, especially continuously with their production. It is to be understood, however, that the invention is not limited to the application just mentioned.

The invention is particularly concerned with the packaging of yarn in the form of cops, i.e., packages of more or less elongated form having their ends tapered in opposite directions with or without an intermediate length of cylindrical form.

According to the invention, a cop or like package of novel characteristics is produced on a winding device provided with traverse mechanism having a stroke extending over a fractional part of the length of the package support combined with an additional traverse mechanism that superimposes a traverse of different frequency and carries the field of action of the primary traverse over the whole length of the support first in one direction and then in the other repeatedly. By reason of the additional traverse, a layer of yarn at one time in the winding cycle terminates at one end of the package, and later in the cycle terminates some little distance along the length of the package, and so on until the layer reaches the other end of the package, whereupon the procedure reverses until the layer once again reaches the first end of the package, and so on until a number of complete layers of yarn have been wound on the support. By reason of the shifting of the field of action of the main traverse, the ends of the package are wound tapered; the package also reaches its greatest diameter at its middle, because of the greater overlapping nearer the middle of the short layers produced at each stroke of the main traverse mechanism.

The package may have a cylindrical portion midway of its length, e.g. by the total length over which the yarn is traversed exceeding twice the length of the main traverse. If the main traverse approximates to half the length of the package, the package consists of two truncated cones placed base to base.

The building operation just described may be carried out in a simple winding operation performed on twisted or untwisted yarn, the duplex traversing motion being the result of relative motion between a package support and a yarn guide. The operation is, however, particularly advantageous when combined with the twisting of the yarn to be packaged, e.g., the ring-spinning of continuous filament yarn continuously with its production by the dry or evaporative method.

The one traverse motion may be applied to the package support and the other to the twisting device, or the combined motion may be applied to the package only or to the twisting device only. Thus, for example, in one form of apparatus according to the invention, the ring of a ring and traveller twisting device may be given the combined motion by means of a cam providing the traverse extending over a part of the length of the support, this cam being connected to a movable ring rail by a chain or the like passing over a sprocket or other means by which it is periodically lengthened and shortened under the control of a second cam. The rates of operation of the two traverse controlling devices are such as to impart the desired build to the package, and to provide that in each full traverse of the support only a relatively thin layer of yarn is wound onto the package.

The invention will now be described in greater detail with reference to the accompanying drawings in connection with a ring spinning apparatus employing a traversing ring rail.

Fig. 1 is a front elevation of the apparatus;
Fig. 2 is a vertical section taken on the line 2-2 of Fig. 1;
Fig. 3 shows graphically the traverse employed to build the package shown in Figs. 1 and 2;
Fig. 4 shows a further form of package built according to the invention; and
Fig. 5 is a graphic representation of the traverse employed in the package of Fig. 4.

Referring to Fig. 1, long small-flanged bobbins 1 are mounted on spindle mountings 2 carried by a fixed spindle rail 3, and are rotated by means of driving bands 41. A ring rail 4 is supported by lifter rods 5 passing through and guided by the spindle rail 3 so as to move parallel to the length of the bobbins 1. Two rows of bobbins 1 and corresponding rings are mounted in staggered relationship, as is clearly shown by Figs. 1 and 2.

A horizontal main traverse bar 6 is operated by a heart-shaped cam 7 through a lever 8. Chains 9 connected at one end by blocks 10 to the bar 6 pass round sprockets 11 rotatable on fixed pivots 12 and have their other end secured to the respective sprocket 11. Sprockets 13 rotate with the sprockets 11 and have secured to their periphery at 14 chains 15 that pass round sprockets 16 rotatable about fixed pivots 17 and are connected to the lower ends of the lifter rods 5. Chains 18 connected to the blocks 10 and passing over idle sprockets 19 are secured to weights 20 heavy enough to overcome the weight of the
lifter rods and ring rail together with static friction.

As the cam 7 rotates through half its motion it overcomes the weights 20 and by pulling the plunger 15 lifts the lifter rods to which the ring rail 4 is attached. During the remaining half rotation of the cam the chains 15 are released and the weights 20 bring about the lowering of the lifter rail, and so on alternately. The throw of the cam 7 traverses the lifter rods by an amount less than the length of the bobbins 1.

An auxiliary traverse bar 21 mounted below the bar 6 is operated by a heart-shaped cam 22 through a lever 23 against the pull of a weight 24 connected by a chain 25 passing over a sprocket 26 to a block 27 on the bar 21. Sprocket 28 carried by brackets 29 from the bar 21 receive the chains 15, idle pulleys 30 on fixed brackets 31 guiding the chains to and from the sprockets 28. Brackets 31 carrying the pulleys 30 and brackets 35 carrying the sprockets 13, 16 and 19 are mounted on rails 36, 37 secured to the machine frame 38.

As the cam 22 propels the bar 21 to the left, the sprockets 28 draw an increasing length of loop in the chains 15 between the idle pulleys 30, and therefore reduce the effective length of the chains 15 between the sprockets 13 and 16, so causing the chains 15 to raise the lifter rods 5 above the position to which they have been brought by the operation of the cam 7 acting through the main traverse bar 6. Similarly, while the auxiliary traverse bar 21 is moving to the right, its effect is to reduce the height at which the lifter rods stand under the action of the cam 7. In other words, the effective length of the flexible connection afforded by the chains 15 between the bar 6 and the rods 5 is alternately increased and decreased by the cam 22, with corresponding increase and decrease in the basic height of the rods 5 from which the traverse movement imposed by the cam 7 extends.

The cam 22 is driven by any suitable means at a lower rate of rotation than the cam 7, so that during one half rotation of the cam 7 the lifter rods 5 are raised by an amount equal to the throw of the cam 7 plus or minus the small amount that the cam 22 has thrown down during the same period. The effect of the two cams can easily be followed from Fig. 3. If both cams are moving the bars 6, 21 to the left, one half revolution of the cam 7 raises the rods 5 by an amount a equal to the throw of the cam 7, together with a lesser amount b due to the effect of the slower moving cam 22. In the next half revolution of the cam 7 the rods 5 are lowered by the amount a less the same amount b by which the cam 22 is trying to lift the rods 5. Therefore, after one complete revolution of the cam 7 the lifter rods have raised the ring rail 4 by an amount equal to 2b. This lifting continues until the full effect of the throw of the cam 22 is felt, by which time the two cams have raised the traverse from the bottom flange of the bobbin 1 to the top flange. The cam 22 then tends to lower the lifter rods 5 so that the traverse again falls short of the top flange of the bobbin, until it again reaches the bottom flange, to complete one winding cycle.

Yarn is thus applied to the bobbin by a series of relatively short traverses which in one revolution of the cam 22 move from the length of the bobbin adjacent to the bottom flange to the length adjacent to the top flange and back once more to the length adjacent to the bottom flange, with the result that approaching the middle of the bobbin from either flange a gradually increasing thickness of yarn is applied. The next revolution of the cam 22 causes a further complete layer of yarn to be applied to the bobbin, completely covering the first layer, as many such layers being wound as is necessary to fill the bobbin to capacity. The final shape of the yarn on the bobbin is indicated in Figs. 1 and 2, the two halves of the bobbin being substantially conical when the heart-cam 7 has a uniform rate of throw. Modifications in the shape of the package can be effected by modifying the shape of the cam.

If the length of the package does not approximately equal twice the throw of the cam 7, i.e., if the throw of the cam 22 is not roughly equal to that of the cam 7, the package is wound with a central cylindrical portion of length c equal to the difference in the throws of the two cams, as shown in Fig. 4, Fig. 5 showing the traversing of the yarn in this case.

The common shaft 42 serves for driving the cam 7 and the cam 22, a large pulley 43 on the shaft 42 driving a small pulley 45 on the shaft 45 of the cam 7 and a small pulley 46 on the shaft 42 driving a large pulley 47 on the shaft 47 of the cam 22. In this way the cam 22 is caused to rotate more slowly than the cam 7.

The packages shown in Figs. 1 and 2 are wound on flanged bobbins, and that in Fig. 4 is wound onto a plain tube. In either case, the yarn can readily be withdrawn by over-end unwinding.

The packages present the important advantage that since each is formed of a number of complete layers each passing from end to end of the package, it is possible to dress off damaged yarn from any part of the surface of the package so as quickly to expose undamaged yarn beneath. Again, the package support is not exposed during unwinding until the last half layer of yarn is reached on the support, when the support becomes progressively exposed by the unwinding of this last half layer. Consequently, if the support itself is rough or otherwise capable of hindering the unwinding of the yarn next to its surface or even damaging the yarn, this condition does not arise until the bulk of the yarn has been removed.

Further, the traversing mechanism described above permits winding of the package to be commenced at any point in the cycle of operations of the mechanism. Therefore, as in the case of the apparatus illustrated, where the two-fold traverse mechanism is used with a large number of twisting and winding devices, each of the devices may be independently operated as far as beginning and ending of each winding operation is concerned. The invention is therefore particularly suited for the winding of continuous filament yarn continuously with its production, especially by the dry or evaporative method, since it enables each twisting and winding unit to be operated independently, and therefore permits the twisting and winding of the continuously produced yarn to take place with the least possible delay between the completion of one package and the starting of another. Figs. 1 and 2 show the yarns 32 being fed to the packages 1 from feed-rollers 33 of the type used in the dry-spinning of cellulose acetate filaments, the yarns passing from the feed-rollers to the usual balloon guides 34.
The invention may be applied to the winding of cop-like packages of various sizes both as regards diameter and length. Using ring and traveller devices as shown in the drawings, cops of several pounds weight of twisted yarn may be produced. The invention is not, however, limited to the use of any particular form of twisting device. Thus, cap-spinning devices may also be employed.

Where continuous filaments are being wound, particularly where the principal traversing device is such as to impart a substantially parallel wind, it is important that the angle of the surface of the package to its axis should be sufficiently low (e.g. 10°) to impart stability and prevent sloughing off.

It may also be important in winding some yarns that the rate of operation of the one traversing device in relation to that of the other should be such that the two devices are out of phase, thereby avoiding turns of one layer of yarn coinciding with layers of a preceding turn. This out-of-phase working of the two cams and can readily be provided for by suitable selection of the rates of rotation of the cams.

Having described our invention, what we desire to secure by Letters Patent is:

1. Apparatus for winding cops and like packages, comprising means for rotating a package support, a traverse member movable lengthwise of the support, a flexible member connected to the traverse member, means including a traverse bar for alternately pulling and releasing the flexible connection so as to move the traverse member over a length less than the length of the support, and further means operating at a different frequency to increase and decrease alternately the effective length of the flexible connection so as to extend the field of action of the traverse member first towards one end of the support and then towards the other, said further means comprising an auxiliary traverse bar parallel to the first mentioned traverse bar and operatively connected thereto by means of said flexible member.

2. Apparatus for winding cops and like packages comprising means for rotating a package support, a traverse member movable lengthwise of the support, a flexible member connected to the traverse member, means including a horizontal traverse bar for alternately pulling and releasing the flexible connection so as to move the traverse member over a length less than the length of the support, and an auxiliary traverse bar parallel to and spaced from the first mentioned traverse bar and operatively connected thereto by said flexible member, a cam and lever adapted to operate the auxiliary traverse bar at a different frequency than the first mentioned traverse bar to increase and decrease alternately the effective length of the flexible connection to the traverse member so as to extend the field of action of the traverse member first towards one end of the support and then towards the other.

CHARLES WESLEY ADDY.
REGINALD HENRY JOHN RILEY.