This invention relates generally to winding cores such as are used in considerable quantities by textile mills for supporting or carrying yarn packages as a means of presenting the yarn for handling at or delivery through particular manufacturing operations, and the invention is concerned more specifically with a uniquely arranged winding core of this sort having exceptionally improved yarn delivery characteristics.

Such winding cores are extensively employed in conical form to provide a conically tapered yarn package from which the yarn delivery may take place from the small end of the core by withdrawal in the general direction of the core axis, and it is common practice to tie the trailing terminal yarn end of a package from which the delivery withdrawal is to start with the leading or starting yarn end of a reserve package so that "transfer" will occur upon exhaustion of the active package to continue delivery withdrawal from the reserve package without interruption. In order for such "transfer" to take place properly, however, the yarn withdrawal must continue delivery withdrawal from the reserve package without prior to the point of transfer, and there has heretofore been a persistent and troublesome difficulty characteristically encountered in this respect.

This difficulty results largely from the conflicting necessities of arranging the windings of a conical yarn package securely enough so that they will stay in place on the supporting core, while at the same time providing for withdrawal of these windings freely in the course of delivery. If the windings are not arranged securely enough, they will tend to slough during run-off so as to foul and cause the end being delivered to break before transfer can occur. On the other hand, if the windings are arranged too securely, there is danger of the delivery tension becoming so great at times as to break the end down ahead of transfer. Both of these conditions are rendered even more critical when the delivery must take place in an intermittent manner, as when the weft supply is fed from conical packages in certain types of looms.

According to the present invention, these opposing conditions are balanced compatibly by providing a conical winding core having a winding surface which is substantially relieved in a pattern that preserves adequate winding drum contact continuously about the circumference of the winding core, so that the winding operation by which a warn package is built on the core may proceed effectively in a normal manner while at the same time presenting a significantly modified winding surface which results in shortening appreciably the beginning wraps of a yarn package being built on the core (i.e., the wraps that are particularly subject to sloughing and fouling at run-off) in relation to the length that these wraps would assume if the winding surface were continuously conical, so that any given beginning wrap by reason of such shortening in effect be stretched in order to slip or slough on the core and induce fouling.

The result of a winding more arrangement such as the present invention provides is a very substantially improved yarn delivery performance that allows "transfer" to occur with excellent regularity. This winding core arrangement is also equally applicable for use in other types of winding cores having a winding surface formed by a surface of revolution of any sort, as will appear further from the more detailed description that follows in relation to the accompanying drawings, which illustrate a representative conical embodiment to the invention, and in which:

FIG. 1 is a side elevation illustrating more or less diagrammatically the arrangement of a conical winding core according to the present invention, and having the general path of the first two beginning wraps of a yarn package indicated thereon;

FIG. 2 is a transverse sectional detail taken substantially at the line 2--2 in FIG. 1, and illustrating more particularly the nature of the winding surface configuration employed according to the present invention; and

FIG. 3 is a further vertical section detail taken substantially at the line 3--3 in FIG. 2.

Referring now in detail to the drawings, FIG. 1 shows a conical winding core, as designated generally by the reference character 10, having circumferential grooves 12 and 14 formed adjacent each end for anchoring the end loops of the beginning yarn windings that result from the winding traverse reverses in placing the successive windings on the core 10. Below the lower end grooves 14, an additional groove 16 is provided to allow a transfer tail of adequate length to be wrapped thereat, and a securing notch 18 is located at the bottom edge of the core 10 in which the trailing end portion of the transfer tail may be lodged so as to be held against disarrangement while remaining readily accessible whenever a transfer tie is to be made with an associated reserve package.

Between the end grooves 12 and 14, the winding surface of the core 10 is configured predominantly with a pattern of substantially flattened portions 20 in the manner and for the purpose that have already been noted generally. In the arrangement shown, these flattened portions 20 are substantially rectangular in outline, and are arranged in a substantial checkerboard pattern predominantly throughout the winding surface.

Because the illustrated core 10 is conical, the flattened portions 20 are not truly rectangular, but have the corresponding tapered shape that results from arranging them vertically or lengthwise of the core 10 in substantially 60° sections of the winding surface. If the conical taper of core 10 were greater than is illustrated (3°—30°), then the flattened portions 20 would of course deviate in a proportionately further extent from a true rectangular form; and, if the winding surface had the form of any other surface of revolution, the flattened portions 20 would necessarily assume a corresponding shape in outline, being truly rectangular only when the core 10 was cylindrical. In any such instance, however, the flattened portions 20 would still retain in substance the same purpose and function as if they were truly rectangular, and are accordingly referred to as being substantially rectangular.

Alternatively, these flattened positions 20 might be shaped with other characteristic outlines for the purposes of the present invention. Thus, they might be circular, or diamond shaped, or have any other geometric form desired. The rectangular form is the simplest and most convenient to use, and allows the invention to be practiced to the best advantage under normal circumstances, so that it is employed in illustrating and describing the invention.

The substantial checkerboard pattern of the flattened portions 20 that is illustrated in the drawings provides an advantageous balance between the aggregate relief of the winding surface and the remaining portion thereof that is left undisturbed for winding drum contact. Adequate winding drum contact must, of course, be afforded continuously about the circumference of the core 10 in order to obtain satisfactory winding action. Also, any relief of the winding surface that results in subjecting the beginning wraps of a textile yarn package to unduly local-
ized pressure by the winding drum contact as they are being wound on the core 10 is highly objectionable, as a likely means of impressing weak spots in the yarn that tend to break readily during the run-off stage.

For both of the foregoing reasons, an entirely continuous winding surface is desirable from the standpoint of arrangement for winding drum contact alone. However, when the flattened portions 20 are arranged in the presently illustrated checkerboard pattern, somewhat more than 50% of the winding surface remains undisturbed for winding drum contact, which has proved fully adequate; and the checkerboard pattern can be readily arranged to avoid undesirably localized pressure points of the yarn by spacing the flattened portions 20 laterally in the manner illustrated, so that the winding drum pressure never bears at less than substantially 50% of the winding surface as it transfers between the staggered contact areas presented by the checkerboard pattern.

In the illustrated checkerboard pattern, it will be seen that the flattened portions 20 are proportioned so that adjacent top and bottom sides are aligned circumferentially of the core 10, while the adjacent vertical or lengthwise sides are spaced closely but sufficiently to provide for the previously noted transferring application of the winding drum pressure continuously about the core 10. The particular pattern illustrated may be varied considerably according to the balance desired in the winding surface and the circumstances of intended use. Thus, the flattened portions 20 may be extended or shortened in the lengthwise direction for respectively increasing the extent of relief at the proportionate winding drum contact provided by the winding surface. Also, as mentioned previously, the winding surface relief may take the form of other geometric shapes if desired. The illustrated checkerboard pattern, however, is a preferred arrangement and, therefore, serves best for reference in describing further the nature of the winding surface that the present invention makes possible.

The flattened portions 20, which characterize the winding surface of the present invention, are proportioned in sideview extent so as to obtain the appreciable shortening of the beginning yarn wraps that has already been mentioned above. This shortening should ordinarily be of the order of about 0.5 to 1.0% of the length that the wraps would assume if the winding surface were not relieved, and while it may be permissible or desirable to decrease or increase the relative amount of shortening in a given case, it will be apparent from Fig. 2 that the width of the flattened portions 20 will basically determine the amount of shortening obtained, as the periphery across these flattened portions 20 is obviously lessened in relation to the circumference of core 10 as their width is increased.

In addition, it should be noted from Fig. 2 that the flattened portions 20 are preferably formed with a transverse or lateral curvature about a radius, such as is indicated at R, which exceeds the radius of core 10, so that the portions 20 are crowned for more intimate contact with yarn windings wrapped thereon. Usually it will be best to form all of the flattened portions 20 with a uniform central depth, as illustrated in Fig. 3, so that the crowning radius R will vary at different positions lengthwise of the core 10.

The length or vertical extent of each flattened portion 20 is proportioned so as to cause any beginning yarn wraps to cross at least one of the vertical sides that merge with the conical surface of core 10, but is limited so as not to allow any given yarn wrap to cross both vertical sides of all of the flattened portions 20 crossed. If a yarn wrap is allowed to cross both the top and bottom horizontal sides of a flattened portion 20, it tends to assume a zigzag path that may actually be shorter than shorter, since the path it would assume on a continuous conical surface; while, if the yarn wraps are allowed to cross both vertical sides of all the crossed flattened portions 20, the result is to lose or lessen the advantage of the knobby effect at the winding surface that is obtained when any given yarn wrap is caused to cross the flattened portions 20 differentially.

This differential crossing of the yarn wraps is indicated in Fig. 1, in which the general path that might be followed by the first two beginning yarn wraps Z and Z' is illustrated diagrammatically. As seen in Fig. 1, the first beginning wrap Z originates from a transfer tail T that has been initially wound at the groove 16 provided therefor adjacent the lower end of core 10. Beyond the transfer tail T, the beginning wrap Z starts its spiral path about the winding surface Y of the core 10, as directed by the traverse used for the yarn package being built. If the path of this yarn wrap Z is followed in Fig. 1, it will be seen to cross nine of the flattened portions 20 without crossing both vertical sides of more than four of them; and upon reversal of the winding traverse to lay the succeeding wrap Z' in place, it will be seen that substantially the same proportion relationship is maintained with respect to the flattened portions 20 that it crosses.

The result is to produce the knobby effect mentioned above in the aggregate surface disposition of the beginning wraps as more and more are laid in place, and while this effect disappears at the surface of the core 10 when it begins to build up substantially, it remains as the characteristic disposition of the beginning wraps until the effect of the winding surface relief is obscured and appears to assist materially in securing these wraps against sloughing and fouling. At the same time, the flattened portions 20 facilitate withdrawal of the yarn windings because the top edges thereof present a rounded gradually rising contour (see Fig. 2) that sheds the spiral yarn wraps readily as they are pulled thereover during withdrawal.

A winding core 10 formed with flattened portions 20 according to the present invention may also be advantageously invested with an overall roughening throughout the winding surface Y, including the portions 20. It has previously been proposed to roughen winding core surfaces to provide against yarn slippage, but the combination of the simplicity of roughening with flattened portions 20 in accordance with the present invention affords a materially better result than can be obtained with roughening alone. This better result is obtained both because the flattened portions 20 serve alone to provide an effective yarn securing action in a manner which readily allows the further amount of roughening to be added; and because the winding surface relief at the flattened portions 20 protects the roughening thereon from wear, so that its effectiveness is made much more permanent than is usual.

The degree of roughening that is referred to here is of a degree such as to present a frictional resistance to the yarn slippage at the winding surface, and such as is exemplified suitably by a roughness measurement of the order of 150 microinches (based on R.M.S. units, i.e., the average root mean square roughness in microinches), although this example is purely representative and might be varied by at least as much as from one-half to double the measurement indicated. Such roughening is readily provided by forming the core 10 of molded plastic and obtaining the roughening as the impression of a sandblasted mold cavity over a lengthwise extent such as is indicated at X in Fig. 1. A suitable plastic material for this purpose is polystyrene, and the amount of roughening may vary between strength and stiffness and general durability.

Finally, it should be noted that a core 10 embodying the present invention may be readily adapted to serve as a carrier for dye packages simply by wall perforations (not shown) at the winding surface through which dye liquor may have access from the interior of the package, the yarn packages wound thereon. These perforations may be added suitably in a supplementary manner throughout the winding surface, or the flattened portions 20 may
themselves be formed as perforations and still serve the same yarn securing purpose described above, although the desirable crowning of these portions 20 would not then be possible. The present invention has been described in detail above for purposes of illustration only, and is not intended to be limited by this description or otherwise except as defined in the appended claims.

1. In combination with a textile yarn package of the type that is wound through surface contact with a winding drum and in which each yarn wrap follows a relatively high-pitch traverse extending from end to end of the package, the improvement which comprises a winding core having a body member presenting an exterior surface of revolution on which yarn may be wound to form a package and which has portions thereof substantially relived in a pattern that provides for adequate winding drum contact continuously about the circumference of said body member at said surface of revolution while modifying said winding surface significantly so that the beginning wraps of a textile yarn package wound thereon are all appreciably shortened in relation to the length that said wraps would assume if said winding surface were not relived and in differential relation to said pattern of relief and to each other.

2. In combination with a textile yarn package of the type that is wound through surface contact with a winding drum and in which each yarn wrap follows a relatively high-pitch traverse extending from end to end of the package, the improvement which comprises a winding core having a body member presenting an exterior surface of revolution on which yarn may be wound to form a package and which has portions thereof substantially relived in a pattern that: (a) provides for adequate winding drum contact continuously about the circumference of said body member at said surface of revolution; (b) relieves said winding surface significantly in a manner that avoids subjecting the beginning wraps of a textile package to unduly localized pressure by said winding drum contact as they are wound on said body member; and (c) shortens the length of all of said beginning wraps appreciably in relation to the length that would be required if said winding surface were not relieved and in differential relation to said pattern of relief and to each other.

3. In combination with a textile yarn package, the improvement defined in claim 2 and further characterized in that said flattened portions are proportioned so as to obtain a lengthwise shortening of said beginning wraps in the order of 0.5 to 1.06.

4. In combination with a textile yarn package, the improvement defined in claim 2 and further characterized in that said winding core is invested with an overall roughening throughout said winding surface, including said flattened portions.

5. In combination with a textile yarn package, the improvement defined in claim 4 and further characterized in that said winding surface roughening is in the order of 150 microinches in R.M.S. units.

6. In combination with a textile yarn package, the improvement defined in claim 2 and further characterized in that said flattened winding surface portions are formed with a convex curvature circumferentially of said body member, which crowns said portions for more intimate contact with yarn windings wrapped thereon.

7. In combination with a textile yarn package, the improvement defined in claim 2 and further characterized in that said exterior surface of revolution is conical.

8. In combination with a textile yarn package of the type that is wound through surface contact with a winding drum and in which each yarn wrap follows a relatively high-pitch traverse extending from end to end of the package, the improvement which comprises a winding core having a conical body member presenting an exterior yarn winding surface in which a pattern of substantially flattened portions is formed, each of said flattened portions merging sidewise at the conical surface of said body member; having a sidewise extent that appreciably shortens the length of all beginning yarn wraps of a textile package wound on said body member, in relation to the length that would be required if said winding surface were continuously conical; and, having a lengthwise extent sufficient to cause any beginning yarn wrap laid thereover to cross at least one of said merging sides, but not so great as to allow said yarn wraps to cross both merging sides of all of said flattened portions crossed.

9. In combination with a textile yarn package of the type that is wound through surface contact with a winding drum and in which each yarn wrap follows a relatively high-pitch traverse extending from end to end of the package, the improvement which comprises a winding core having a conical body member presenting an exterior yarn winding surface that is relieved by a pattern of substantially flattened portions, said flattened portions being: (a) substantially rectangular in outline; (b) arranged in a substantial checkerboard pattern predominantly throughout said winding surface; (c) proportioned in sidewise extent for appreciably shortening the length of all beginning yarn wraps on said body member in relation to the length that would be required if said winding surface were not relieved; (d) extended lengthwise sufficiently to cause any beginning yarn wrap laid over any flattened portion to cross at least one side of said flattened portion, but not so much as to allow said beginning yarn wrap to cross both sides of all flattened portions crossed; and (e) spaced so that adequate winding drum contact is afforded continuously about the circumference of said body member.

10. In combination with a textile yarn package, the improvement defined in claim 9 and further characterized in that said flattened winding surface portions are transversely arcuate at a radius exceeding that of said conical body member.

11. In combination with a textile yarn package, the improvement defined in claim 9 and further characterized in that said body member is invested with an overall roughening throughout said winding surface, including said flattened portions, of the order of about 150 microinches in R.M.S. units.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,158,335

Helmut Deussen

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 29, strike out "delivery withdrawal from the reserve package with-" and insert -- in an orderly manner through the last run-off stages --; line 54, for "warn" read -- yarn --; column 4, line 53, for "rougtening" read -- roughening --.

Signed and sealed this 27th day of April 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents