United States Patent [19]

Ito et al.

[11] **3,782,648**

[45] **Jan. 1, 1974**

[54] **METHOD FOR WINDING A PLURAL NUMBER OF YARNS AND AN APPARATUS THEREFOR**

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[22] Filed: **May 3, 1971**

[21] Appl. No.: **139,510**

[52] **U.S. Cl.** ..... **242/35.5 R**

[51] **Int. Cl.** **B65h 54/20**

[58] **Field of Search** ..... 242/35.5 R, 18 DD, 242/18 R, 18 PW, 43.2

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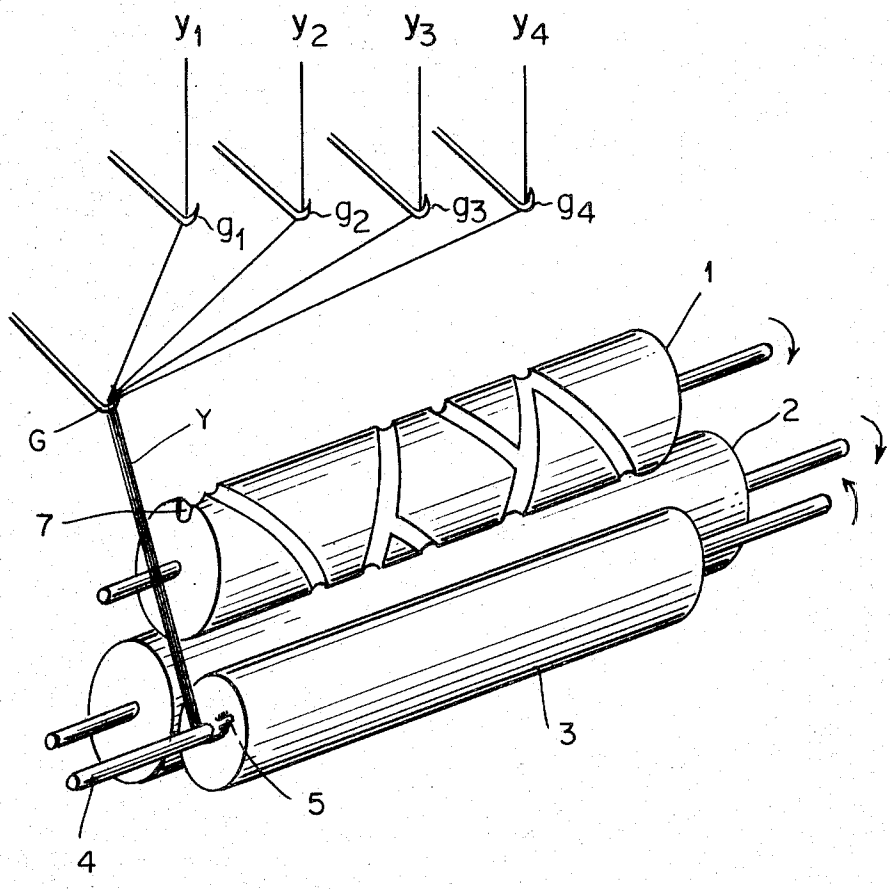
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[57] **ABSTRACT**

A method and an apparatus for feeding a plural number of yarns simultaneously to a single take-up drum without a time lag due to supplying the respective yarns one by one. A grooved drum having lateral helical traverse grooves with precisely angled intersection points receives a plural number of yarns from overhead fulcrum guides and winds them on respective laterally spaced portions of a take-up roll positioned beneath the drum.

6 Claims, 13 Drawing Figures



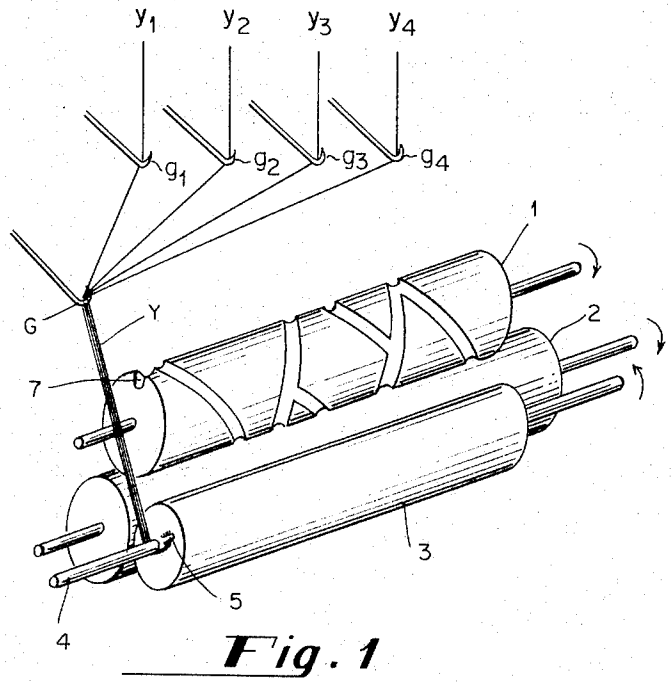


Fig. 1

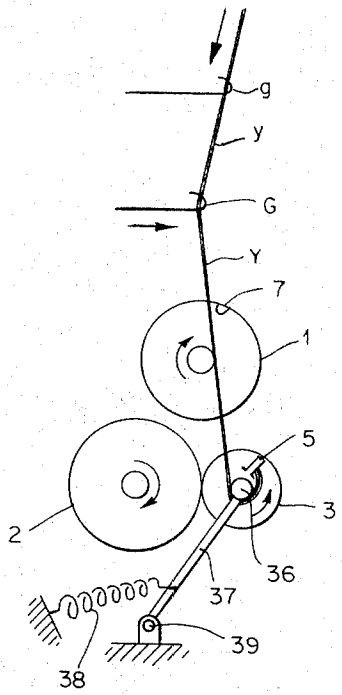


Fig. 9

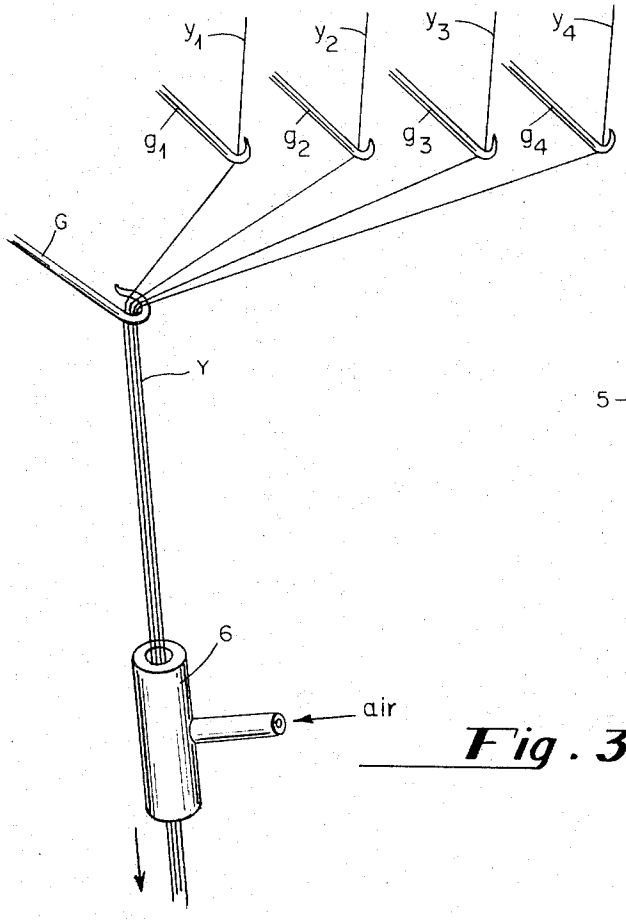


Fig. 3

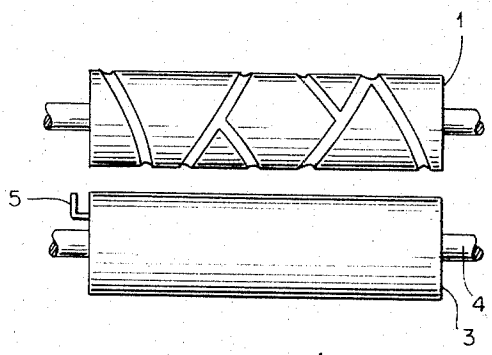


Fig. 2

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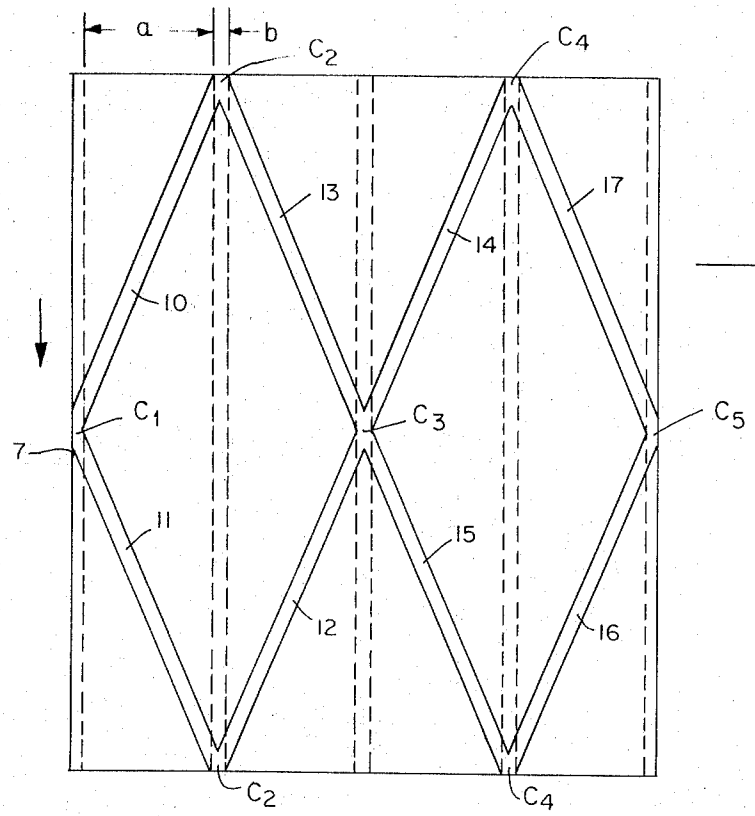


Fig. 4(A)

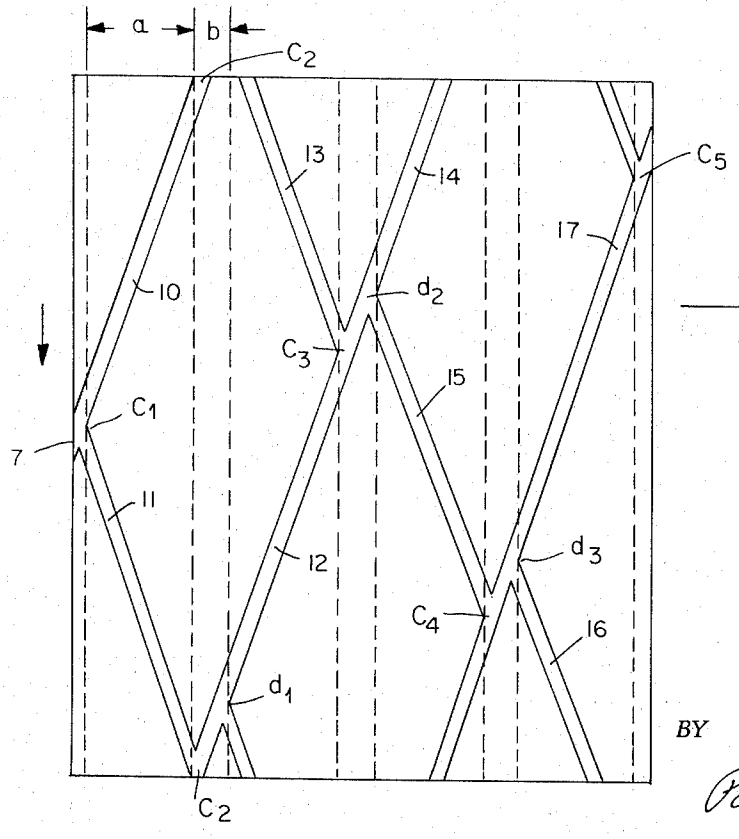


Fig. 4(B)

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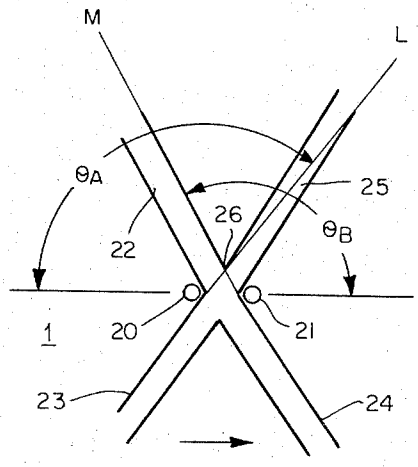


Fig. 6(A)

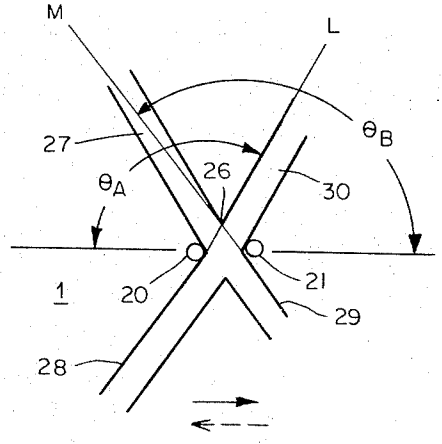


Fig. 6(B)

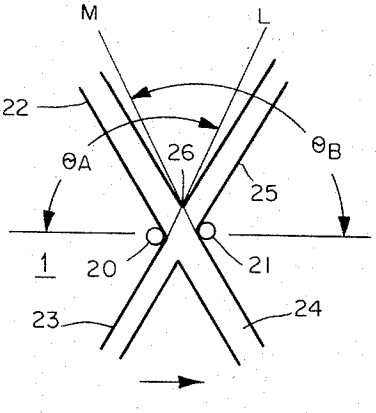


Fig. 7

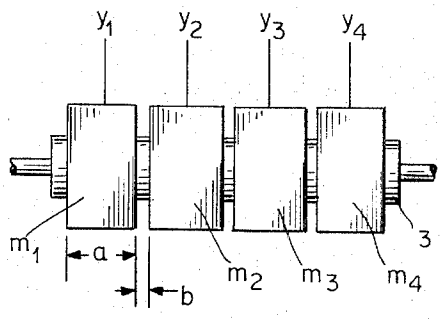


Fig. 5(A)

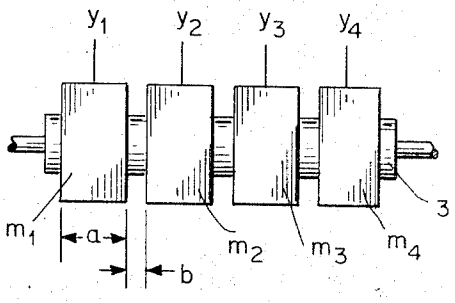


Fig. 5(B)

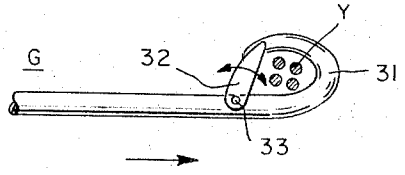


Fig. 8(A)

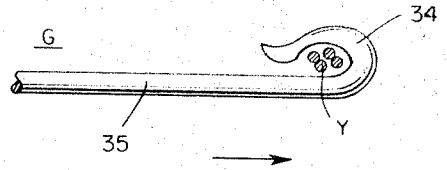


Fig. 8(B)

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METHOD FOR WINDING A PLURAL NUMBER OF YARNS AND AN APPARATUS THEREFOR

BACKGROUND OF THE PRESENT INVENTION

The present invention relates to a method and an apparatus for simultaneously taking up a plural number of yarns such as synthetic fibers.

Conventional take up means used for winding a plural number of yarns such as a tandem type winder, a dual type winder, or a combination thereof, and another type take up means according to which yarns are taken up in two rows on a drum by reducing the traverse width of each row, are generally known to those skilled in the art.

However, in conventional take-up means for winding a plural number of yarns, when optional number of yarns are desired to be taken up on one or plural number of drums, it is necessary to feed and wind yarns independently, and therefore the operability is remarkably poor, and this is considered to be a drawback of conventional take-up means.

For example, in the presently practised process for high speed spinning and drawing carried out at a high speed ranging from 2,000 m/sec. to 4,000 m/sec., or the process for drawing undrawn yarn to be texturized, a remarkable difference results at the final point of the process in the quantities of the yarns taken up on the drums or bobbins if a plural number of yarns are fed to the take-up drums or take-up bobbins one after the other rather than simultaneously.

When the yarns are taken up in four to six rows of taken up yarns, a remarkable difference between the amount of the yarn taken up on the first drum or bobbin and the amount of the yarn taken up on the last drum or bobbin results, and this drawback may bring about troubles in the following drawing process, working process or weaving process.

SUMMARY OF THE INVENTION

A principal object of the present invention is to provide a method for winding a plural number of yarns simultaneously free of time lag by eliminating the drawbacks of the yarn feeding operation in the conventional methods and apparatuses for winding a plural number of yarns.

A second object of the present invention is to provide a take up apparatus capable of performing the above mentioned method of the present invention without requiring complicated structure.

The present invention has the following structure in order to attain the above mentioned objects.

Namely, the present invention relates to a method for winding a plural number of yarns on a take-up drum provided with a plural number of yarn winding portions situated beneath a grooved drum having lateral helical traverse grooves forming a plural number of traverses rotating in correspondence to said yarn winding portions, which drum is situated beneath a plural number of fulcrum guides in positions corresponding to the respective traverses of said grooved drum. The respective yarns to be taken up on the respective winding portions are passed through said fulcrum guides, pulled into a bundle at one axial end of said grooved drum, and thereafter released into the grooves to the effect that a plural number of yarns are simultaneously fed to the respective traverse grooves of said split drum. This invention also relates to an apparatus for taking up a plural number of yarns on a single take-up drum provided with a plural number of yarn winding portions positioned beneath a grooved drum having traverse grooves corresponding to said yarn winding portions. Situated above the grooved drum are respective fulcrum guides in positions corresponding to the respective traverses of said grooved drum. A bundling guide for bundling a plural number of yarns after they have passed through said fulcrum guides is positioned near one axial end of said grooved drum, and between said drum and said fulcrum guides; and a yarn holding means for holding a bundle of yarns after they have passed through said bundling guide under a predetermined tension till said yarns are fed to the respective grooves of said grooved drum is situated at the same end of the grooved drum.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings to which the scope of the invention is in no way limited.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic oblique view of the apparatus to be used in the present invention;

FIG. 2 is a schematic front view of the grooved drum and the take-up drum;

FIG. 3 is a schematic view of a mechanism for sucking a bundle of yarns usable for the present invention;

FIG. 4 (A) and FIG. 4 (B) are the diagrams showing a developed plan view of the grooved drum to be used in the present invention;

FIG. 5(A) and FIG. 5(B) are a front view of the take-up drum showing the state thereof when a plural number of yarns are wound,

FIG. 6(A) and FIG. 6(B) are developments showing the form of the crossing point of the traverse grooves on the grooved drum of the present invention;

FIG. 7 is a development showing the form of the crossing point of the traverse grooves on a conventional grooved drum;

FIG. 8(A) and FIG. 8(B) are diagrams showing a partial plan view of the yarn bundling guide to be used in the present invention; and

FIG. 9 is a diagram showing a schematic side view of the whole apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 is an embodiment of the present invention, showing how four yarns are simultaneously taken up.

In other words, the respective four yarns y_1, y_2, y_3 and y_4 to be taken up, are passed through the fulcrum guides g_1, g_2, g_3 and g_4 provided on almost the same plane with almost the same intervals between said guides, and then said four yarns are bundled by means of the yarn bundling guide G provided above one axial end of the grooved drum **1**.

At this time point, the respective yarns y_1, y_2, y_3 and y_4 are supplied at a high speed, and said grooved drum **1** is rotated, and the take-up drum **3** is rotated as it is contacted against a surface drive roller **2**.

Therefore, it is necessary to hold the end portion of the bundle of yarns Y in order to prevent the lowering of tension of the bundle of yarns Y to be supplied, and for this purpose, it is necessary to provide a yarn pinching appendage **5** on the side surface of said take-up drum **1** as is shown in FIG. 1 and FIG. 2.

In other words, when said bundle of yarns is hooked on said yarn pinching appendage **5** of said take-up drum **3** after having bundled the respective yarns, the bundle of yarns Y is wound on the shaft **4** of said take-up drum **3** by the rotation of said take-up drum **3** until engaged by cut groove **7**, and therefore there is no fear that the tension of the bundled yarns Y should be lowered.

In accordance with the present invention, a means for continuously sucking the bundle of yarns Y (in the direction as is shown by the arrow) by utilizing an air-ejector **6** as is shown in FIG. **3** is used instead of said yarn pinching appendage **5**.

As described above, after having passed the respective yarns through the respective fulcrum guides g_1, g_2, g_3 and g_4, having bundled the respective yarns, and having retained the tension of said bundle of yarns Y to be constant, the respective yarns y_1, y_2, y_3 and y_4 are automatically fed into the grooves **10, 11** from the cut groove **7** of said split drum **1** by means of the tension of the respective yarns when said bundle of yarns Y is removed from said yarn bundling guide G.

In regard to the traverse groove of said split drum **1**, a drum whose groove is in such a form as is shown in FIG. **4**(A) and FIG. **4**(B), is preferable.

In regard to the respective crossing points C_1, C_2, C_3 and C_4 of the respective traverse grooves it is necessary to adjust the positional relation between the respective fulcrum guides g_1, g_2, g_3 and g_4, and the split drum **1** in such a manner that said crossing points C_1, C_2, C_3 and C_4 can be placed respectively almost exactly between the above mentioned fulcrum guides g_1, g_2, g_3 and g_4.

As mentioned so far in the foregoing paragraphs, among the bundle of yarns Y having entered into the cut groove **7**, having reached the second crossing point C_2 of the first traverse grooves **10, 11** and the second traverse grooves **12, 13**, only the yarn y_1 passing through the fulcrum guide g_1 alone remains in the first traverse groove **10 11** by means of the effect of that yarn's tension, and is taken up on the take-up drum **3** as it traverses within said traverse grooves **10, 11** as is shown in FIG. **4**(A) and (B).

On the other hand, the rest of the bundle of yarns are transferred to the second traverse grooves **12, 13**, but only the yarn y_2 alone, passed through the fulcrum guide g_2, remains in the second traverse grooves **12, 13** at the third crossing point C_3, and is taken up on the take-up drum as it traverses traverse grooves **12, 13.**

In the same manner the yarn y_3 passing through the fulcrum guide g_3 enters into the third traverse grooves **14, 15** at the fourth crossing point C_4, and the last yarn y_4 enters into the fourth traverse grooves **16, 17,** and is turned back at the fifth crossing point C_5, and is traversed between the fourth traverse grooves **16, 17.**

As mentioned above, the respective yarns y_1, y_2, y_3 and y_4 are traversed between the traverse grooves **10 11, 12 13, 14 15,** and **16 17** right below the respective fulcrum guides g_1, g_2, g_3 and g_4, and the four yarns can be almost simultaneously taken up on the take-up drum almost without any time lag.

In the above mentioned take-up motion for winding yarns in multiple rows, such a grooved drum as is shown in FIG. **4**(A) is used when yarns are taken up regardless of the intervals between the wound yarn rows, m_1, m_2, m_3 and m_4 of the respective yarns y_1, y_2, y_3 and y_4 as is shown in FIG. **5**(A), but when an adjustment of the intervals b between the rows of taken up yarns m_1, m_2, m_3 and m_4 as is shown in FIG. **5**(B) is desired to be carried out, the grooved drum of FIG. **4**(B) is used.

In other words, in the diagram of FIG. **4**(B), transferring grooves d_1, d_2 and d_3 following the crossing points C_2, C_3 and C_4 are provided away from said crossing points C_2, C_3 and C_4.

Therefore, the respective distance b in the axial direction of the drum between said crossing points C_2, C_3 and C_4 and the transferring grooves d_1, d_2 and d_3, directly becomes the distance b between the respective rows of the taken up yarns as is shown in FIG. **5**(B).

In FIG. **4**(A), (B), a is the traverse width and said traverse width becomes the width a of the yarn row.

In addition, in accordance with the present invention, in regard to the forms of the respective crossing points of said split drum, the form of the crossing point C_5 and the forms of the crossing points C_1, C_2, C_3 and C_4 are required to be different.

In other words, the forms of the crossing points C_1, C_2, C_3 and C_4 are those shown in FIG. **6**(A), and the form of the crossing point C_5 is such a form as is shown in FIG. **6**(B).

In the diagram of FIG. **6**(A), a minimum admission angle θ_A of yarn to be traversed in the direction of the arrow at said crossing point is greater than a minimum admission angle θ_B thereof when it is traversed in the opposite direction.

$$\theta_A > \theta_B$$

What is meant by the minimum admission angle in the present invention, is the angle as is shown by θ_A or θ_B of FIG. **6**(A) formed by a straight line L or M connecting the pin **20** or **21** for controlling the yarn path at the crossing point of the traverse grooves, and the branch point **26** of the neighbouring traverse grooves **22, 25,** and a straight line passing through said pin **20,** or **21** in parallel to the axial direction of the split drum **1.**

It has been confirmed through experiments that, when the relation between the minimum admission angles θ_A and θ_B at the crossing points C_1, C_2, C_3, and C_4, is determined to be $\theta_A > \theta_B$, the yarn Y1 passing through the first fulcrum guide among the bundle of yarns, remains alone in the first traverse grooves **10, 11** and the other yarns y_2, y_3, and y_4 do not turn back to said traverses **10, 11** but proceed in the direction as is shown by the arrow of FIG. **6**(A), in accordance with the present invention.

Except for the last crossing point C_5, all the crossing points have such form as is mentioned above and therefore only the desired yarn alone remains in each traverse groove, and traverse winding is initiated in each traverse groove.

When the minimum admission angles θ_A and θ_B at the above mentioned crossing points C_1, C_2, C_3 and C_4 are in the relation of $\theta_A = \theta_B$ as is shown in FIG. **7**, there is such a phenomenon that the bundle of yarns is turned back in the opposite direction against the direction (as is shown by the arrow) in which said bundle yarns should proceed, and when it is forcibly controlled, an excessive tension is given to the yarn, and this becomes the cause for yarn breakage.

On the other hand, it is not necessary to have the finally solitary yarn proceeded in the direction of the arrow at the final crossing point C_5 of the split drum **1,** but the traverse is initiated by the traverse grooves **16, 17** of FIG. **4**(A), (B), and therefore at said crossing

point C_5 it is necessary to have the yarn turned back in the direction as is shown by the dotted line arrow.

Therefore it is necessary that the relation C_5 between the minimum admission angles θ_A and θ_B should be such as to satisfy the following formula;
Formula:

$$\theta_A < \theta_B$$

Thus, it is possible to start the traverse winding smoothly without yarn breakage by supplying a plural number of yarns at once into the split drum.

In regard to the yarn bundling guide to be used in the present invention, those shown in FIG. 8(A) and FIG. 8(B) are preferable.

A yarn bundling guide G as shown in FIG. 8(A) has an embodiment such as a latch needle in a knitting machine, and has a latch 32 capable of moving with the point 33 as the fulcrum in order to prevent the slip-out of the bundle of yarns Y having once entered into the hook 31.

When the bundle of yarns is removed from said yarn bundling guide G, the bundle of yarns Y can be easily removed from the hook 31 of said guide G as said latch 31 can be moved by the tension of yarn when said latch 32 is moved in the direction as is shown by the arrow of FIG. 8(A) and FIG. 9, i.e., in the direction of the head of said guide G.

A yarn bundling guide G as shown in FIG. 8(B) has an embodiment such as a spring bearded needle of a knitting machine, and has such a form that the yarn path is made narrower as the end of the hook 34 gets closer towards the body 35 of the guide G.

In regard to the take-up drum 3, it is preferable, as is shown in FIG. 9, that said take up drum 3 should be held by the drum chuck 36, and said drum chuck 36 should be supported with the supporting arm 37 wherein said grooved drum 3 is pressed into contact against the surface drive roller 2 by means of a spring 38.

Therefore, when the full packaged drum is desired to be removed from the drum chuck 36, said arm 39 is put down on the opposite side of said surface drive roller 2 so as to overcome said spring 38 with the supporting point 39 of said supporting arm 39 as the fulcrum, and thereafter said full take-up drum 3 is removed from said drum chuck 36.

What we claim is:

1. Method for winding a plural number of yarns simultaneously on a single take-up means provided with a plural number of yarn winding portions and a yarn holding means, a grooved drum having a first continuous lateral helical traverse groove terminating at an axial end face of said grooved drum in a traverse groove terminus, and at least one reverse lateral helical traverse groove, said reverse lateral helical traverse groove defining separate laterally spaced yarn winding portions between its intersection points with the first continuous lateral helical traverse groove, a plurality of fulcrum guides each positioned above one of said yarn winding portions, a bundling guide positioned horizontally slightly beyond said axial end face and vertically between said grooved drum and said fulcrum guides, said fulcrum guides, said bundling guide and said traverse groove terminus being positioned such that the path of yarns released from said bundling guide passes into said axial end face and said traverse groove terminus thereon, comprising: passing the respective yarns to be taken up on the respective winding portions through their respective fulcrum guides located above their respective winding portions; pulling said yarns together in a bundle through said bundling guide; anchoring the end portion of said bundle of yarns to said yarn holding means of said take-up means thereby placing the yarns under tension, and thereafter releasing the bundle of said yarns toward said axial end face and into said traverse groove terminus thereon.

2. Apparatus for taking up a plural number of yarns simultaneously on a single take-up means, comprising: a take-up drum provided with a plural number of yarn winding portions; a grooved drum positioned slightly above said take-up drum having a first continuous lateral helical traverse groove terminating at an axial end face of said grooved drum in a traverse groove terminus, and at least one reverse lateral helical traverse groove, said reverse lateral helical traverse groove defining separate laterally spaced yarn winding portions between its intersection points with the first continuous lateral helical traverse groove; a plurality of fulcrum guides each positioned above one of said yarn winding portions; a bundling guide positioned horizontally slightly beyond said axial end face and vertically between said grooved drum and said fulcrum guides, said fulcrum guides, said bundling guide and said traverse groove terminus being positioned such that the path of yarns released from said bundling guide engages said axial end face and said traverse groove terminus thereon; and a yarn holding means on said take-up drum for holding said bundle of yarns having passed through said bundling guide under a predetermined tension till said yarns are released from said bundling guide.

3. Apparatus for winding a plural number of yarns according to claim 2 wherein the respective intersection points of the first continuous lateral helical traverse groove and the reverse lateral helical traverse groove of said grooved drum have such a relation that the minimum admission angle (θ_A) at said intersection points in the direction in which the yarns initially proceed is greater than the minimum admission angle (θ_B) in the opposite direction, except for the last crossing point on the opposite side from said bundling guide at which (θ_A) is less than (θ_B).

4. The apparatus of claim 3 wherein there is a single reverse lateral helical traverse groove which is continuous; and the two lateral helical traverse grooves intersect each other at, including the end points, $n + 1$ points, where n is the number of yarns to be wound simultaneously.

5. The apparatus of claim 3 wherein the reverse lateral helical traverse groove is composed of n discrete lateral helical traverse groove segments, where n is the number of yarns to be wound simultaneously, and each said segment is separated laterally from adjacent segments at said intersection points with the first continuous lateral helical traverse groove by a desired spacing distance between yarn lengths wound thereon.

6. An apparatus for taking up a plural number of yarns simultaneously on respective laterally spaced portions of a single take-up drum comprising:

a. a take-up drum driven by a surface drive roller;

b. a yarn pinching appendage at one end of said take-up drum used to anchor and apply tension to an end of a bundle of said yarns to be wound;

c. a grooved drum positioned slightly above said take-up drum having a first continuous lateral helical traverse groove terminating at an axial end face of said grooved drum, and at least one reverse lateral helical traverse groove, said reverse lateral helical traverse groove defining separate laterally spaced yarn winding portions between its intersection points with the first continuous lateral helical traverse groove, said reverse lateral helical traverse groove composed of n, where n is the number of yarns to be wound simultaneously, discrete groove segments separated laterally from each other at the intersection points with the first continuous lateral helical traverse groove, by a desired spacing distance between yarn lengths wound thereon;

d. a plurality of fulcrum guides situated above said grooved drum each approximately centered within a lateral position corresponding to that respective laterally spaced portion of said take-up drum on which a yarn passing through that particular fulcrum guide is to be wound;

e. a bundling guide for pulling said plural number of yarns into a single bundle after they have passed through said fulcrum guides, prior to initiation of winding on said take-up drum, positioned horizontally slightly beyond the same axial end of said take-up drum on which the yarn pinching appendage is situated, and vertically between said grooved drum and said fulcrum guides; and

f. a take-up drum chuck, a supporting arm, and a spring which together hold the take-up drum in contact with the surface drive roller.

* * * * *