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Suzuki et al.

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[54] **METHOD OF FORMING A YARN PACKAGE**

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[21] Appl. No.: **224,820**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 877,727, Nov. 18, 1969, abandoned.

[30] **Foreign Application Priority Data**

Nov. 19, 1968 Japan 43/84150

[52] **U.S. Cl.** ..... **57/157 R,** 57/153, 156/148, 156/167, 156/296, 156/306, 242/159

[51] **Int. Cl.** **D01h 1/00,** D01h 7/92

[58] **Field of Search** ..... 57/153, 157 R, 157 F, 57/35, 34 R; 242/159, 42, 166; 264/103; 156/148, 167, 296, 306

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Primary Examiner—John Petrakes
Attorney—Richard C. Sughrue et al.

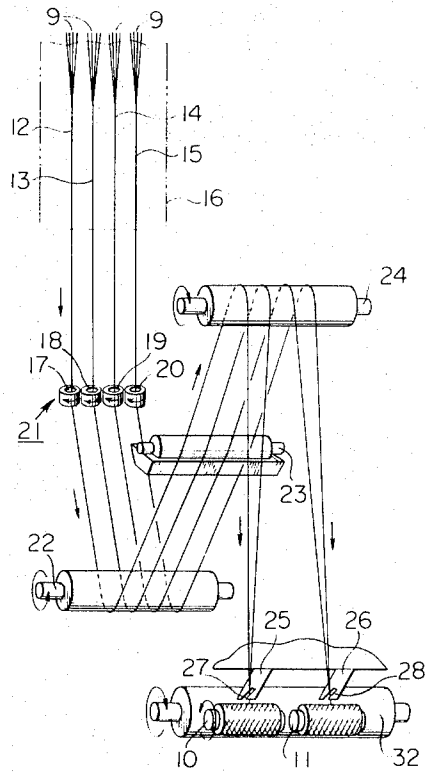
[57] **ABSTRACT**

This invention concerns with a process for the preparation of a yarn package which comprises a plurality of polyurethane elastic yarns wound up on a single bobbin. The yarns are arranged substantially in a plane when seen laterally of the yarn group and provisionally bonded together for providing the possibility of re-separation into the constituent yarns at a later rewinding stage of the package.

According to the invention, a plurality of groups of multifilaments comprising essentially polyurethane as extruded are passed through a corresponding number of false twisters, so as to group the respective filaments together to such a degree that the related filaments are partially fused together to set a mutual core-to-core material communication, yet having a solidified surface skin except the thus realized material communication areas on the filaments.

Then, at least two of the yarns of multifilaments are jointly passed through a skew-grooved traverse for provisionally bonding these yarns together so as to realise a skin-to-skin co-bonding, for ready for winding into a yarn package on a single bobbin tube.

3 Claims, 7 Drawing Figures



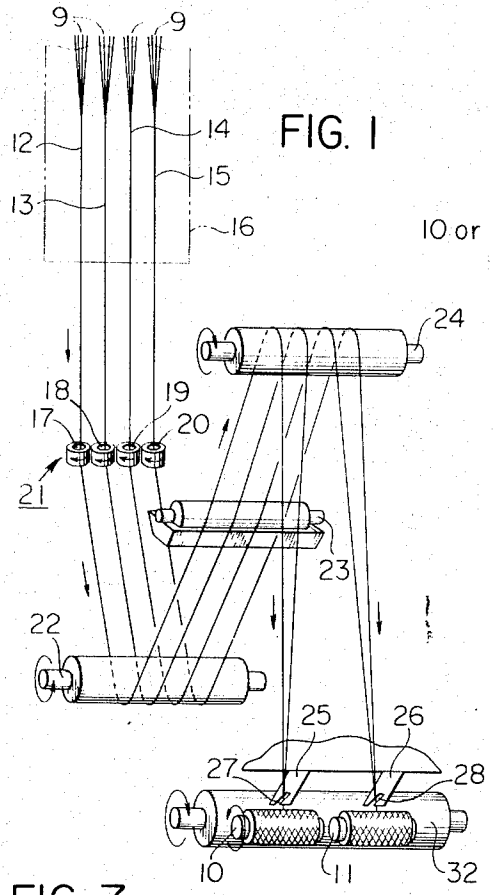


FIG. 1

FIG. 3

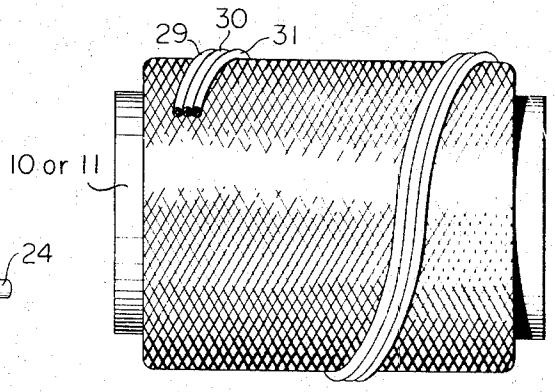


FIG. 4

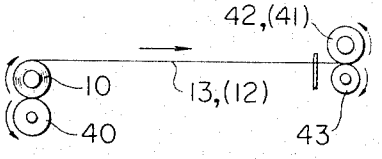


FIG. 5

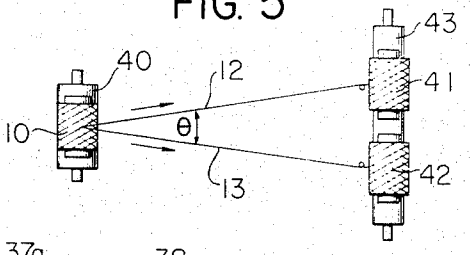
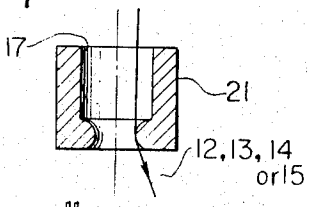


FIG. 7



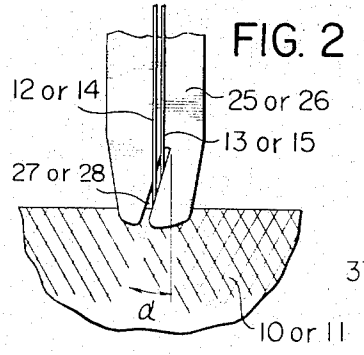


FIG. 2

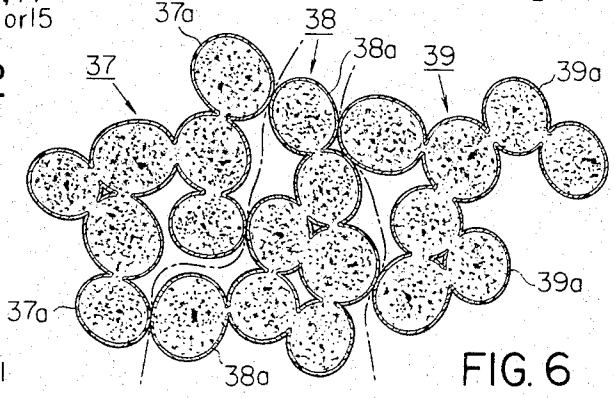


FIG. 6

METHOD OF FORMING A YARN PACKAGE

CROSS REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part of Ser. No. 877,727, filed Nov. 18, 1969, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to improvements in yarn packages. It relates more specifically to improvements in the process for the manufacture of yarn packages of polyurethane elastic yarns.

2. Description of the Prior Art

Polyurethane elastic yarn is generally utilized in the form of a wound-up package on a bobbin, preferably paper tube, said yarn being in the shape of a multifilament composed of several tens of monofilaments partially fused together upon delivery from a spinning tube or cylinder. When it is desired to further processing these material yarns on a warper, core spinner or knitter, a large number of yarn packages of the above kind corresponds to the number of the yarns to be processed must be set. When warping, as an example, each of the required number of yarn packages must be placed on a cradle of the creel, thus requiring the same number of cradles and resulting in a correspondingly voluminuous space of the cradle frame for the warping machine. This will apply correspondingly to the case of core spinning, or a similar yarn processing technique. With an increase of yarn packages and thus cradle means for the latter, the yarns delivered from the packages will frequently be subjected to various and different tensions. Especially in the case of processing polyurethane elastic yarns into knitted fabrics, it is ideally a requisite condition to keep the warped yarns at a constant tension. Otherwise, the knitted fabrics will become so far inferior in their commercial value. This will apply substantially equally to other yarn finishing techniques above referred to. In the case of core spinning or normal knitting, the increased number of the feed yarns will require the correspondingly increased investment in the provision of roller feed mechanisms and the like yarn feed appliances from the yarn packages.

The main object of this invention is to provide an improved process for the preparation of yarn package capable of substantially reducing the degree of the aforementioned convention drawbacks.

A further object of the invention is to provide a process for the manufacture of a yarn package wherein a plurality of polyurethane elastic yarns are wound up on a single bobbin, and indeed, in a separable way during its later rewinding stage.

SUMMARY OF THE INVENTION

For attaining the abovementioned several objects, the invention resides in its broadest coverage in a process for the manufacture of such yarn package characterized by a plurality of polyurethane elastic yarns, each being formed at its overall periphery with a completely shaped skin, which are provisionally bonded together and arranged substantially along a plane when seen in the lateral direction of the group consisting of said yarns, and wound up on a single bobbin, in a separable way at a later rewinding stage of the yarns.

The "yarn" as employed throughout the present specification and appended claims may be in the form of multifilaments partially fused together, yet having at its overall periphery a coagulated surface skin, as will be more fully and definitely described by reference to the accompanying drawing.

The term "bonded together" denotes such bonded condition of the group of the filaments wherein the surface skin has not been destroyed by the bonding, while the term "partially fused together" denotes such conditions of the group of filaments wherein two of the neighboring filaments are destroyed in its skin configuration partially by the fusing and there has occured a material exchange between the fused-together filaments, as will become more apparent as the description proceeds.

The main feature of this invention resides in such a process for the preparation of a yarn package on a single bobbin having a plurality of elastic yarns wound thereon, comprising the following steps of:

extruding a plurality of groups of multifilaments comprising essentially polyurethane material through a spinneret;

passing each of said multifilament groups through a false twister, preferably a false twisting ring for grouping the contained multifilaments into mutual core-to-core-material communication. yet having their respective surface-solidified skins except said material-communication areas on the filaments;

passing at least two of the yarns of said multifilament group through a skew-grooved traverse guide at a traverse angle 7°–15° for provisionally bonding these yarns together through skin-to-skin bonding; and

winding these skin-bonded yarns, each consisting core-to-core bonded and substantially parallel-arranged multifilaments on a rotating single bobbin at a residual percentage of elongation of about 5–15 percent, with the bond being of such a nature that the yarns may be readily separated at a peel-off angle less than 28° during a subsquent rewiding of said yarns.

These and further objects, features and advantages of the invention will become more clear as the specification further proceeds by reference to the accompanying drawing and several preferred numerical examples.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. **1** is a schematic perspective view of an arrangement for the simultaneous manufacture of two packages, each having two multifilament yarns wound up on a bobbin or paper tube in accordance of the teachings of the process according to the invention.

FIG. **2** is an enlarged schematic and partial elevational view of a skew-grooved traverse guide and a bobbin employed in the manufacturing arrangement shown in FIG. **1.**

FIG. **3** is an enlarged front view of a yarn package as produced by the process according to this invention wherein three yarns bonded together are being wound on a single bobbin, part of said yarns being however exaggeratedly represented for better understanding of the nature of the invention.

FIG. **4** is a side view of an arrangement for measuring the peel-off angle between individual yarns appearing at a rewinding stage of the yarn package according to the invention.

FIG. **5** is a plan view of the arrangement shown in FIG. **4.**

FIG. **6** is an enlarged cross-sectional view of three yarns provisionally bonded together and ready for

winding on a single bobbin according to this invention, each of said yarns consisting of seven multifilaments partially fused together as shown, wherein thick chain showing respective and imaginary separation planes among these multifilament yarns.

FIG. 7 is an enlarged axial section of one of the false twist rings appearing in FIG. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIG. 1, a preferred process for the manufacture of the yarn package will be described more in detail.

In this embodiment, two bobbins 10 and 11 are used for simultaneous manufacture of two yarn packages, each comprising in this case two yarns provisionally bonded together. Each of the yarns 12–15 comprises elastic polyurethane filaments at least 85 percent of which comprises in turn segment-polymerized polyurethane commonly called "Spandex" among those skilled in the art.

Multifilaments 9 of the above nature and extruded from a large number of spinning nozzles, not shown, are fed into a spinning tube, only schematically shown by an imaginary rectangular block 16, and grouped into four parallel yarns 12–15. Each yarn may consist of several to several tens of filaments, as the case may be. These yarns are then passed through respective false twister elements 17–20 of a false twister unit 21, so as to fuse the yarn-consisting multifilaments partially together, as will be seen representatively in FIG. 6 by constituent yarns. As the false twister, a conventional false twisting ring may be used, as shown.

As seen from FIG. 7, the multifilament is brought into sliding contact with an inner portion of the false twist ring substantially at a point contact and taken out therefrom at an outlet angle 4°–45° as measured relative to the hitherto passage direction of the multifilament. As schematically shown by respective small arrows, the false twister elements are rotated in the same direction and at an equal speed, although the necessary drive means have been omitted only for its very popularity.

The filaments of each yarn have been partially fused together so as to have a round or elliptical general cross-sectional configuration, although in FIG. 6 an extremely different and expressly deviated fused-together yarn cross-sections are shown for the illustration of manufacturing possibilities of the yarn package according to the invention.

Upon leaving from the false twister unit 21, the yarns 12–15 are passed around a first godet roll 22, an oiling roll 23 and a second godet roll 24. If necessary, the oiling roll 23 may be provided at an intermediate position between the false twister unit 21 and the first godet roll 22. The contact of the yarns 12–15 with the oiling roll should preferably be made in the parallel and separated conditions of the yarns, and thus not in their overlapped conditions. The mutual spacing of the yarns during contacting passage thereof around the second godet roll must be at least 5 mm. With smaller spacing than that above specified, the yarns may be subjected to tanglings during passage through a traverse guide 25 or 26 in the next stage. If this kind of tangling should occur, separation of the individual yarns during later rewinding of the yarn package will become rather difficult or even impossible, by virtue of the worsened peel-off angle. The interspace of the yarns can be adjusted by means of the false twister unit 21. As seen especially from FIG. 2, the traverse guide 25 or 26 is formed each with an inclined guide slot 27 or 28., the angle of inclination alpha thereof must preferably be within 5°–10°.

Upon being guided through the traverse guide 25 or 26, each group of two yarns are conjointed together upon the respective bobbin 10 or 11, so as to be wound up thereon in the state of the yarns mutually bonded together, yet separable at a later rewinding stage of the yarn package. During passage through the respective traverse guide, the respective constituent yarns of the yarn group must preferably be spaced at a distance between 0.5 and 3.0 mm during passage through the yarn guide and kept in parallel with each other in the inclined guide groove 27 or 28. For attaining these travelling conditions, the spacing of the yarns upon the second godet roll and the distance between the latter and a front roll 32 kept in driving engagement with the respective bobbins 10 and 11, as well as the proper position of the respective traverse guides 25 and 26, must be carefully adjusted. With smaller yarn spacing than the above specified minimum distance 0.5 mm on the traverse guide, a tangling of the guided yarns would occur and the thus produced yarn package will provide a considerable difficulty in the desired yarn reseparation during the rewinding thereof when used. With larger yarn spacing than the above specified maximum value or about 3.0 mm, the desired provisional bond in the yarn group would fail to realize so that an easy and later separable winding thereof on the respective bobbin would not be realized.

The winding speed and the traversing speed must preferably be adjusted, so as to set the traverse angle to be about 7°–15°. With larger traverse angle than above specified maximum value, mutual tangling of yarn components would liably occur at the instance when the yarn group is about to be wound. With smaller traverse angle than above specified minimum value, on the other hand, easy separation of the yarns from the package would become rather worse, and under circumstances the finished yarn package will represent appreciable undulations on the surface thereof.

The absolute and mutual speeds of the first and second godet rolls and the front roll must be so selected that the residual percentage of elongation of the wound-up yarns on the bobbin should preferably be ranged from about 5 percent to about 15 percent. When the package is prepared with smaller residual percentage of the above kind than about 5 percent, it lacks of enough hardness to keep the desired shape of the package. With higher residual percentage of elongation than above specified maximum value, on the other hand, the yarn package will represent frequently too much tight local windings, which will frequently invite reseparation of the constituent yarns from the yarn package during rewinding thereof, as well as fluctuation of the yarn tension appearing in the course of rewinding. These difficulties must naturally be avoided.

Three or more multifilament yarns may also equally be fabricated into a yarn package. FIG. 3 represents a three-yarn package, each of the constituent yarn being a group of fused-together multifilaments. In FIG. 3, each of such yarns is denoted with numeral 29, 30 or 31, one after another.

In FIG. 6, a yarn group composed of three yarns 37–39 are shown as ready for winding up on a single bobbin such as at 10 or 11 into a yarn package according to this invention. As seen, the overall cross-sectional configuration of each yarn 37, 38 or 39 represents clearly a well defined surface skin 37*a*, 38*a* or 39*a*, and that these skins have not been destroyed in spite of the provisional bond among the constituent yarns. However, in FIG. 6, it will be seen that seven constituent filaments of each of the yarns 37, 38 and 39 are partially fused together at their mutually contacting points, where their surface skins have been broken and a core-to-core material exchange between the related filaments has been introduced to a lesser or larger degree.

It should be noted that the above kind of filament fusion is introduced in the stage of false twisting, while the provisional bond among the yarn is introduced either directly before yarn winding or even simultaneously with the latter stage.

In the rewinding stage, the peel-off angle θ between the delivering two neighboring yarns must be kept, according to our practical experiment, must preferably satisfy the following formula:

$$\sin \theta/2 \leqq 1/(S+s)\,(6.57 - 220/v + 40) + 0.11 \quad (1)$$

In the above formula, the angle θ defined as the peel-off angle will be described more fully by reference to FIGS. 4 and 5 hereinafter. v and S are measuring conditions for the determination of said angle θ. More specifically, v is the feed-out speed expressed in m/min. This speed v must be maintained within the following range:

$$10 \leqq v \leqq 50 \quad (2)$$

The value S is the elongation rate of the yarn as appearing in the course of the rewinding operation. More specifically, it is defined by such elongated amount of the yarn appearing in said operation as measured in percentage relative to the original length of the same yarn appearing in the wound condition on the yarn package.

The value s is defined as the percentage of residual elongation of the yarn, said value being expressed in terms of the contracted length of the yarn appearing when it is released from the package at room temperature, relative to the original length of the same yarn showing under the packaged conditions. This value s should be within the following range:

$$10 \leqq (S+s) \leqq 50 \quad (3)$$

The peel-off angle θ can be defined, as will become apparent more specifically hereinafter, by the included angle between two neighboring yarns as appearing in the course of rewinding at specific values of v and S selected within said requisite respective ranges. In this case, the apex is assumed to coincide with the peel-off or separating point of these yarns.

The yarns must have a good separation performance as observed when being released from the package. It should be mentioned at this stage that there has been no reliable and well-established method for the determination of such separation performance for yarns as adopted by those skilled in the art. Under these uncertain conditions, we have adopted the following process which will appear by reference to FIGS. 4 and 5.

In these figures, a yarn package denoted as at 10 is rotatably mounted on a conventional cradle, not shown, and kept in pressure engagement with the peripheral surface of a feed-out roll 40 which is naturally mounted rotatably on a conventional bearing means, not shown. The bonded yarn end is drawn out from the package 10 and the separately spread-out constituent yarns 12 and 13 are wound on respective paper tubes 41 and 42 which are rotatably supported on a conventional cradle, again not shown and kept in pressure and peripheral engagement with a winding drive roll 43.

The peel-off or separation angle θ is determined by measuring the included angle between two neighboring yarns 12 and 13 with its apex positioned on the package 10.

With inferior peel-off performance of the yarn, the angle θ will become rather larger, and vice versa. The angle θ depends upon the occasionally selected rewinding speed as well as the specific elongation characteristics of the yarn. These feed-out speed v for and the elongation rate S of the yarn should be kept within a specified respective range, as was referred to hereinbefore. If these values should fall outside the specified respective range, the formula (1) can not always be satisfied.

With use of a number of the yarn packages the yarns of which can be rewound with the peel-off or separation angle defined by said angle θ satisfying said formula (1) and set on a warper, knitter or core spinner, otherwise frequency met troubles of yarn breakage can be substantially obviated and the yarn tension for every warped yarn can be set at a nearly constant value, thus the required fabricating operation being realized in a highly smooth and trouble-free way. On the contrary, with use of the unfavourable yarn packages with such peel-off angle standing outside the specified range, considerable and frequent yarn breakage and high variable and fluctuating feed rate of yarns will be encountered, leading in considerable formation of wale streaks and wale and course marks when speaking only of knitted fabrics therefrom. Generally speaking, the angle θ must be less than 28° for attaining better yarn separation of the yarn package according to this invention.

As an example, two polyurethane elastic yarns, 40 deniers, each consisting of five multifilaments, were bonded together and wound up on a single paper tube. In this way, three samples of yarn packages A, B and C were finished, of which only the first sample A was prepared according to this invention. Comparative samples B and C were prepared with use of a conventional traverse guide with non-inclined guide slot. Then, the composite yarn was taken out from the package and separated into the two constituent multifilament yarns as before. The conditions were:

$v = 50$ m/min.; $S = 40$ percent; $s = 10$ percent.

The angle θ amounted to 9°–10° for the first sample A; 10°–31° for the second sample B and 9°–43° for the third sample C, respectively. In this case, the angle θ must be equal to or less than 22°. Therefore, only the first sample could satisfy the required peel-off angle value.

These samples were set on a warping machine designed for "Spandex" yarns and manufactured by LIBA, so as to maintain the separating angle at 30° with the apex positioned of the respective package. Feed-out speed: 50 m/min; Wind-up speed on the beam: 100 m/min; Overall length of the yarn: 1,000 m. The yarn tension was measured at a place positioned directly before the beam and by means of a tension meter. The results are shown in the following Table I.

Table I

Sample	Peel-off angle θ	Tension, g	Number of yarn breakages as encountered
A	9–10	3.5–3.6	0
B	10–31	3.3–3.9	0
C	9–43	3.2–4.0	8

As seen, the variation range of yarn tension in the first sample was least with no breakage. The second and third samples showed a considerably wide and thus unacceptable range of yarn tension. With the third sample, unacceptably frequent yarn breakage were encountered.

It has already been realized that several tens of non-elastic filaments made of nylon, polyester or the like material are wound up on a single bobbin and then the constituent filaments are rewound in their separated state. With elastic polyurethane yarns which represent a high elasticity as well as high adhesive properties could not be treated in the same way. The present invention provides, as will be seen from the foregoing, the possibility of realization of the highly desired technique.

25 percent, these being of representative figures concerning the invention. The yarn of a package were arranged naturally substantially in a plane when seen laterally of the bonded yarns which are arranged practically in parallel to each other. The physical properties of each of the separated yarn components were highly superior when obeying the principles of the invention.

With use of 300 packages corresponding to that of Example 5 were set on a warping machine for "Spandex" manufactured by LIBA and warped out in the conventional way, practical no appreciable variation of yarn tension and substantially no yarn breakage were encountered.

With packages of the type according to Example 2 set on a stocking manufacturing machine for mixingly knitting nylon yarns of 15 denier, the products stocking could be finished with superior physical properties and good appearance. Disadvantageous fluctuations in the yarn tension and yarn breakage were not practically encountered in the course of knitting.

The packages of Examples 1–9 were prepared with use of the traverse guides each having an inclined yarn guide slot, while those of the reference were manufactured with use of conventional traverse guides having no inclined guide slot. In the latter case, two yarns were wound up only in parallel to each other. The peel-off angle θ satisfying the formula (1) amounted to 28° or less, under $v = 25$ m/min. and $(S + s) = 25$ percent. While all the packages according to Examples 1–9 satisfied the above conditions, those of the reference did not.

TABLE II

Examples	Manufacturing conditions: Number of yarns wound on a package	Filament denier	Yarn denier	Fusing means	Speed of first godet, m./min.	Speed of second godet, m./min.	Speed of front roll, m./min.	Yarn distance on second godet roll, mm.	Yarn distance on traverse guide, mm.	Conditions of product package: Traverse angle, degrees	Residual elongation, percent	Peel-off angle, degrees
1	2	5	20	(1)	434	548	565	7	1.5	10	12	9–11
2	2	4	20	(1)	434	548	565	5	1	10	12	8–9
3	2	8	40	(1)	307	388	400	10	1.5	10	9	7–8
4	2	6.67	20	(1)	434	548	565	10	1.5	10	10.5	8–9
5	2	6.67	20	(1)	434	548	565	10	1.5	11	10	9–10
6	2	5	20	(1)	434	548	565	6	1	10	10	8–9
7	3	5	20	(1)	434	548	565	5	0.5	10	13	9–11
8	3	6.67	40	(1)	434	548	565	6	1	10	9	10–13
9	4	5	20	(1)	434	548	565	5	0.5	10	13	11–14
Reference	2	8	40	Guide	307	388	400	3	0.5	10	9.5	11–56

[1] False twist ring.

For the realization of the improved technique according to the present invention, the inclined guide slot embodied on the traverse guide must preferably have a length of 3–12 mm and a breadth of 0.5 – 1.5 mm.

As was referred to hereinbefore, the percentage of residual elongation must preferably amount to about 5–15 percent. This is measured generally with the yarn which was spun and packaged in the aforementioned way and preserved for at least 3 days. When the yarn is rewound at room temperature, a yarn contraction will be observed. The percentage of residual elongation is determined in percentage by the thus contracted yarn length relative to the wound-on yarn length on the bobbin.

The following Table II shows the results of a plurality of different yarn packages according to this invention in comparison with a reference example. The peel-off angle θ was measured at $v = 25$ m/min. and $(S + s) =$

The peel-off angle was measured on the samples in the foregoing Examples 5 and 6 under various working conditions. The results are shown in the following Table III.

TABLE III

Feed-out speed: v, m./min.	Residual elongation: s, percent	Yarn elongation: S, percent	Peel-off angle: θ, degrees: Example 5	Example 6	Range of peel-off angle, degrees, for satisfying formula (1)
25	10	0	13–22	11–20	$\theta \leqq 51$
25	10	15	9–10	8–9	$\theta \leqq 28$
25	10	40	7–9	6–7	$\theta \leqq 20$
50	10	0	18–29	14–25	$\theta \leqq 63$
50	10	15	13–17	11–15	$\theta \leqq 32$
50	10	40	9–13	9–11	$\theta \leqq 22$

As was referred to hereinbefore, the polyurethane elastic yarn in the meaning of this invention consists of at least 85 wt. percent of segment-polymerized poly-

urethane, called "Spandex". For the manufacture of such polyurethane, the following steps are generally employed.

A bifunctional compound such as polytetramethylene oxide, poly- -caprolactone or polyethylene adipate, having a molecular weight of 800 – 4,000 and at its end position a hydroxide radical is reacted with an organic diisocyanate in an excess amount, the thus formed prepolymer is polymerized in the presence of a proper solvent such as dimethyl formamide, dimethyl acetamide and added with a chain extender such as diamine, water, glycol, hydrazine or the like, and the resulted highly viscous solution is adjusted with titanium oxide and stabilizer, so as to provide a spinning liquid wherein the concentration of the polymer, titanium oxide and the stabilizer amounting to 20 – 35 percent.

Manufacturing Example 10

A spinning liquid of the above nature, concentration 30 percent, is extruded at 50°– 100°C from a spinneret, overall diametrical dimension 350 – 500 mm, having four groups of seven orifices, each 0.2 mm I.D., in a spinning cylinder, height: 4 – 6 m, hot air of inlet temperature of 250°– 300°C and outlet temperature including introduced ambient air and amounting to 80°– 150°C circulating therethrough, thereby providing four yarns of seven continuous multifilaments, 40 denier. The solvent was dimethyl formamide.

The thus formed four yarns of multifilaments, 100°–150°C, were passed through respective rotating false twister rings mounted below the outlet or lower end of said spinning cylinder for subjecting to a partial confusion, yet providing each yarn with a coagulated skin, thence through a first godet roll, an oiling roll and a second godet roll, substantially in the same manner as was described hereinbefore with reference to FIG. **1.** The rotational surface speed of each of the godet rolls was set to 350 – 550 m/min.

These yarns were passed through a traverse guide as was referred to at **25** or **26** in FIG. **1** (inclination angle of guide slot being 10°) and wound up substantially in a transversal plane arrangement of the constituent yarns and on one and same bobbin at a speed of 400 – 600 m/min. The bobbin was 130 mm in length and 70 mm in diameter. The stroke of the traverse guide amounted to 95 mm. The provisional bond was realized directly before the winding position and after passage through the traverse guide.

After preservation of the finished yarn package, a rewinding operation was carried out for warping purpose. The feed-out was made at 25 m/min. The separation of the four yarn compositions into its constituent yarns was successful. The peel-off angle was measured to 10°. From these yarns, a knitted fabric was manufactured with superior results. No yarn breakage.

Manufacturing Example 11

In the foregoing manufacturing Example 10, the spinneret was replaced by that which was formed with two groups of four orifices, each being 0.18 mm I.D., and the composition of the spinning solution was as before. The spun multifilaments were passed through respective rotating false twist rings upon leave from a spinning cylinder. Then, the thus false twisted multifilaments was guided through a godet roll and a finishing roll and then through a skew-grooved traverse, with a groove inclination angle of 7° at a traverse angle of 11°, so as to be wound upon a single bobbin tube.

Speed of the first godet roll: 370 m/min. That of the second godet: 400 m/min. That of front roll : 400 m/min.

The thus produced group of multifilaments has a solidified and well-defined, substantially uniform skin as representatively shown in FIG. **6.** The four constituent filaments of each multifilament yarn have partially fused, core-to-core-material communication zones, the two yarns being bonded together and capable of later separation. The separation into constituent yarns could be performed at a separating angle θ of 12°.

According to our practical experiments, use of false twisting rings was most suitable for obtaining the inventive advantages. Use of the air-jet twisting apparatus, or utilization of stationary narrow gap means demonstrated only the formation of irregular and uneven skin which represents frequent interruptions, thus resulting in entangles of constituent filaments during the rewinding and separating step of the yarn packages, by virtue of the failure of the necessary uniform yarn tension and successful and continuous yarn re-separation or peel-off.

The embodiments of the invention in which an exclusive property or privilege is claimed are as follows:

1. Process for the preparation of a yarn package on a single bobbin having a plurality of elastic yarns wound thereon, comprising the following steps of:

extruding a plurality of groups of multifilaments comprising essentially polyurethane material through a spinneret;

passing each of said multifilament groups through a false twister, preferably a false twisting ring for grouping each of the filaments in the group into contact with at least one other filament in the group with said filaments having surface-solidified skins except in the area of contact with other filaments in the group;

passing at least two of the yarns of said multifilament group through a skew-grooved traverse guide at a traverse angle 7°–15° for provisionally bonding these yarns together through skin-to-skin bonding; and

winding these skin-bonded yarns on a rotating single bobbin at a residual percentage of elongation of about 5–15 percent with the bond being of such a nature that the yarns may be readily separated at a peel-off angle less than 28 degrees during a subsequent rewinding of said yarns.

2. The process as set forth in claim **1,** wherein said multifilament group is kept in sliding contact with the false twisting ring substantially in the manner of point contact, and led to leave therefrom at an outlet angle of 4°–45° as measured relative to the inelt passage of the yarn to the false twister.

3. The process as set forth in claim **1,** wherein the yarns are guided through a skew groove of the traverse guide having an inclination angle of 5°–10°.

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