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RAYON LOOPER CLIP YARNS

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ABSTRACT OF THE DISCLOSURE

A new rayon looper clip yarn engineered especially for use in the manufacture of seamless hosiery comprising a selected number of uniquely designed ribbon-like continuous rayon filaments twisted into yarn, the number of filaments being critical and in amounts sufficient to produce a yarn having a denier from about 90 to 120 grams per 9000 meters and each of said filaments having as a cross-section, a length-to-width ratio ranging from about 9:1 to about 15:1. The number of filaments comprising the yarn may vary only over a limited range and the denier per filament has an absolute value ranging from about 6 to about 15.

This invention relates to new rayon yarns uniquely suited for circular knitting of goods and in particular to rayon yarns having improved physical characteristics that make them especially useful as looper clip yarns in the circular knitting of nylon hosiery.

In the knitting of ladies' seamless hosiery, looper clip or run-off yarns are often used to knit several extra courses at the end of the nylon body (toe) portion of the hose. These yarns act to prevent the nylon hose from raveling until the toe portion is closed by looping or seaming. Customarily, after closing of the toe is completed, the looper clip or run-off portion is cut off and discarded as waste.

Heretofore, the manufacturers of such hosiery have been forced to use either high price cotton or texturized nylon yarns as looper clip or run-off yarns in their knitting operations. Furthermore, the need for yarns free from lint and yet capable of preventing raveling prior to or during the looping or seaming operations has caused the industry to use the ever-increasing higher priced cotton yarns. However, even with the higher priced cotton yarns, lint build-up still remains a problem in that their use often results in needle and sinker damage which, in turn, causes needle streaks, machine stoppage for cleaning, and eventual expensive overhaul of the equipment.

Also, because these cotton and nylon yarns are expensive, many attempts have been made to use the less expensive regular rayon yarns for these purposes. However, such rayon yarns generally prove unsatisfactory since they have been found to ravel or "tail-out" nearly as badly as the nylon yarn used to knit the hose. Such conventional rayon yarns also have been noted for their low run resistance. In accordance with this invention, novel improved flat filament rayon yarns are produced which are particularly suitable for use as looper clip yarns in that they have many advantages over the cotton yarns which are primarily used for such purposes; e.g., greater freedom from lint, improved machinability, and substantially lower cost, and also provide excellent knit-holding properties.

Thus, in one aspect, this invention contemplates an improved rayon yarn characterized by an ability to be made into knit goods substantially free of "tails" and resistant to runs which comprises a selected number of

ribbon-like continuous rayon filaments slightly twisted together to provide a yarn denier having sufficient tenacity for use as looper clip and the like yarns, the cross-section of each of said filaments having a length-to-width ratio of at least about 9:1.

More particularly, this invention is directed to a novel improved rayon looper clip yarn for use in the manufacture of seamless nylon hosiery comprising a selected number of ribbon-like continuous rayon filaments, preferably "S" twisted into a yarn, the number of filaments being sufficient to produce a yarn having a denier from about 90 to 120 grams per 9000 meters, and each of said filaments having a cross-section with a length-to-width ratio ranging from at least about 9:1 to about 15:1.

In addition, this invention contemplates a method for producing the improved rayon yarns particularly suitable for use as looper clip yarns including the steps of spinning a viscose solution into continuous ribbon-like rayon filaments from slot-shaped orifices, forming a yarn from a selected number of the ribbon-like continuous rayon filaments, and applying a twist, preferably of the S type to the resulting yarn, the slot-shaped orifices having slot sizes that produce filaments having a cross-section with a length-to-width ratio of at least about 9:1 to about 15:1 and a denier sufficient for their intended use.

The improved rayon continuous multifilament yarns of this invention can be produced from a variety of viscose spinning solutions which may contain pigments, delusterants, dyes, and/or the like processing aids by conventional rayon spinning techniques. In general, the viscose is prepared from a cellulose source such as wood pulp, cotton linters, or a mixture thereof. The cellulose content of the viscose may range from about 5 to 9 percent and have an alkaline content of from 4 to 8 percent by weight. After ripening at room temperature for several hours, the viscose is then deaerated and ready for use as a spinning solution.

The viscose solutions are extruded into an acid primary bath and the resulting filaments are removed and after-treated in the conventional manner. A selected number of the filaments are formed into a yarn and the desired twist is applied. The yarn is then put up in a cone or other desired package.

In the spinning of the viscose, the slot orifices of the spinneret used in accordance with this invention can have widths of from 35 to 50 microns and lengths of from 315 to 750 microns. Two particularly effective slot sizes are 450 x 40 microns and 550 x 40 microns.

It will be appreciated that the choice of the dimensions for the slot orifices is dependent on the denier of and number of filaments required for the improved product. For the purposes of this invention, it surprisingly has been found that the denier of the improved yarns may vary only from about 90 to about 120 grams per 9000 meters and is preferably about 100. Perhaps more surprisingly, it has been found that in order to obtain the aesthetic qualities necessary for looper clip purposes, the number of filaments in the yarn may vary only over a limited range, and usually the number of filaments in the yarn varies from about 8 to about 15. Preferably, about 9 to 11 filaments are employed. Thus, the denier per filament of the yarns has an absolute value ranging from about 6 to about 15.

In accordance with this invention, the ribbon-like filaments are only slightly twisted together, i.e., from 1 to 6 turns per inch, to form the desired yarn product. Either S or Z twists may be employed. Preferably, the yarns have an S twist of about 3 turns per inch.

It will be understood from an inspection of the yarn parameters, i.e., cross-section dimensions, denier, number of filaments, and the twist required, that the physical properties of yarns contemplated by this invention may

vary considerably and still be within acceptable limits. From our investigations, it has been found that particularly effective rayon yarns for preparation of looper clip sections contain 10 continuous filaments produced from spinnerets having a slot size of 450 x 40 microns, a total denier of about 100 grams per 9000 meters, and an S twist of about 3 turns per inch.

Although many of the properties of the improved rayon yarns of this invention contribute to their usefulness as looper clip yarn, it is believed that their frictional characteristics are of particular importance. Thus, it has been found that the yarn-to-yarn friction of the improved rayon yarns that have proved to be most suitable as looper clip yarns are equal to and oftentimes greater than that of cotton yarns commonly used for this purpose.

It will be understood that the rayon yarns of this invention have several advantages over the cotton yarns conventionally used as looper clip yarns. Among these advantages are freedom from lint, substantially lower cost, more yards of yarn per pound (44,600 yds./lb. for the preferred rayons in contrast to 37,800 yds./lb. of 90/2 cotton), freedom from "slubs," and more uniform quality in the continuous filaments.

It will also be appreciated that in the handling and knitting of the yarns of this invention, certain processing techniques are desirable. In particular, it has been found that the use of a felt pad or comparable material under the cone package in which the yarns are usually put up helps to prevent any wraps of yarns that might slough down from catching under the base of the cone and thereby causing a cutout. Also, in regard to the cone build-up, the addition of a taper to the cone further facilitates removal or takeoff of the yarn. For example, increasing the inclination of the yarn from the cone core from an angle of 3° to an angle of about 9° has been found to improve the takeoff of yarn.

The invention is further described with reference to the following examples which are intended to be merely illustrative and not as limiting the scope of the invention. In the examples, the compositions of the viscose, the spinning bath and the like are expressed in percentages by weight, unless otherwise specified.

Example I

A viscose spinning solution was prepared with the cellulose content of about 7 percent and an alkali content of about 6 percent, calculated on the weight of viscose. This solution at a xanthate ratio of about 0.40 and a viscosity of about 50 seconds (as determined by the falling sphere method) was spun through a spinneret having 10 slot orifices into an aqueous spinning bath containing 10 percent sulfuric acid and 18 percent sodium sulfate and about 1 percent zinc sulfate maintained at 55° C. The dimensions of the slot orifices were 450 x 40 microns.

The extruded filaments were immersed in the spinning bath for a distance of 12 inches. The freshly spun yarn was then withdrawn from the spinning bath and was stretched 10 percent in the atmosphere by a takeup roller traveling at a speed of 75 meters per minute.

The resulting yarn was thereafter washed free from acid in the conventional manner and then dried under tension in a conventional conditioning oven. The yarn was then given an S twist of 3.0 turns per inch by a conventional twister and was collected on a spool.

The resulting yarn (designated as yarn A) which had a denier of 104 and consisted of 10 continuous filaments was put up in a cone having 9° angle of inclination from the cone core and weighing approximately one pound. In the following table, the properties of the rayon yarn of this invention are compared with 50/1 combed mercerized cotton and 90/2 combed mercerized cotton yarns that are conventionally used as looper clip yarns in the hosiery industry.

TABLE I

Yarn properties	100/10 rayon yarn	50/1 combed merc. cotton	90/2 combed merc. cotton
Denier	104/10	103	120
Cond. str. (gm./den.)	1.69	1.82	2.23
Wet str. (gm./den.)	.76	1.58	2.40
Cond. elong. (percent)	22.2	10.0	4.6
Wet elong. (percent)	28.7	10.8	6.6
Twist (TPI) "S"	3.0	----------	21.0
Shrinkage (percent)	.8	.2	.9
Eveness (percent)	9.8	16.0	16.4
Knot str. (gm./den.)	1.50	1.74	2.30
Loop str. (gm./den.)	1.08	1.60	2.08
Loop elong. (percent)	8.2	5.6	3.5
Liveliness (turn per meter-looped)	6	14	2
E.D. and E.A. ext. (percent)	2.20	.79	1.52
Friction, yarn to metal (gms.)	.353	.236	.375
Bendability:			
45° (mg.)	8.5	5.0	6.6
99° (mg.)	11.4	6.1	8.8
Friction, yarn to yarn (gms.)	64.0	61.1	64.7
Scroop (gms.)	19.4	2.7	4.1

Inspection of the data in the table reveals that the rayon yarns of this invention have physical properties that favorably compare with that of the cottons. Not only are the condition, knot and loop strengths of the same order of magnitude, but of most importance, the rayon yarn exhibits yarn-to-yarn friction substantially equal to or greater than the cotton yarns.

Example II

In order to demonstrate the importance of the cross-sectional configuration of the filaments and also the number of filaments used in the rayon yarns of this invention, additional rayon yarns B and C were spun following the procedures outlined in Example I using spinneret having slot orifices with dimensions of 550 x 40 microns and 280 x 40 microns, respectively. Yarn B has a denier of 100 grams/9000 meters with 10 filaments and yarn C has a denier of 100 grams/9000 meters with 20 filaments. These yarns both had S twists of 3.0. These rayon yarns, that is, B and C, and yarn A were wound into cones and employed as looper clip yarns in a series of tests on different types of knitting equipment.

All the yarns were evaluated as looper clip yarns on two types of circular knitting machines: a Singer-Fidelity Model LBMF—4 feed, and a Scott & Williams, Model KN—single feed, with six of the former and twenty of the latter machines being used.

Before using yarns A or B, yarn C was used on all the machines. The resulting hose were collected and then compared with those made with yarns A and B. The test samples were collected in red trays for identification and set aside until all the yarn samples had been knit.

Upon evaluation of the hose samples it was found that yarns A and B produced fewer "tails" than yarn C, with yarn A being somewhat better than yarn B. The looper clips made with both yarns A and B (approximately 60 dozen hose) also appeared to be more difficult to start a "run" in.

Example III

In the example, several hose were made with looper clip sections to evaluate the improved rayon yarns of this invention. Samples of yarn A were run on six Reading Mark III knitting machines for two weeks until all of the yarn was depleted (approximately 27 pounds in 1 pound cones). Prior to this run, yarn C was used in the same machine with approximately a minimum of 50 "tails" occurring on the six machines every 24 hours. After changing to yarn A, all "tails" were eliminated. In addition, it was also found that there was a definite improvement in the "resistance to runs" and that the feel and appearance of the yarn was very similar to that encountered with cotton. Advantageously, the general running of the yarn was found to be very good with no other detected problems.

Example IV

In this example, yarns A and C were evaluated on Scott & Williams KN—single feed knitting machines. The evaluation of yarn A was initiated by tying samples of it to three machines that previously had been producing hose with "tails" from the use of sample C yarns. After changing the yarns and making an adjustment of tension, all "tails" were completely eliminated with yarn A.

After approximately 7 to 10 hose were knitted on each machine, samples of yarn C were tied back on the "tails" again occurred on every hose. Following these evaluations, cones of yarn A were tied on fifteen machines which had previously produced hose with "tails" using yarn C. After 6 days' evaluation, approximately 150 dozen hose were produced, and in each case there was a substantial decrease in the number of "tails." In many cases "tails" were completely eliminated. Thus, in every instance yarn A gave superior results over yarn C.

Example V

In another series of runs, evaluation of yarns A and C were conducted on Reading Booton 2-feed machines with an overhead air-conveyor system that conveys the hose to an inspection table. 90 dozen hose were produced from samples of yarn A run on eight machines and observed for two days. As a result of this evaluation, it was found that the hose had fewer "tails" and a greater resistance to runs than encountered with hose produced with looper clip sections using yarn C.

Example VI

In this example, runs were conducted in which yarn A was used to produce looper clip sections on Reading Mark III knitting machines using the normal cone sizes, that is, cones having a 3° inclination from the cone core. Upon knitting of 400 hose utilizing yarn A, only one "tail-out" was encountered. From these and similar evaluations on the same machines, it was found that the rayon yarn of this invention appeared to be equal to cotton yarns in "run" resistance and its use resulted in less waste (that is the number of hose that are seconds or waste) than with the use of rayon yarns such as yarn C.

One difficulty experienced was with the wind of the yarn on the 3° cone. In some instances, the yarn would tend to "pick" or "hang" as if it had been underwound.

Subsequently, several of the Reading Mark III's were changed to run with yarn A built on 9° cones and it was found that the "hang" or "pick" problem was substantially eliminated.

It will be understood that while the preferred embodiments have been described in the examples and in the specification, various changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claim.

What is claimed is:

1. An improved rayon looper clip yarn for use in the manufacture of seamless knit goods and characterized by unique knit-holding properties therein, constructed to comprise in combination:

(a) yarn composed of flat filaments each having a length-to-width ratio from about 9:1 to about 15:1,

(b) said yarn having a maximum twist of from 1 to 6 turns per inch,

(c) a total denier of from about 90 to 120 grams per 9000 meters, and

(d) the denier per filament of said yarn being approximately equal to the absolute value of the length-to-width ratio of said filaments.

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