Oct. 16, 1956 E. WEISS 2,766,505

PROCESS FOR IMPROVING CRINKLED SYNTHETIC YARN

Filed March 27, 1952

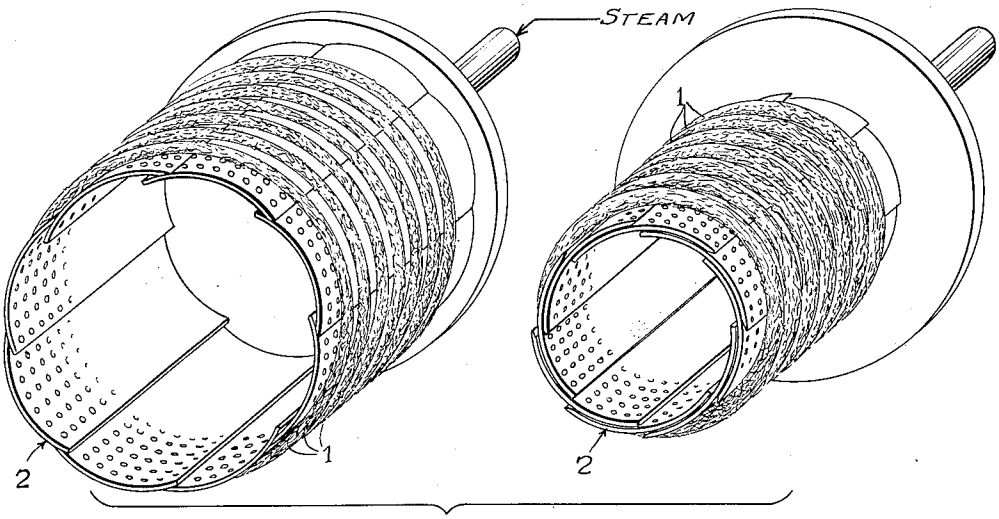

Fig. 1.

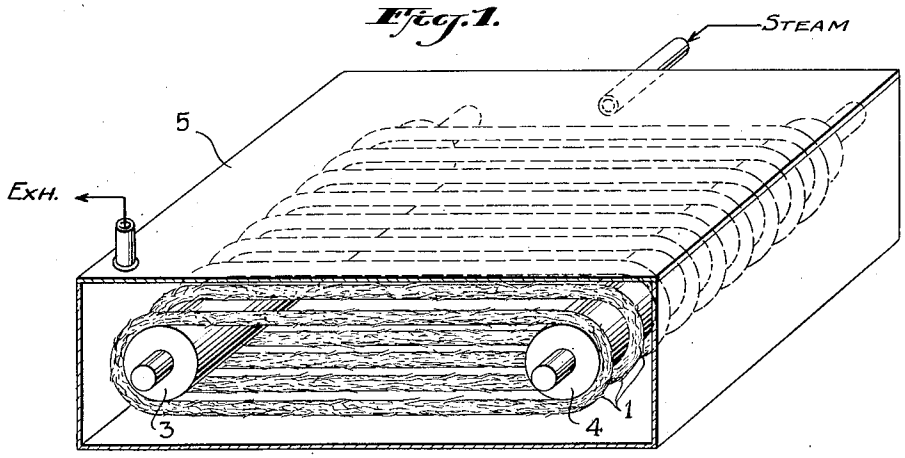

Fig. 2.

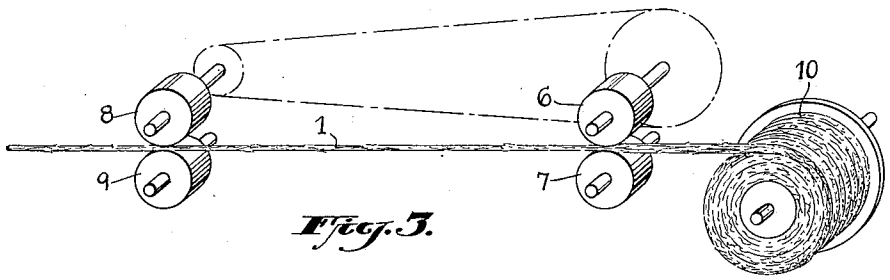

Fig. 3.

INVENTOR.
ERNST WEISS.
BY Wood Crosby & Neal
his ATTORNEYS.

United States Patent Office

2,766,505

Patented Oct. 16, 1956

2,766,505

PROCESS FOR IMPROVING CRINKLED SYNTHETIC YARN

Ernst Weiss, Wattwil, Switzerland, assignor to Heberlein Patent Corporation, New York, N. Y., a corporation of New York

Application March 27, 1952, Serial No. 278,840

Claims priority, application Switzerland April 5, 1951

9 Claims. (Cl. 28—76)

This invention relates to a process for improving the characteristics of wool-like crinkled yarns composed of synthetic fibres.

Mechanical and chemical processes are known for producing wool-like curliness in yarns of artificial fibres. Thus, it has heretofore been proposed by former workers in this field to twist commercial yarns of artificial fibres to at least three times their normal twist, then to submit the yarns to moistening and drying at an elevated temperature to fix the twist, whereupon the yarn was detwisted beyond the zero point, if desired.

The proposed method had the disadvantage, when applied to yarns composed of synthetic fibres, especially polyamide fibres, that the crinkled yarns have some undesirable qualities when used in preparing knitted or woven fabrics. Yarns of this kind, particularly those of large denier, have an exaggerated elongation (sometimes up to more than 200% of their original length) which renders them unsuitable for hand or machine knitting. Furthermore, knitted and woven fabrics produced of finer one-ply crinkled yarns have the unpleasant tendency of rolling and deforming caused by latent tension in the yarn.

The principal object of the present invention is to provide a process which shall avoid at least in part the disadvantages mentioned above. The invention accordingly consists of the novel products as well as the novel processes and steps of processes according to which such products are manufactured, the specific embodiments of which are described hereinafter by way of example and in accordance with which I now prefer to practice the invention.

I have found in accordance with my invention that wool-like crinkled yarn composed of synthetic organic fibres such as nylon, "Perlon" (polyamide fibres), "Terylene," "Dacron" (polyester fibres), "Orlon" (acrylonitrile polymer) and others, which have an excessive elongation or other disadvantage mentioned above, can be treated to reduce this elongation substantially and permanently. The yarns mentioned in this paragraph are those which are prepared by high twisting followed by steaming with ultimate detwisting beyond the zero point. In accordance with my invention such yarn is stretched from about 10 to 70% beyond its unstretched length and is then steamed in such stretched state from 10 to 30 minutes at 1 to 4 atmospheres absolute pressure.

Relatively coarse yarns having the undesired elongation mentioned above, treated according to my process, are rendered more suitable for use as machine and hand-knit yarns. In addition the latent tension in finer yarns as used in weaving and knittuing is removed by my process so that woven and knitted goods prepared therefrom have practically no tendency to roll or deform.

The result obtained by the process herein described

was a surprise. It might have been expected that stretching an dsteaming of the yarns would remove the crinkled or curly effect. This effect, however, is maintained substantially intact by my process while the disadvantages mentioned above are substantially overcome.

The process is applicable primarily to polyamide fibres as, for instance, polyhexamethylene adipamide or the polymer of ε-caprolactam; but as mentioned it is also applicable to other organic fibres as, for instance, those of polyesters of dicarboxylic acids and glycols or acrylonitrile polymers.

Tensioning and steaming of the crinkled yarns can be carried out while the yarns are in the form of skeins or wound on a perforated bobbin under precisely regulated tension. The snrfaces on which the skeins rest should be substantially regularly and uniformly curved and should show substantially no irregularities to avoid the appearance of uneven sections in the yarn which could be easily detected.

In the accompanying drawings there is shown a diagrammatic apparatus for carrying out the tensioning and steaming of the yarns. In these drawings Fig. 1 represents a perspective view of a segmental reel having perforations for admission of steam to the yarn from the interior, the figure on the left of Fig. 1 showing the segments expanded to their fullest extent and that on the right showing the segments overlapping and accordingly in contracted position.

Fig. 2 represents a perspective view of a mechanism adapted for a similar purpose including two parallel rotatable cylinders, the distance of which can be varied; and Fig. 3 is an elevation showing high-speed and low-speed rolls between which the yarn is stretched.

The skeins **1** may be placed, for instance, on a reel **2**, the circumference of which can be adjusted as desired. By enlarging the circumference of the reel the desired tensioning in the skeins can be accomplished. The reel, as shown on the left in Fig. 1, is a segmental reel which is uniformly curved and may be made of circularly curved segments of sheet metal. With a small reel circumference, as shown on the right in Fig. 1, the segments show considerable overlapping while at the maximum reel extention the segments are no longer interlocked. Such interlocking and expansion means are well known.

Tensioning of skeins **1** may also be accomplished by means of the two parallel rotatable rollers **3** and **4** shown in Fig. 2. The skeins **1** are placed on these rollers and by adjusting the distance therebetween in a well-known manner more or less tension can be put upon the skeins, the rollers being mounted in a steam chamber **5**. Due to the steady movement of the skeins on the rotating rollers the irregularities in the yarn may be avoided.

Instead of treating the yarns in skeins they may be tensioned as single yarns between two roller pairs placed at a suitable distance from each other and having different speeds. Thus rollers **6** and **7** shown in Fig. 3 are slow-speed rollers and rollers **8** and **9** are high-speed rollers. The yarn passes consecutively through the pair **6**, **7** and **8**, **9** from a roll **10** and then passes to a perforated take-up spool (not shown) without changing the dimension of the yarn. The so stretched yarn, wound up on the perforated spool is then placed in a closed chamber and steamed.

Relatively coarse yarns processed in accordance with my invention for use in hand and machine knitting should be elongated to about 50 to 70% of their length. Finer yarns intended for knitting and weaving should be elon-

gated to about 10 to 50% before steaming. Such yarns are frequently sized after being treated according to my process.

The following are examples of the manner in which I now prefer to carry out the process of my invention. It is to be understood that the examples below are simply illustrative and that the invention is not restricted thereto except as indicated in the appended claims.

Example 1

Nylon yarns (consisting of endless fibres of polyhexamethylene adipamide) 150 den., 46 filaments, are twisted on well-known apparatus to 2300 T/mz (turns per meter **Z** direction), steamed on the twisting bobbins for one-half hour under 3 atmosphere absolute pressure, detwisted beyond point zero to 100 T/ms (turns per meter **S** direction); then 4 such yarns are plied together to 50 T/mz, reeled and the skeins are steamed again for a short period without pressure. Thus an extremely voluminous yarn is obtained, the fibres of which are very curly. But the yarn has an excessive elongation, which renders it difficult to use by hand or machine. However, the yarn can be stretched about 60% to 70% without losing its wool-like character and curliness. The yarn in the form of skeins **1** is accordingly placed on a reel **2** (Fig. 1), the circumference of which can be changed at will, and which has a wide surface and is elongated to about 60–70% beyond its length in unstretched condition, and steamed in tensioned condition for 15 minutes with 3½ atmosphere absolute pressure. Thus a fixation of the length and the character of the yarn is obtained so that it has a good wool-like character and its elongation proportions are fixed so that it has the desired characteristics of yarn for knitting and other processing.

Example 2

A 140 den. yarn, composed of 48 endless polyamide fibres made from ε-caprolactam, is twisted respectively to 2200 T/mz, and 2200 T/ms, then steamed for 40 minutes at 1.75 atmospheres absolute pressure. The z yarn is detwisted beyond point zero to 100 T/ms, the s yarn is twisted beyond point zero to 100 T/mz. One s and one z yarn are now twisted together to 60 T/mz, reeled under tension-circumference of reel 135 cm. The skeins thus obtained are suspended now without any tension in damp air, resulting in a very voluminous yarn, consisting of strongly curled fibres. The skeins **1** are now put on a pair of parallel rotating rollers **3, 4** (Fig. 2) the distance of which can be changed, and in enlarging the distance between the two cylinders, the skein circumference is stretched up to 85 cm. giving a 65% elongation beyond its unstretched length. While rotating the cylinders, the yarn is then steamed for 10 minutes at 2 atmospheres absolute pressure. Thus one gets a relatively voluminous yarn with typically crinkled fibres and having the desired elastic properties.

Example 3

A yarn composed of endless fibres of polyhexamethylene adipamide of 45 den. is twisted to 3800 T/mz and steamed in this condition for ¾ hour at 3.2 atmospheres. Then the yarn is detwisted to 120 T/ms, reeled, and then removed from the reel, whereby the skeins contract. They are then stretched to about 20% beyond their unstretched length and are steamed with a little tension for ½ hour at 4 atmospheres aboslute pressure. The yarn is then sized under tension, whereupon it can be used in manufacturing woven and knitted fabrics. Knitted fabrics, manufactured with these yarns, do not show any tendency to curl or to deform, as usually happens with the well-known prior process.

Example 4

Nylon yarn of 150 den. is twisted as described in Example 1 to 2300 T/mz, steamed, detwisted to 100 T/ms, plied 4 times, skeined, and steamed again. This plied yarn, which is extremely stretchable, is now extended to

50% in a tensioning arrangement, containing two roller pairs **6, 7** and **8, 9** (Fig. 3) turning at different speeds and covered with soft rubber. The yarn is passed successively through the two roller pairs; the roller pair **8, 9** operates at 50% more speed than the roller pair **6, 7**. The yarn is elongated to 50% beyond its unstretched length. After leaving the roller pair **8, 9**, the yarn is then wound on a perforated spool, the speed of which is similar to the roller pair **8, 9**; and then it is steamed for 20 minutes at 3½ atmospheres absolute pressure. After this, the yarn shows good wool-like character and favourable stretch qualities for further processing.

Polyester yarns ("Dacron") and acrylonitrile polymer yarns ("Orlon") show similar results when processed in accordance with the above examples.

What I claim is:

1. In a process for improving the characteristics of wool-like crinkled yarn composed of endless synthetic organic fibres and prepared by highly twisting such fibres followed by steaming with steam for about ¼ to ¾ hour at 1 to 4 atmospheres absolute pressure and ultimate detwisting beyond the zero point, the step of stretching said yarn from about 10 to 70% beyond its unstretched length and steaming the yarn in such stretched state for about 10 to 30 minutes at about 1 to 4 atmospheres absolute pressure, thereby limiting the subsequent elongation of the yarn and substantially avoiding the tendency to curl and distort in fabrics made from said yarn.

2. A process in accordance with claim 1 in which the steaming of the yarn is conducted while the yarn is wound in substantially cylindrical form on substantially uniformly curved surfaces.

3. A process in accordance with claim 1 in which the yarn prior to steaming is wound in substantially cylindrical form and is stretched while in such form while undergoing further steaming.

4. A process in accordance with claim 1 in which the yarn is placed on rotating supports having their longitudinal axes arranged substantially parallel and the supports are then moved apart to provide the desired tension in the yarn.

5. A process in accordance with claim 4 in which the yarn is moved constantly by the rotating supports during tensioning and steaming to avoid irregularities in the resultant yarn.

6. A process in accordance with claim 1 in which the yarn is reeled up under accurately regulated tension and is then subjected to the steaming.

7. A wool-like crinkled yarn composed of synthetic organic fibres treated in accordance with the process of claim 1 to limit the elongation and improve the characteristics thereof.

8. In a process for improving the characteristics of wool-like, crinkled, multiple-ply yarn composed of a plurality of yarns each comprising endless synthetic organic fibers and prepared by highly twisting such yarn followed by steaming with steam for about ¼ hour to ¾ hour at about 22–52 lbs./sq. in. and ultimate detwisting beyond the zero point, the so-treated yarns being plied together to form said multiple-ply yarn, the stem of stretching said multiple-ply yarn from about 10 to 70% beyond its unstretched length and steaming the yarn in such stretched state with steam for about 10 to 30 minutes at about 15–60 lbs./sq. in., thereby limiting the subsequent elongation of the yarn and substantially avoiding the tendency to curl and distort in fabrics made from said yarn.

9. In a process for improving the characteristics of wool-like, crinkled yarn comprising endless synthetic organic fibres and prepared by highly twisting such yarn followed by steaming at a temperature and for a time sufficient to fix the twist and ultimate detwisting beyond the zero point, the step of stretching said yarn from about 10% to 70% beyond its unstretched length and steaming the yarn in such stretched state for about 10 to 30 minutes at a pressure above atmospheric pressure but no greater

than about 4 atmospheres absolute pressure, thereby limiting the subsequent elongation of the yarn and substantially avoiding the tendency to curl and distort in fabrics made from said yarn.

References Cited in the file of this patent

UNITED STATES PATENTS

1,962,424	Brownell	June 12, 1934
2,398,787	Hansen et al.	Apr. 23, 1946
2,477,156	Waltz	July 26, 1949
2,509,351	Reinhardt et al.	May 30, 1950
2,577,453	Miller	June 19, 1951
2,584,779	Averns et al.	Feb. 5, 1952
2,624,934	Munson et al.	Jan. 13, 1953
2,662,558	Mersereau et al.	Dec. 15, 1953
2,662,559	Miller	Dec. 15, 1953
2,662,560	Jackson	Dec. 15, 1953