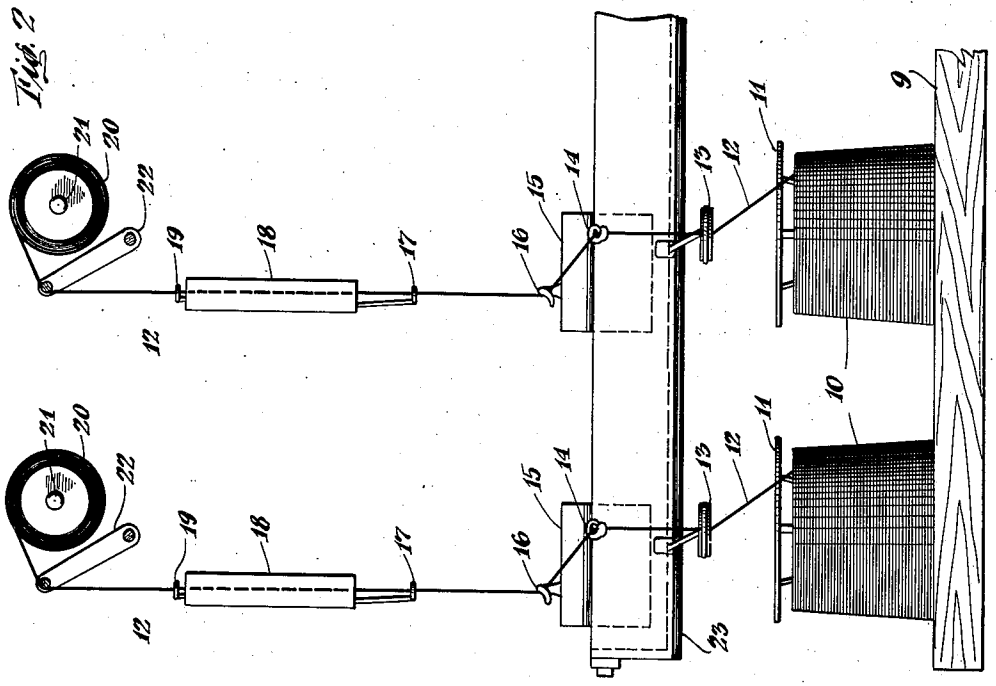
June 20, 1944. F. W. MATTINSON ET AL 2,351,865

TREATMENT OF RAYON YARN

Filed Oct. 9, 1942

Fig. 2



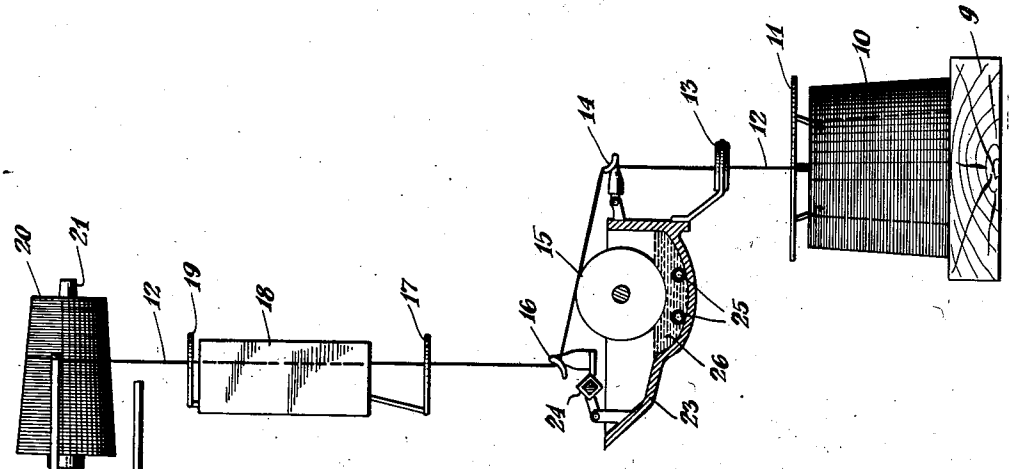


Fig. 1

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Patented June 20, 1944

2,351,865

UNITED STATES PATENT OFFICE

2,351,865

TREATMENT OF RAYON YARN

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Application October 9, 1942, Serial No. 461,366

7 Claims. (Cl. 117—144)

This invention relates to the manufacture and treatment of rayon; and, more particularly, to such manufacture and treatment of a type of rayon yarn which is especially adapted for the manufacture of ladies' hosiery, or for other use as a substitute for natural silk.

In the manufacture of hosiery from rayon as a substitute for silk, a substantial problem which has been encountered has been to discover or develop a sizing material suitable for treatment of the yarn before it is subjected to the hosiery or other manufacturing process. Generally speaking, yarn for use in knitting hosiery should be flexible but firm. A "silk" stocking should maintain its shape, and should not "drape," but a stiff or harsh yarn, which is inflexible, is apt to give serious difficulty in knitting.

To avoid these and other difficulties encountered in the hosiery manufacturing process, it has been found that a thread containing a "solid" type of size has properties superior to one containing the more usual liquid size. Various efforts have been made to apply such solid or wax-like sizes to rayon yarn. For example, use has been made of a process in which a waxy sizing material is dissolved in an organic solvent. The skeins of yarn are then soaked in the solution prior to twisting and winding. This process is expensive, both because of the use of the organic solvent and because of the extra labor and processing involved. Use has also been made of a process of treating the yarn with a water-emulsified wax, but the use of such an aqueous emulsion is disadvantageous for two reasons, first—the yarn has a selective absorption for the moisture or water in the emulsion; and second—this water has to be evaporated or dried before subsequent use.

We have found that markedly better results can be obtained, in the application of solid or waxy types of sizing materials, and that labor, time, handling and expense are reduced, by the application of such sizes in molten condition. For best results the sizing material should be solid, or, at least, of a waxy texture, under normal atmospheric conditions, but capable of being melted at a temperature low enough so that its application in molten condition will not injure the thread. By maintaining the sizing material in a molten condition, and so applying it during the winding of the thread, the difficulties and expense of the former processes—that is dissolving the solid size in an organic solvent, treating the thread with the resulting solution, and then evaporating the solvent from the treated thread; or the use of a water-emulsified wax—are avoided, and better results are obtained with the use of standard equipment, requiring only the installation or use of heating means in conjunction with the usual oil trough. This avoids many difficulties and expenses arising from use of either an organic solvent or a water emulsion as previously proposed.

In the accompanying drawing:

Figure 1 is a side elevation, partly in section, of suitable apparatus for carrying out our invention; and

Fig. 2 is a front elevation of the same apparatus.

Referring to the drawing more in detail, 10 represents a rayon yarn cake supported on a shelf 9, for rewinding. The cake is provided with a cake "bonnet" 11 to prevent tangling of the thread 12 as the latter is unwound. This thread then passes through the circular guide 13, thence over the pigtail guide 14 and across the roller 15. From the latter the thread passes around the lower guide 16, thence through the washboard tension guide 17, the "book" or "washboard" tension device 18, and the slub-catcher 19, after which it is wound into the cone 20. The latter rotates on the cone-spindle 21 and the yarn is wound onto the cone over the traverse mechanism 22 (see Fig. 2). The roller 15 rotates in an immersion trough 23 provided with a control bar 24, whereby the amount of size picked up by the thread can be adjusted and controlled by changing the angle at which the thread crosses the roller, and thus altering the time of contact with the roller.

As described so far, the apparatus may be similar to conventional ones in common use. According to a preferred embodiment of our invention, however, we provide in the immersion trough 23 a suitable heating coil or loop of tubing 25 (e. g., carrying high pressure steam or other heating fluid), or other heating device (such as electrical heating elements, not shown), by means of which the sizing material, which is solid or wax-like at ordinary temperatures, may be brought to and maintained in molten condition, and at a desired temperature, for example between about 30° and 48° C., when placed in the trough 23. This molten material is indicated at 26, and its level is sufficiently high so that a portion of the surface of the roller 15 is immersed therein. The amount applied to the thread 12 may be regulated by adjusting the length of contact of the latter with the roller 15, as by moving the control bar 24 horizontally farther away or closer to the pigtail guide 14.

We have found that a variety of "solid" type or waxy sizes, which are solid under ordinary atmospheric conditions but have a melting point sufficiently low so that they may be applied to the yarn without injury thereto, are suitable for use according to our invention. Thus we have found that either a mineral wax such as paraffin or ceresin, or waxes of the poly-alkylene-glycol type are suitable for the purpose. We have successfully employed both mineral waxes made self-emulsifiable by means of a triethanolamine oleate, and water-soluble synthetic waxes such as those sold under the trade name "Carbowax," by Carbide and Carbon Chemicals Corporation of New York city.

"Carbowax" is a generic term used by the Carbide and Carbon Chemicals Corporattion to describe solid polyethylene glycols having the general formula $HO(CH_2CH_2O)_nH$.

The polyethylene glycols of comparatively low molecular weight are viscous liquids as for example:

Tetraethylene glycol ($n=4$; molecular weight approx. 200)
Hexaethylene glycol ($n=6$; molecular weight approx. 300)
Nonaethylene glycol ($n=9$; molecular weight approx. 400)

The identifying property used by the Carbide and Carbon Chemicals Corporation is the molecular weight, e. g. "Carbowax 1540" represents a polyethylene glycol where n is sufficiently large to yield an average molecular weight of about 1540. The melting point of the wax is proportional (but not in direct proportion) to the average molecular weight of the glycol and we have made mixtures of the various polyethylene glycols to obtain waxy materials having various melting points.

For example a typical sample of Carbowax "4000" has a melting point of 50° C. and of Carbowax "1540" a melting point of 45° C. whereas nonaethylene glycol molecular weight of approximately 400 is liquid at normal temperatures. We have used mixtures of Carbowax "4000," Carbowax "1540" and liquid ethylene glycols such as nona and hexaethylene glycol (molecular weights 400 and 300 respectively) to obtain waxes of various melting points.

We have found that we obtain the best results with polyethylene glycol mixtures having a melting point of about 37° C. but good results are also obtained with mixtures having melting points of from about 30° C. to 47° C.

Below about 30° C. we do not obtain the necessary firmness and rigidity in the yarn while above about 47° C. there is difficulty in obtaining a uniform cone.

With waxes melting above about 47° C. the cone tends to bulge at the nose and although the reason is not clear it is probably due to the heat driving off moisture from the yarn on the cone resulting in shrinkage and hence pressure causing the inner layers of thread to be pushed outwards.

We have also found that good results are obtained in hosiery processes by the use of yarn containing from as low as approximately 5% to as high as approximately 15% of the sizing material with best results, as at present advised, at a size content of about 12% by weight.

The examples given above, and illustrative method and apparatus for their use, include the best embodiments of our present invention now known to us; but it is to be understood that the invention is not necessarily or specifically limited thereto and may, under proper conditions, have other embodiments, produced in other ways, without departure from the spirit of the invention, and within the scope of the following claims.

We claim:

1. The process of treating rayon thread with a solid sizing material which comprises applying to the thread a molten sizing material comprising a wax having a melting point between approximately 30° and 48° C.

2. In a process of treating rayon thread, the step which comprises treating the thread with a molten sizing material comprising a mixture of poly-alkylene-glycols having an average melting point between approximately 30° and 48° C.

3. In a process of treating rayon thread, the step which comprises treating the thread with a polyethylene glycol composition having a melting point of approximately 37° C.

4. An article of manufacture comprising a rayon yarn thread sized with between approximately five and fifteen percent by weight of a wax having a melting point between approximately 30° and 48° C.

5. An article of manufacture comprising a rayon yarn thread sized with between approximately five and fifteen percent of a polyethylene glycol material having a melting point between approximately 30° and 48° C.

6. An article of manufacture comprising a rayon yarn thread sized with approximately twelve percent of a wax-like material having a melting point of approximately 37° C.

7. As a novel article of manufacture, a twisted rayon yarn suitable for use in knitting ladies' hosiery, as a substitute for natural silk, said yarn being sized, before knitting, with between about 5% and 15% of a sizing material comprising a mixture of polyethylene glycols having a melting point between about 30° C. and 47° C., both inclusive.

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