

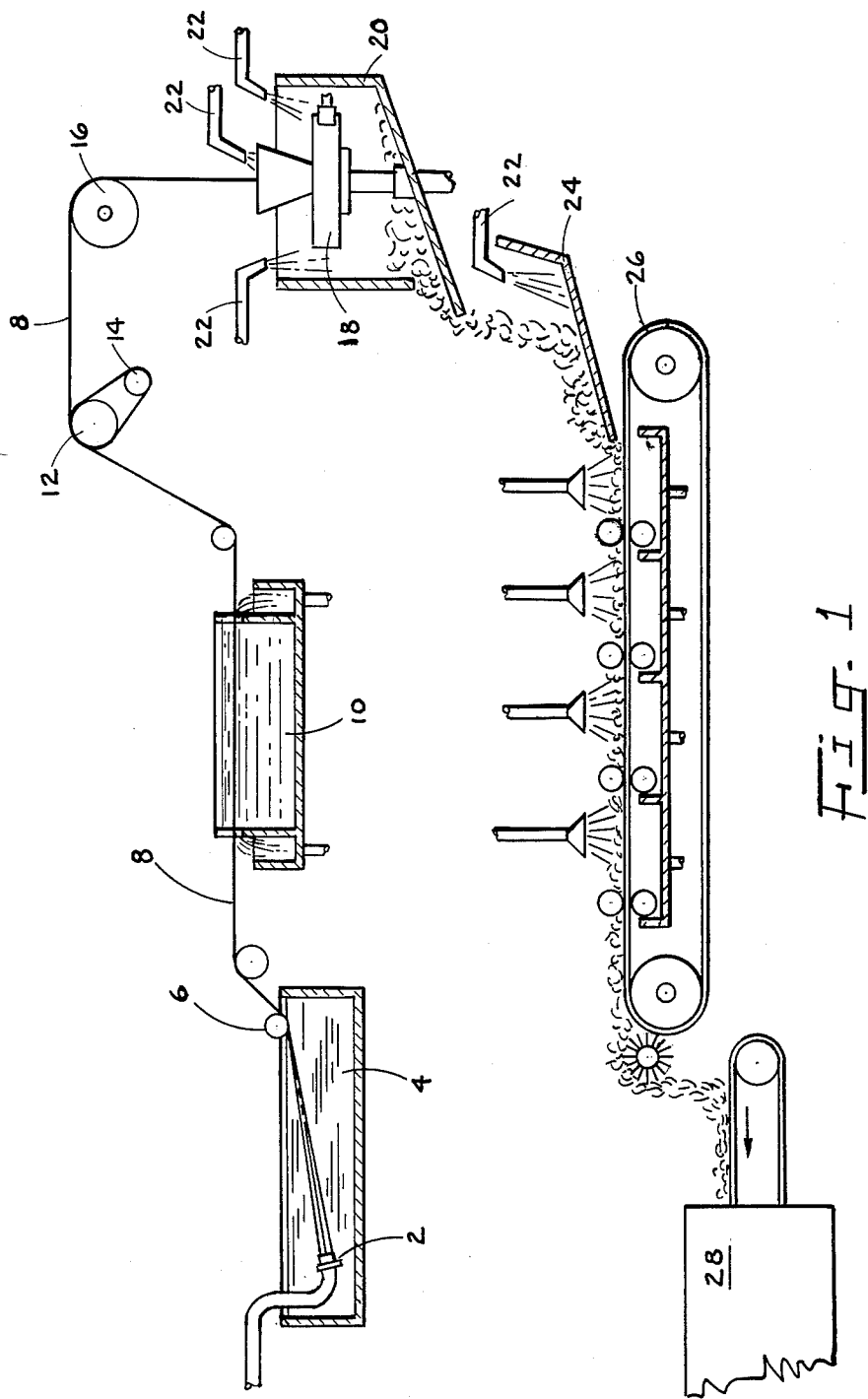
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METHOD FOR PRODUCING CRIMPED RAYON STAPLE FIBER

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METHOD FOR PRODUCING CRIMPED RAYON STAPLE FIBER

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3 Claims. (Cl. 18—54)

This invention relates to a method of manufacturing improved regenerated cellulose filaments and fibers. More particularly it relates to a method of producing regenerated cellulose fiber having improved crimp, crimp recovery and soil resistance.

The crimped rayon staple fiber used in cut pile tufted carpets has a highly serrated contour in cross section. These serrations or grooves in the fiber surface provide easily accessible sites in which fine particles of dirt become lodged. This impairs the appearance and weaving quality of the carpet as well as making it difficult to clean by the usual vacuuming procedures. Rayon fibers with smooth circular cross sectional contours are used in tufted carpets, but their use is limited to loop pile construction as they do not have sufficient crimping properties to produce a satisfactory texture in cut pile construction.

The crimping of fibers in general is beneficial to improve the properties of articles manufactured therefrom; for examples, carpets, blankets and towels manufactured from crimped fibers usually demonstrate improved texture and durability. Crimped fibers most desirable for the manufacture of carpet material and other fabrics subjected to hard wear should contain filaments having low strength moduli and high elongation properties in order to produce a more durable material.

It is an object of this invention to provide regenerated cellulose fiber having a high degree of crimp, crimp recovery and smooth cross sectional contour.

It is another object of this invention to provide a method for the production of regenerated cellulose filaments of smooth cross sectional contour having low strength moduli and high elongation properties in a relatively wide denier range.

These and other objects are accomplished in accordance with the present invention wherein a method is provided for producing improved regenerated cellulose fibers which comprises extruding filament forming viscose having a total sulfur content of from about 1.5 and less than 2.4% by weight into a spinning bath having a strong coagulating action and containing from 0.1 to 0.4% by weight of zinc sulfate, applying tension in air to the formed filament to obtain a stretch of from about 5 to less than 20% of the original length of the filament, and then washing said filament in a relaxed state in an aqueous medium having a temperature ranging from over 60 up to 100° C.

Filament forming viscose which in general is useful for the present invention contains from 7 to 12% by weight of cellulose, and from 4.5 to 7.5% by weight of sodium hydroxide. Enough carbon disulfide is present in the viscose to obtain a total sulfur content of from 1.5 to less than 2.4%. It is preferable that the total sulfur content of the viscose should be in the range of from 2 to 2.3%. Beneficial properties of fibers produced in accordance with the invention drop off and disappear with amounts of sulfur of 2.4% and over. It is apparent that a low by-product sulfur content at spinning age is beneficial to the development of desired fiber properties. The preferred viscose for this invention contains from 8–10% cellulose and from 5 to 6.5% sodium hydroxide. Broadly the viscose should be aged to a sodium chloride salt test of from 3.5 to 5 and preferably should possess

a salt test figure of 4. This salt test range is necessary to produce a fiber having a smooth cross sectional periphery.

As previously stated the spinning bath for the method of this invention must have a strong coagulating action upon extruded viscose. Thus it is required that from 17 up to about 21% and preferably about 19% of sodium sulfate be incorporated in the bath. This amount of sodium sulfate is required to obtain crimp, crimp recovery and a smooth cross sectional surface of the regenerated filament. Zinc sulfate in the amount of from 0.1 to 0.4% and preferably 0.3% by weight of the spinning bath is required to produce a fiber with crimp recovery and in addition for improvement of elongation properties which affects the amount of crimp in the finished fiber. From 5–6% and preferably 5.2% by weight of sulfuric acid is incorporated in the spinning bath solution. Lower and higher amounts of the bath acid have been shown to undesirably decrease the crimp recovery property of the fiber. The spinning bath temperature should be kept between 40 and 60° C. in order to obtain the best properties in the finished fiber.

After leaving the spinning bath the fiber may or may not be run through a regenerating bath, usually of the cascade type, containing up to 3% acid. Care should be taken, however, to remove the fiber from this bath after a short period of immersion to prevent excessive regeneration of the fiber to avoid destroying the ability of the fiber to crimp.

On leaving the coagulating or regenerating bath or baths, tension is applied to the formed fiber or filaments to obtain a stretch of from about 5 to less than 20% and preferably 10% of the original length of the filament. This low stretch results in a highly disoriented cellulose structure having abnormally high swelling characteristics and on further processing the filaments or fiber obtain a high degree of crimp and linear contraction or crimp recovery. Slight tension on the fiber is necessary for satisfactory plant operation while, under the conditions of the invention, a stretch of 20% and over produces a fiber having very little crimp. It appears that the optimum amount of stretch for this method is about 10%.

After stretching the fiber is caused to become relaxed. This is usually accomplished by cutting the fiber in short free lengths. The relaxed fiber is washed or sluiced in an aqueous medium having a temperature of from 60–100° C. Sluice water temperature below 60° C. causes a considerable reduction in the crimp produced in the fiber. Temperatures above 100° C. will tend to degrade the regenerated cellulose. After sluicing, the crimped fibers are processed and dried.

The finished fibers are used in the manufacture of carpeting, blankets, toweling, etc. During the fabric manufacturing process, the fibers are necessarily subjected to longitudinal tension and some of the crimp is removed. However, upon wetting, the crimp is reestablished to produce an excellent finished fabric. As can be realized, this property of crimp recovery is an extremely important fiber characteristic.

FIGURE 1 of the drawing is a diagrammatic view of the manipulative steps of this invention.

Viscose as defined herein is extruded through spinneret 2 into the spinning bath 4 to form a plurality of filaments drawn together under guide 6 to form fiber 8. The fiber 8 may or may not be run through regenerating bath 10 of the cascade type. On leaving the baths the fiber 8 proceeds over godet 12 and hook or idler guide 14 and then makes several turns around large godet 16. Godet 16 moves at a faster peripheral speed than godet 12 resulting in the desired stretch of fiber 8 between the two godets. The stretched fiber proceeds from the godet 16

3

to a cutting mechanism 18 which cuts the fiber into short free lengths and permits them to drop to sluice box 20. Water is fed to the sluice box and wash trough through nozzles 22 at a temperature within the given range. The washed or sluiced fibers float down trough 24 into moving belt 26 which carries the fibers through processing zones and then into the dryer broadly designated as 28.

The following example demonstrates the best mode of carrying out this invention under plant conditions.

Example

A viscose containing 9% by weight of cellulose, 26-30% carbon disulfide based on the weight of the cellulose and 6% by weight of sodium hydroxide was extruded at a speed of 61.6 meters per minute into a spinning bath containing 5.2% by weight of sulfuric acid, 0.3% by weight of zinc sulfate and 19% by weight of sodium sulfate, and having a temperature of 53° C. The viscose had a common salt test of 3.8. The 15 denier filaments produced were immersed in the spinning bath for a length of 30 inches and then tension was applied in air to the formed filaments to obtain a 10% stretch. After stretching, the fiber was cut into short lengths and dropped into a sluice box having a water inlet temperature of 90° C. The resulting crimped fibers from the sluice box were processed by washing, desulfurizing, rewashing, finishing and drying.

Fibers produced in a manner as described were woven into a cut pile construction carpet. The carpet produced was placed in a well used area along with carpets woven with crimped regenerated cellulose fibers produced by other methods and with carpets woven of wool. After long continuous use wherein many persons walked on these carpets the fabric was examined and it was found that the carpet woven with fabric produced in accordance with this invention was much more durable and cleaner than the other carpets woven of crimped regenerated cellulose fibers and said fabric demonstrated only slightly more wear and was just as clean as the wool carpet.

The conditions under which the method of this invention is practiced were developed, after realization of the broad concept, by extensive experimentation and testing. Within the conditions of this invention crimped fiber is produced which is characterized by excellent crimp development, retention and recovery. In addition, said fiber excels in soil resistance and durability when compared with other crimped rayon fiber.

4

Various changes and modifications may be made in practicing the invention without departing from the spirit and scope thereof and, therefore, the invention is not to be limited except as defined in the appended claims.

We claim:

1. A method of producing improved regenerated cellulose fibers which comprises extruding viscose, having a common salt test figure of from 3.5 to 5 and containing from 7 to 12% by weight of cellulose, from 4.5 to 7.5% by weight of sodium hydroxide, and carbon disulfide in an amount sufficient to provide from 1.5 to less than 2.4% sulfur in the viscose, into a spinning bath containing from 5 to 6% by weight of sulfuric acid, from 0.1 to 0.4% by weight of zinc sulfate and from 17 to 21% by weight of sodium sulfate, and having a temperature of from 40 to 60° C.; applying tension in air to the formed filament to obtain a stretch of from about 5 to less than 20% of the original length of the filament, and then washing the filament in a relaxed state in an aqueous medium having a temperature ranging from about 60 to 100° C.

2. The method of claim 1 wherein the filament is stretched to about 10% of its original length and the aqueous washing medium has a temperature ranging from 80 to 90° C.

3. A method for producing improved regenerated cellulose fibers which comprises extruding viscose having a common salt test figure of about 4 and containing from 8 to 10% by weight of cellulose, from 5 to 6.5% by weight of sodium hydroxide and carbon disulfide in an amount sufficient to provide a viscose containing from 2 to 2.3% sulfur into a spinning bath containing about 5.2% by weight sulfuric acid, about 0.3% by weight of zinc sulfate and about 19% by weight sodium sulfate, and having a temperature of from 40 to 60° C.; applying tension in air to the formed filament to obtain a stretch of about 10% of the original length thereof, sluicing the filament in a relaxed state with water having a temperature of from about 80 to 90° C., and drying the fiber.

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