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METHOD OF FULLING KERATINOUS GOODS

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ABSTRACT OF THE DISCLOSURE

Woolen goods with or without other keratinous or artificial fibers are fulled in a bath containing an aqueous fulling solution and a major amount of an organic liquid substantially immiscible with water, of greater density than the aqueous solution, in shorter time and with fewer steps than are customary in fulling practice.

This invention relates to the fulling of keratinous materials especially wool and mixtures of wool with other keratinous or synthetic fibers, for instance to the fulling of woven or knitted goods, including those having a base of carded wool.

It is desirable that some goods, such as sweaters and robes should have a soft and fluffy appearance and hand and improved thermal qualities, and to obtain these the goods are customarily subjected to fulling. Fulling, especially when applied to mixed goods containing some hair, such as Angora, cashmere, camel, and lamb's wool, produces a migration of the hair toward the surface whereas, before the treatment, it was tightly twisted into the threads. This migration enhances the fluffiness and imparts qualities pertaining to hair. Fulling has required a succession of treatments, degreasing in aqueous medium at about 40° C. to remove natural fats and oiling products, the medium usually containing a strong surface active agent in soft water, followed by rinsing and treatment in an aqueous bath of soft water, at about 40° C., containing wetting agents and wool softeners; after centrifuging the goods were dried and had a good feel, soft and fluffy. The results were good but the process was long, taking more than an hour in most cases, and requiring skilled supervision if even quality was to be obtained.

It is an object of this invention to produce fulled goods of excellent quality equal to that currently available in a shorter time by a process requiring less expert attention, simpler apparatus, and fewer steps. A special object is to full the goods in a single step with reproducible results.

The objects are accomplished, generally speaking, by a method of finishing keratinous goods such as knitted and woven articles and carded wool to impart improved qualities which comprises immersing the goods repeatedly in an agitated bath having as essential components an aqueous fulling medium and a major quantity of an organic liquid substantially immiscible with water, of greater density than the aqueous medium.

In putting the invention into effect a fulling bath is made up of an aqueous fulling medium and an organic liquid, substantially immiscible with water, of greater density than the aqueous medium and usually present in major proportion by volume, the bath is agitated with sufficient vigor to produce a suspension of one phase in the other, and the goods are repeatedly plunged into, drawn through, and removed from it. The process is particularly effective with woven or knitted articles having a carded wool base and containing some hair such as Angora, cashmere, camel and lamb's wool in proportions between about 5 and 30% by weight.

The aqueous medium of the invention is usually a simple solution of a wool softener of classic type in water. Among such softening agents are quaternary ammonium salts, and amine salts of fatty acids, which also improve the qualities of the wool. In most cases 5 to 50 g. of softener per liter are satisfactory. The aqueous medium should be present in an amount capable of wetting the goods thoroughly, which is accomplished if its weight is between about one and ten times the weight of the dry goods, but one may use much greater weights without decreasing efficiency.

The organic liquid of the bath is of greater density than the aqueous medium, is substantially immiscible with water, and is desirably a halogenated hydrocarbon, such as a halogenated aliphatic hydrocarbon, for instance perchloroethylene, trichloroethylene, dichloroethylene, the trichloroethanes, and the trichlorotrifluoroethanes. The organic phase of the bath is desirably present as far as fifty times the volume of the aqueous medium, six to one being quite satisfactory in most uses. During the treatment the bath is agitated so as to keep the aqueous and organic phases in mutual suspension.

It has been observed with surprise that fulling proceeds much more rapidly in the mixture of the aqueous medium and of an organic liquid of greater density than the aqueous medium, than in ordinary fulling liquids and to an equally good result.

The apparatus employed is essentially simple, including an enclosed chamber containing a tank and a rotary drum the lower arc of which is submerged in the fulling bath. The drum is foraminous, rotates about a horizontal axis and has a ratio of diameter to depth being between 1 and 5. The drum can be rotated and reversed in rotation and can be run at high speed to centrifuge the wet goods. The drum may have internal baffles or projections to assist in the manipulation of the goods. The drum picks up the goods, draws them through the liquid, and elevates them until they fall back into the bath by gravity. For a drum of about 80 cm. diameter and 35 cm. of depth a good speed of rotation is 40 r.p.m. The apparatus may be provided with temperature control for the bath, for instance a heating coil of electric or steam type controlled by a thermostat, with a circulating line passing through a filter to strain out dust and loose fibers, and with a reservoir to keep the bath at constant level. A hot air drier can be associated with the chamber to complete the drying begun by spinning the drum. The apparatus can be connected to apparatus for recovering organic liquid, for instance a still and condenser to purify the organic liquid by distillation and condensation.

It is advantageous to associate an air drier and means for clarifying the organic solution with the fulling apparatus itself, for example a still and a condenser may be attached to the vat to recover contaminated organic liquid, recovery being either by direct distillation of the liquid or by distillation of its azeotrope with water.

A preferred method of proceeding is as follows: The drum of the apparatus receives the goods to be treated, of which the apparent volume does not substantially exceed 75% of the volume of the drum, and the vat receives the fulling bath. The drum is rotated so as to subject the goods to repeated immersions in and travel through the bath followed by withdrawal on the drum and a fall back into the bath from above. The treatment is accomplished at a temperature preferably approaching the ambient temperature but temperatures between 10° and 70° C. may be suitable. During successive operations the temperature of the bath increases but this does not reduce the quality of the result. However, it is advantageous to reduce the time of treatment as the temperature rises, when uniformity of result is desired. It is to be noted that the temperature may vary several degrees

during the course of an operation without appreciably modifying the uniformity of result. It is an astonishing accomplishment of this invention that the time of treatment is usually between 3 and 7 minutes and seldom exceeds 15 minutes. It is unnecessary to degrease the goods prior to treatment because they are degreased by the treatment itself; this is highly novel and advantageous. Preliminary cleaning of the goods is also unnecessary because the bath of this invention acts as a cleaning bath. Other treatments may be accomplished by including appropriate agents in the bath. For example bacteriacides, antilarval agents, waterproofing agents, and greaseproofing gents, all of which are known for the treating of wool and need not be recited here.

After the treatment the goods are drained and dried, preferably by hot air in the fulling apparatus itself.

In comparison with the prior art of fulling the novel process produces fulling of excellent quality, with sharply reduced time of treatment. It eliminates most of the preliminary processes and adjuvants which have heretofore been employed. It is carried out in a single relatively simple apparatus which produces effects which are entirely reproducible so that the machine may work according to a program. The bath may be used in successive operations before recouping the organic liquid.

The following example illustrate the invention without detracting from the generality of what is elsewhere herein described:

EXAMPLE 1

An enclosed vat provided with a perforated rotary drum rotating about a horizontal axis and composed of stainless steel, having a diameter of 815 mm. and a depth of 335 mm. received 35 l. of an aqueous solution containing 10 g./l. of a softening agent, constituted by a quaternary ammonium salt having a long fatty acid chain which had been partially ethoxylted, and 35 l. of tetrchloroethylene. The level of the liquid was established at about 33% of the height of the drum. 5 kg. of knitted sweaters, containing 88% carded wool and 12% camel hair were admitted to the drum, which was rotated at 40 r.p.m. for 10 minutes at 29° C. The articles were centrifuged for 3 minutes and dried in air at 70° C. for 20 minutes. The sweaters had a particularly soft touch and a fluffiness similar to that obtained by the best prior art fulling in aqueous medium. The bath was used again in 20 successive operations, alway maintaining the total volume of the bath and its content of water and sofening agent.

EXAMPLE 2

Operating as in Example 1 but with a bath constituted by 10 l. of an aqueous solution at 35 g./l. of an amine salt of palmitic acid and 60 l. of tetrachloroethylene. The treatment was carried on for 4 minutes at 50° C. After centrifuging and drying, the sweaters had a feel and a fluffiness identical to those obtained in Example 1.

EXAMPLE 3

Using the apparatus of Example 1 but with a bath composed of 10 l. of the aqueous solution described in Example 2 and 60 l. of tetrachloroethylene there were

introduced 5 kg. of knitted robes containing 78% carded wool, 10% rabbit hair (Angora), and 12% polyamide fibers. Fulling was carried on for 10 minutes at 30° C. The robes were centrifuged and dried in hot air as aforesaid. The goods had a soft feel and were fluffy and springy. This example demonstrates the fact that the process is useful on goods containing synthetic fibers.

The advantages of the invention with respect to the prior art lie in simplicity of apparatus, brevity of treatment, elimination of preliminary washing, and degreasing and in the accomplishment of the overall fulling operation in a single step and a single apparatus.

As many apparently widely different embodiments of the present invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments.

What is claimed is:

1. A method of finishing keratinous goods to impart improved qualities thereto which comprises immersing the goods repeatedly in an agitated bath having as essential components an aqueous fulling medium containing a wool-softening agent, and the aqueous medium being present in quantity sufficient to completely wet the goods. and a major quantity of a halogenated aliphatic hydrocarbon, substantially immiscible with water, of greater density than the aqueous medium, the halogenated aliphatic hydrocarbon being chosen from the group consisting of prechloroethylene, trichloroethylene, dichloroethylene, and trichlorotrifluoroethane.

2. A method according to claim 1 in which the softening agent is present in about 5 to 50 g./l. in the aqueous solution, the aqueous solution is from about 1 to 10 times the weight of the goods, and the halogenated aliphatic hydrocarbon is from about six times to fifty times the volume of the aqueous medium.

3. A method according to claim 1 in which the keratinous goods have a base of carded wool and a minor content of keratinous material of the type of mohair, cashmere, camel, or lamb's wool.

4. A method according to claim 1 in which the process is carried out on the goods at a temperature between 10° C. and 70° C. and the treatment lasts for less than 15 minutes.

5. A method according to claim 1 in which the wool softener is chosen from the group consisting of quaternary ammonium salts and amine salts of fatty acids.

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