

UNITED STATES PATENT OFFICE

2,501,435

TREATMENT OF WOOLEN PILE FABRICS

Joseph Caspé, Newark, N. J., assignor to American Cyanamid Company, New York, N. Y., a corporation of Maine

No Drawing. Application June 11, 1947,
Serial No. 754,077

9 Claims. (Cl. 28—74)

1

This invention relates to a method of treating pile fabrics having a pile of animal fibers in order to improve the appearance, feel or texture, and water-repellency of the fabrics. Although the principles of the invention are applicable to a wide variety of woolen pile fabrics including velvet carpets, velvets and the like, they will be illustrated with particular reference to pile fabrics of the type used in the preparation of artificial furs, such as mouton pile fabric.

The fabrics employed in the manufacture of artificial furs usually consist of a pile of animal hair such as mohair, wool, alpaca and the like, which is woven into a backing of cotton or other fabric. The wool used is a mixture of coarse, medium and fine grade in proportions which approximate the nature and character of fur hairs one wishes to imitate. This natural hair or wool, which is naturally kinky, requires straightening for the manufacture of artificial furs. One of the principal objects of the present invention is the provision of a method for the straightening and opening or conversion of the wool fibers or threads of an artificial pile fabric so that they resemble the natural hair of an animal fur or pelt in appearance and feel.

In preparing the wool or hair for weaving it is cleansed by scouring to remove dirt and natural oils and greases and is spun into longer fibers which are woven into backing or supporting layers by standard weaving processes, using either a W or V weave. The yarn may be dyed prior to weaving or the woven pile fabric may be dyed prior to its treatment by the process of the present invention although, as will be explained, the dyeing is frequently and preferably carried out after the first stage of the treatment process.

In accordance with my present invention I apply to the pile of a wool or hair-pile fabric an aqueous acidified formaldehyde solution capable of straightening and opening the fibers upon subjecting them momentarily to contact with a rotating iron heated to elevated temperatures. This treatment changes the character of the wool to that of a fur fiber or hair; after the treatment, including the ironing, the woolen threads are straight and soft in texture and feel and are acidified to a condition such that they can be treated successfully with resin solutions.

The second stage of the process consists in applying to the pile fibers a solution of a heat-curable thermosetting aminoplast resin, followed by again ironing the fibers for a short time at elevated temperatures to cure the resin to a water-insoluble condition. This resin treatment

2

gives both luster and water-repellency to the fibers, and converts them into a finished condition in which they are similar to the hairs of a finished natural fur.

In practicing the process outlined above there are a number of factors which should be controlled in order to obtain the best results. The aqueous formaldehyde solution should be acidified to a pH of about 2-3, and preferably to a value within the range of about 2.5-2.8. The use of an organic acid such as formic or acetic acid for this purpose avoids danger of damage to the fiber, such as might be caused by an oxidizing-type acid such as nitric acid or a dehydrating acid such as sulfuric acid. Hydrochloric acid is undesirable because it might tender the backing of the pile fabric if too much of the solution were applied. On the other hand, hydrochloric and other mineral acids are better accelerators of conversion of the wool threads into hair than are such organic acids as formic and acetic acid. I have found, as one important feature of my invention, that trichloroacetic acid combines the safety of organic acids with the rapid acceleration of the inorganic acids referred to above, and therefore this is the preferred acidifying material. However, phosphoric acid and formic acid have also been used with success; also metallic salts having an acid reaction, such as aluminum chloride, may be used in conjunction with organic acids such as formic, acetic or trichloroacetic acids.

Care should be taken to avoid applying too much of the acidified formaldehyde solution to the pile of the fabric at one time. Preferably the solution is brushed on so that the pile is moistened to about one-half of its depth. If it appears that larger quantities of the acidified formaldehyde solution will give better results, the pile can be again moistened with the solution after ironing; and this sequence can be repeated as often as desired. The acidified formaldehyde solutions are preferably dilute in order to obtain a uniform application and avoid localized over-treatment.

The moistened pile is then ironed by contact with an iron heated to at least 350° F. A rotating cylindrical iron is preferably employed in conjunction with mechanical means for maintaining the pile in a raised condition so that it is not crushed against its fabric backing by the pressure of the iron. This may be accomplished, for example, by applying a vacuum to raise the pile simultaneously with the ironing, or by mechanical means attached to the iron itself. Pref-

erably an iron is used which rotates at about 350-900 R. P. M. which, with a gas-heated iron cylinder 18 inches in diameter, corresponds to a peripheral speed of about 1400-3600 feet per minute. The pile fabric is passed under the iron rapidly so that contact between the pile fibers and the heated iron is only momentary. As is noted above, the moistening and ironing treatment may be repeated as often as is desirable.

Following the above treatment, the pile of the fabric is shorn. This is done both to obtain an even surface and to avoid dead wool which would become matted into the fabric and cause clumping. Any suitable shearing machine may be used for this purpose.

Although the process of the invention may be applied to dyed fabrics it is usually preferable to dye the fabric after it has been treated, ironed and shorn by the above-described procedure, since discoloration or stripping of the dye by the acidified formaldehyde is avoided. I have found, as another important feature of the invention, that the dyes and dyeing processes usually applied by industry to wool pile fabrics can be employed in dyeing fabrics that have been treated by either or both of the stages of the process of my present invention, so that no unusual difficulties in the dyeing step are encountered. Typical dyestuffs which may be employed are those commonly known in the trade as chromes, acids, metallized types, and direct or substantive colors. In addition, some of the so-called intermediate products with which various colors may be produced in situ on the fabric are also used. Typical examples of the groups mentioned would be:

Alizarine Blue Sap, C. I. 1054
 Chrome Brown RH, Pr. 98
 Fast Light Yellow 2G, C. I. 639
 Acid Eosine G, C. I. 114
 Acid Green G, C. I. 666
 Acid Orange Y, C. I. 151
 Direct Red 8BL, C. I. 278
 Direct Yellow NN, C. I. 814
 Direct Fast Blue 8GL, Pr. 27
 Direct Blue SL, Pr. 71
 Calcofast Wool Green 3B, Pr. 321
 Calcofast Wool Blue BN, Pr. 318
 Aniline salt
 Paraphenylene diamine
 Diamino anisole

In the final stage of the process of my invention the pile is treated with a solution of a thermosetting resin which imparts sheen and water-repellency. Best results are obtained with a thermosetting aminoplast resin, which term is used by resin chemists to define the resinous formaldehyde condensation products of urea, thiourea or melamine or mixtures thereof. These resins are available commercially in water-soluble form, and are converted into aqueous solutions simply by dissolving them in warm or hot water and cooling. Preferably a small amount of an acidic material such as trichloroacetic acid or phosphoric acid is added as a curing accelerator to speed up the conversion of the resin to its water-insoluble condition upon heating. The resin solutions are preferably applied to the pile at relatively high dilutions from about 2% to about 6-8%, most advantageously at about 3.5-4%, in order to ensure uniformity of application, using amounts sufficient to thoroughly moisten or saturate the threads of the pile without, however, leaving excess quantities of solu-

tion between the threads which might cause clumping of the fibers.

After moistening the pile of the fabric with the resin solution, which is preferably done by brushing, the pile is heated to cure the resin to a water-insoluble condition. This is done by contact with a hot iron, preferably using the type of iron and ironing procedure given above in describing the formaldehyde treatment, in order to impart both luster and water-repellency to the fibers. Application of the resin solution and ironing may be repeated as many times as may be desirable when larger quantities of resin are to be applied.

Although best results are obtained by preliminary treatment of the pile fabric with acidified formaldehyde, as described above, somewhat similar results are obtainable by a one-stage application process using an aqueous solution containing both formaldehyde and a thermosetting aminoplast resin. This method is slightly faster and therefore cheaper than the two-stage process outlined above, but the results and particularly the water-repellency of the fiber are not so good. However, it may be used in the preparation of a cheaper grade of artificial furs, and therefore is included within the scope of the invention in its broader aspects. The one-stage method consists in brushing the pile fabric with an aqueous solution having dissolved therein both an aminoplast resin and free formaldehyde, using amounts sufficient to wet the threads but without saturating the fabric, followed by ironing with an iron heated to 350-400° F. as described above, and repeating the resin application and ironing as many times as may be necessary.

The invention will be further illustrated by the following specific examples. It should be understood, however, that although these examples may describe in detail certain preferred features, the invention in its broader aspects is not limited thereto.

Example 1

A pile fabric composed of a scoured and dyed spun wool pile on a cotton backing was made into an artificial mouton fur by the following procedure:

The wool pile was converted to fur by brushing on, to about one-third the depth of the pile, a solution prepared by diluting 9 liters of 37% aqueous formaldehyde with 9 liters of water and dissolving 180 grams of trichloroacetic acid in the solution to obtain a pH of about 2.5-2.8 followed by ironing the pile while damp. The ironing was done by passing the pile under a cylindrical iron having longitudinal grooves with serrated edges on its surface, heated to about 350-360° F. and rotated at a peripheral speed of about 1400-2000 feet per minute to create a vacuum that pulls the pile up so that the threads are raised substantially to a right angle with the backing of the fabric. This treatment changes the character of the wool pile to that of a fur fiber or hair having a soft and "silky" feel.

After drying, the converted pile was shorn to remove hairiness and avoid the presence of dead wool. It was then treated with a solution of a thermosetting aminoplast resin prepared by dissolving 600 grams of methylated methylol urea (prepared as described in U. S. Patent No. 2,397,825) in 9 liters of water at 130° F., cooling to room temperature and adding a solution of 16 grams of trichloroacetic acid in 7 liters of cold water. This solution was applied by brushing

it on the pile, which was then ironed on the rotating iron as described above at the same ironing temperature.

The amounts of the acidified formaldehyde and resin solutions applied by the above treatments are those sufficient to moisten thoroughly the pile of the fabric while avoiding the presence of unabsorbed solution between the individual pile threads. Wetting of the cotton backing with the acidified formaldehyde solution is especially undesirable, and should be avoided. The solutions are therefore most advantageously applied by advancing the fabric, with the pile side up, on a moving belt or table under a rotating brush the bristles of which are preferably continuously supplied with the treating solution so that the solution is applied to a constant depth over the entire fabric. The belt or table carrying the fabric can then be passed under the rotating iron so that the moistening and ironing steps are carried out continuously. When larger quantities of either or both of the treating solutions are to be applied to the fabric the brushing and ironing steps may be repeated as many times as may be desirable.

The fabric obtained by the above treatment resembled a dyed natural fur in appearance and feel and was completely water-repellent; i. e., when sprinkled with water the drops remained on the surface of the pile without wetting the fibers and could be removed completely by shaking.

Example 2

The conversion of the wool, mohair, alpaca or other natural fiber pile into fur fibers can be done prior to dyeing, since I have found that the treatment with acidified formaldehyde and ironing does not alter the affinity of the fibers for the dye. The converted fabrics can be dyed with acid and chrome dyestuffs such as Chrome Brown RH—C. I. 98, Fast Acid Yellow 2G—C. I. 639 and the like using the dyeing conditions ordinarily employed for dyeing animal fibers.

A sample of undyed pile fabric was treated with acidified formaldehyde solution, ironed at 300–450° F., shorn, and again treated with the formaldehyde solution and ironed, all as described in Example 1. It was then dyed brown with a mixture of chrome and acid dyes using the procedures ordinarily employed for the dyeing of pile fabrics.

After dyeing the fabric was dried thoroughly and was then ready for finishing with a thermosetting resin solution. It was brushed with a solution prepared as follows:

A cold solution of 300 grams of methylated methylol urea in 9 liters of water was mixed with a dimethylol thiourea solution prepared by dissolving 152 grams of thiourea in 650 cc. of 37% aqueous formaldehyde solution at 30–35° C. When cold, the mixture was acidified by the addition of 7.5 liters of water containing 16 grams of trichloroacetic acid.

After brushing with this solution the pile was ironed as described above, and the moistening and ironing treatments were repeated. The treated fabric resembled in texture and appearance a natural dyed sheepskin.

Example 3

Instead of urea or thiourea resins, a melamine-formaldehyde resin may be used as the finishing agent. A solution of this type which has produced excellent results is the following:

A solution is prepared from 710 grams of a

spray-dried but substantially monomeric methylol melamine, produced by the reaction of 3.5 mols of aqueous formaldehyde for each mol of melamine, in 9 liters of cool water. This is acidified by the addition of from 500 to 750 cc. of 85% formic acid. When cool, the solution is diluted with 7 liters of water.

This solution is applied to the pile of the fabrics as described in Example 1, and is cured by passing the treated fabric under a rotating iron heated to 350–400° F. as described in that example.

Equally good results are obtained when 710 grams of water-soluble methylated methylol melamine are substituted for the methylol melamine in the above composition.

Example 4

Instead of applying the acidified formaldehyde and the thermosetting resin as separate treatments they can sometimes be applied together from a single bath. This method is usually employed in the treatment of pile fabrics which have already been dyed. Solutions containing methylated methylol melamine, methylated methylol urea, dimethylol urea, methylol melamines or methylol thioureas may be used. The following is typical:

Methylated methylol melamine	
(80% soln.)	cc. 100
Formaldehyde (37% aqueous)	cc. 200–400
Water	cc. 700
Diammonium hydrogen phosphate	grams 2

This solution is brushed on the pile of the fabric as described in Example 1. After ironing the fabric is shorn. The treated fabric has a good appearance, but its water-repellency is not so good as that obtained by the two-stage process illustrated in the preceding examples.

What I claim is:

1. A method of treating pile fabrics having a pile of animal fibers which comprises applying to the pile only of said fabric an aqueous formaldehyde solution acidified to a pH of about 2–3 and then contacting the dampened pile momentarily with an iron heated to at least 350° F. while maintaining the pile in a raised condition whereby the fibers of the pile are converted to a hair-like condition, shearing the pile, and applying thereto an aqueous solution of a curable thermosetting aminoplast resin and then heating the pile to cure the resin to a water-insoluble condition.

2. A method of treating pile fabrics having a pile of animal fibers which comprises applying to the pile only of said fabric an aqueous formaldehyde solution acidified to a pH of 2.5–2.8 and then contacting the dampened pile momentarily with an iron heated to at least 350° F. while maintaining the pile in a raised condition, shearing the pile, applying to the pile an aqueous solution of a curable thermosetting aminoplast resin, and again ironing said pile with an iron heated to at least 350° F. to cure the resin to a water-insoluble condition.

3. A method according to claim 1 in which the aqueous formaldehyde solution is acidified with trichloroacetic acid.

4. A method according to claim 1 in which the aminoplast resin is a methoxymethyl urea.

5. A method according to claim 1 in which the aminoplast resin is a methylol melamine.

6. A method of treating an undyed pile fabric having a pile of animal fibers which comprises

7

applying to the pile only of said fabric an aqueous formaldehyde solution acidified with water-soluble organic carboxylic acid to a pH of about 2-3 and then ironing the dampened pile by contacting it momentarily with an iron heated to at least 350° F. while maintaining the pile in a raised condition, shearing the pile, dyeing the fabric so treated, drying the dyed fabric and applying to the pile thereof an aqueous solution of a curable thermosetting aminoplast resin, and then ironing the dampened pile with an iron heated to at least 350° F.

7. A method according to claim 6 in which the aqueous formaldehyde solution is acidified with trichloroacetic acid.

8. A method according to claim 6 in which the aminoplast resin is a methoxymethyl urea.

9. A method according to claim 6 in which the aminoplast resin is a methylol melamine.

JOSEPH CASPÉ.

5

10

20

8

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,055,322	Teller	Sept. 22, 1936
2,225,267	Gottfried	Dec. 17, 1940
2,240,388	Calva	Apr. 29, 1941
2,329,622	Johnstone	Sept. 14, 1943
2,359,444	Schneider	Oct. 3, 1944

FOREIGN PATENTS

Number	Country	Date
550,541	Great Britain	Jan. 13, 1943

OTHER REFERENCES

Ser. No. 316,520, Bartok (A. P. C.), published June 8, 1943.