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FABRIC, HAT, AND METHOD OF MAKING THE SAME

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This invention relates to felted fabrics and to methods of making the same. A preferred embodiment of the present invention relates particularly to a method of making hats and to the hats made from mixtures of fibers including substantial amounts of fibers derived from proteins of relatively high molecular weight, such as soy bean protein.

Heretofere there has always been considerable disagreement regarding the reasons for felting. In the development of the present invention an effort was made to further determine the reasons for felting. It was found that carroted rabbit and other fur sometimes had a sulfur content of about 4.28%. This is substantially greater than the sulfur content of wool, which is about 3.06%. However, according to the present invention, mixtures of fur and certain synthetic fibers derived from protein having a sulfur content less than 1% were found to felt quite satisfactorily.

Those fibers most susceptible to acid dyestuffs, and which, accordingly, were believed to contain a larger number of free amino and carboxyl groups, were generally more easily felted than those fibers which were less susceptible to dyestuffs. However, it was found that some fibers could be treated with ketene at elevated temperatures for prolonged periods of time, thereby substantially eliminating the free amino and carboxyl groups, and thereby decreasing the feltability of the fibers. The overketenation did not, however, entirely destroy the felting properties of such fibers.

Although an extensive study was made, over a considerable period of time, no single determining characteristic was found by which the feltability of a fiber could be easily and universally determined. It was found that the quality of felt from mixtures of fibers including fibers derived from proteins was consistently dependent upon the molecular weight of the protein.

Any synthetic textile fiber formed by extruding dissolved material into a coagulating bath is sometimes designated herein as an "extruded fiber." A generic term which has sometimes been used (e. g., in "Industrial and Engineering Chemistry," vol. 32, p. 1547, December, 1940) to designate any or all extruded protein fibers is "prolon," which is used hereinafter in said generic meaning. Thus, when the protein of milk is dissolved and extruded into a coagulating bath, the fibers may be designated as milk prolon fibers. When soy bean protein is dissolved and extruded into a coagulating bath, the fibers may be designated as soy prolon fibers; etc.

Heretofore some felt hats have been made of wool. The wool felt hat industry is generally considered quite separate and distinct from the fur hat industry. Heretofore some hats have been made from beaver fur, which sometimes sells for as much as $30 per pound. Beaver hats possess a very soft feel and other desirable characteristics which command a very high price. Heretofore some hats have been made from rabbit fur. Hats made from rabbit fur possess a feel which an ordinary consumer can readily distinguish from the feel of a wool hat; however, the feel of a hat made from rabbit fur is not equal to the feel of a hat made from beaver fur.

Rabbit fur has been somewhat unsatisfactory as a material for making hats, particularly because of its nonuniformity. Differences in fur have been caused by such factors as the health of the rabbit, geographical location of the rabbit, portion of the hide of the rabbit, season when killed, etc. Moreover, the price of rabbit fur has fluctuated widely because of demands by other businesses than the hat industry. Furthermore, rabbit fur is generally imported from Australia or Europe with consequent uncertainty of delivery.

Efforts have frequently been made to provide materials suitable for blending with rabbit fur. Wool has sometimes been used with fur. However, a hat made from a mixture of wool and fur, even when the amount of fur is several times that of the wool, in most instances possesses a feel that is rather readily distinguishable from that of an all-fur hat, not only by hat experts but also by the ordinary consumer. Moreover, such wool-fur hats, particularly those containing less than about 20% of fur fibers, have generally possessed an objectionable springiness and have lacked the shapeability which has characterized all-fur hats. The unsatisfactory results from wool-fur mixtures has discouraged attempts to produce hats containing substantial amounts of nonfur fibers.

The admixture of very small percentages of cotton, rayon or the like in a fur felt hat, although it has made possible novelty dyeing and style effects, has not provided hats equivalent in feel, durability, etc., to an all-fur felt hat. Accordingly, in spite of the many efforts to provide a substitute or adulterant for fur fibers in hats, most medium and high-quality hats have been made substantially entirely from fur until a very recent date.

Heretofore the process of manufacturing hats formed by felting a mixture of fur fibers and

fibers derived from casein has been disclosed in a copending application filed by George M. Rickus (the inventor of the present invention) and William L. Braun, bearing Serial No. 333,425, filed May 4, 1940. The fibers described in detail in said application and derived from milk are hereinafter sometimes designated as milk prolon fibers.

Although hats are of particular importance and represent a main embodiment of the invention, felted fabrics have been made according to the teaching of the present invention.

It is an important object of the present invention to provide a felted fabric and/or a hat having a feel superior to that of a felted fabric made entirely from rabbit fur.

It is an important object of the present invention to provide a felted fabric and/or a hat having a feel approximately equal to and/or competitive with a beaver fur hat, but containing no beaver fur, and having a production cost only a small fraction of the production cost of a beaver fur hat.

It is an object of the present invention to provide a felted fabric and/or hat possessing a tensile strength sufficient to be competitive with felted fabrics formed entirely from rabbit fur.

Other important objects of the present invention are: to provide a high-quality hat having a lower production cost than any heretofore available; to provide a process of controlling the dyeing characteristics of fibers used in hats so as to produce hats having uniform dyeing characteristics; and other objects which are apparent from a reading of the description and claims.

An important feature of the present invention is the provision of a felted fabric and/or hat including substantial amounts of a prolon fiber of relatively high molecular weight.

Another feature of the present invention is the provision of a felted fabric and/or hat including nonfur fibers chemically treated to possess dyeing characteristics substantially equivalent to fur; e. g., brought back to the acid pH side.

An important feature of a preferred embodiment of the present invention is the provision of a felted fabric and/or hat including a substantial percentage of soy prolon fibers.

A still further and important feature of the invention is the teaching of a method of making hats with a substantial percentage of wool, replacing fur, yet having much of the feel and shapeability of an all-fur hat.

Other features are apparent from a consideration of the description and claims.

The present invention is not limited to the details described herein, for the invention is capable of other methods of operation. Therefore, the phraseology used is for the purpose of description and not of limitation.

An illustrative example of one embodiment of the present invention includes the steps of: (1) preparing an extruded fiber having a relatively high molecular weight, such as soy prolon; (2) preparing rabbit fur for felting, as by carroting; (3) mixing the soy prolon fibers and rabbit fur fibers; (4) air-blowing the mixture of fibers and drawing or sucking the same onto a suitable form such as a cone; (5 hardening the cone; (6) shrinking and felting the cone to its final size with the aid of moisture, motion and pressure; (7) dyeing the hat if desired; (8) stiffening the brim and blocking the cone into a hat body; and (9) completing the hat by certain of the usual "front shop" operations.

Soy prolon formation

Although the present invention relates essentially to the manufacture of felted fabrics including prolon fibers such as soy prolon fibers, the following notes regarding the manufacture of soy prolon should be helpful to an understanding of the present invention.

Soy prolons may be formed by any of divers methods including such steps as: (1) gathering soy beans; (2) extracting oil from the soy beans to form an oilfree meal rich in soy protein; (3) dissolving the soy protein in a suitable reagent, such as alkali; (4) adjusting the pH of the solution of soy protein; (5) preparing the solution of soy protein for extruding; (6) extruding the protein solution into a suitable coagulating bath to form soy prolon fibers; (7) stretching the soy prolon fibers during and/or after coagulation thereof to form fibers preferably 10 to 30 microns in diameter; (8) treating the soy prolon with a suitable hardening agent such as formaldehyde or ketene in a chemical condensation reaction; (9) preferably dry carding and French combing the soy prolon fibers to separate or open the snubs and noils, and to separate the individual fibers; and, (10) cutting said soy prolon fibers into staples preferably approximately ¼ to 1 inch long.

Because of the nonuniformity of ordinary technical soy bean meal, it is sometimes desirable to use soy bean meal prepared from beans especially grown for fiber purposes.

Ordinarily the soy protein is dissolved in a basic water solution and sufficient additional alkali, dependent upon the peculiarities of the batch, may be added to adjust the pH of the solution. Ageing is sometimes an important factor in the preparation of an extruding bath. Carbon disulfide is sometimes included in the soy protein solution to aid in controlling the viscosity thereof.

Formaldehyde, ketene or other hardening agents may be included in the coagulating bath. It is believed that some of the hardening agent chemically reacts in a condensation reaction (the hardening agent is sometimes designated as a condensing agent) with the free amino groups of the prolon. Such a condensation reaction substitutes methylol groups for some of the hydrogens on some of the nitrogen atoms.

It has been found that when the soy prolon is treated with just sufficient hardening agent to provide dyeing characteristics most nearly equivalent to those of fur, then said soy prolon also possesses desirable felting characteristics. Such fibers possess an acid pH of from 3.5 to 4 and preferably 3.85.

Although soy prolon fiber having a diameter from 10 to 30 microns produces reasonably satisfactory results in felting mixtures with fur, best results are obtained if the soy prolon is about 15 to 20 microns in diameter. If the fiber is suitably stretched prior to setting, it may develop several crimps per inch, and thereby develop greatly improved felting properties. The fibers may be provided with roughened surfaces, such as disclosed in U. S. Patent 2,110,371 to G. S. Radford and U. S. Patent 2,108,361 to Y. Asakawa.

After the soy prolon fibers are formed, they are preferably carded and French combed to remove the snubs and noils and to separate the individual fibers in the manner conventional to the tex-

tile arts. The details of the preparation of the soy prolon fibers are not claimed in the appended claims, and for a more complete disclosure of the preparation of soy prolon fibers, reference may be made to: U. S. Patent 2,192,194 to Kajita et al.; U. S. Patent 2,198,538 to Kajita et al.; U. S. Patent 2,211,961 to Meigs; and "Industrial and Engineering Chemistry," vol. 32 (December 1940), Boyer, p. 1549.

It should be particularly noted that the soy prolon fibers above described differ substantially from fibers heretofore used in making fur felt hats. Soy prolon protein has a molecular weight several times as great as the molecular weight of some of the fibers heretofore used in the textile arts. It is believed that the tensile strength of the fibers, and particularly the wet strength, are peculiarly dependent upon the molecular weight of the fiber protein.

Mixing

Prolon fibers prepared as above described are mixed with rabbit fur fibers which have been carroted by any of the conventional processes. The fibers are preferably very thoroughly mixed to assure uniformity in the finished felt. Of particular importance it should be noted that hats of medium or high quality may be produced by using at least 60% rabbit fur fibers and up to 40% by weight of soy prolon fibers. The use of about 20% soy prolon has been found to be particularly satisfactory. Cheaper hats can be made with greater percentages of prolon fibers. Samples of felted fabric have been made containing 90% soy prolon and 10% rabbit fur. However, to provide a suitable tensile strength, to provide adequate cooperation between and cofelting of the prolon and rabbit fur, and to provide for the inaccuracies and nonuniformity of commercial production, not more than 60% of soy prolon should ordinarily be used in a hat.

Making a hat

The hereinbefore steps of: (4) air-blowing (or sucking) the mixture of fibers onto a suitable form such as a cone; (5) hardening the cone; (6) shrinking and felting the cone to its final size with the aid of moisture, motion and pressure; (7) dyeing the hat if desired; (8) stiffening the brim and blocking the cone into a hat body; and, (9) completing the hat by certain of the usual "front shop" operations; are all substantially the same as the conventional steps used in the manufacture of all-fur felt hats.

Felted fabrics may be made from the above-described fiber mixtures in the conventional manner. For example, the "skirt" or tube may be felted from a large truncated cone by the ordinary fur hat-making machinery. Such a "skirt" or tube may be cut up in the conventional manner for the manufacture of external hatbands, etc.

Flat felted fabrics comprising soy prolon fibers may also be made into hats, either by sewing or pressing operations.

Resultant fabric

The hat or fabric resultant from the above-described process is characterized by a feel that is easily distinguishable from the feel of hats made from wool or from mixtures of wool and fur. Usually, and especially if the felting and finishing have been expertly performed, the hats made according to the present invention possess a feel superior to the feel of a felt hat made entirely from rabbit fur. In fact, such hats possess a feel approximately equal to and/or competitive with the feel of beaver fur hats. However, the cost of producing a hat from a mixture of rabbit fur and soy prolon is only a small fraction of the production cost of a beaver hat.

It should be particularly noted that the tensile strength of the fabric prepared according to the present invention is so high that it is competitive with felt made entirely from rabbit fur. However, the cost of producing the prolon-fur hat is only a fraction of the cost of producing a hat entirely from rabbit fur.

The felted fabric and/or hat of the present invention is dyed with perfect uniformity, notwithstanding the fact that the felt comprises a fur and nonfur fiber mixture.

An alternative method of practicing the present invention relates to the use of machinery and processes such as used in the manufacture of wool hats. The manufacture of fur felt hats and the manufacture of wool felt hats are so radically different, and are considered so separate and distinct industrially that it is ordinarily believed that an improvement in one art is totally unfit for the other. However, according to the present invention, hats may be made on wool hat-making machinery by steps generally such as the following: (1) carding a mixture of soy and wool fibers on a carding machine to form a continuously advancing web of intertwined fibers; (2) wrapping the flat web about a wooden cone until the desired weight is obtained; (3) removing the cone from the forming machine; (4) pressing or hardening the cone in a steam press while subjecting it to steam and to vibration to prepare it for subsequent operations; (5) shrinking the hat on a multiroller machine; (6) treating the hat on a bumper machine; (7) tightening the felt on a suitable machine; (8) dyeing; (9) stiffening; (10) blocking into a suitable shape; (11) pouncing the hat on a lathe; and, (12) finishing the hat by suitable hand and machinery operations in the front shop, including trimming.

The felted hats made from mixtures of soy prolon and wool possess a feel superior to all-wool hats. However, they are not equal to hats made from mixtures of fur and prolon or to beaver hats.

Another alternative embodiment relates to the use of fur hat-making machinery. It has been found that mixtures of rabbit fur, wool and prolon may be satisfactorily felted. Mixtures containing 40% rabbit fur, 40% wool and 20% prolon fibers were found to produce commercially satisfactory hats. This is surprising in view of the fact that when no prolon fiber is used not more than about 15% wool can satisfactorily be used with rabbit fur in a commercially satisfactory hat. The exact chemical or physical factors leading to this unusual result are not known.

Variations and modifications may be made within the scope of this invention and portions of the improvements may be used without others.

Having thus described the invention what is claimed as new is:

1. A hat comprising a body consisting essentially of a mixture of animal fibers and soy prolon fibers intimately felted together.

2. A hat comprising a body consisting essentially of a felted mixture of soy prolon fibers and other feltable fibers, said mixture comprising substantial amounts of soy prolon fibers.

3. A hat comprising a body consisting essen-

sentially of a mixture of four fibers and soy prolon fibers intimately felted together.

4. A hat comprising a body consisting essentially of a mixture of fur fibers and soy prolon fibers intimately felted together, the soy prolon fibers being approximately ¼ to 1 inch long and from 10 to 30 microns in diameter.

5. The process of manufacturing hats which includes the steps of carding and forming about a conical form a mixture of wool fibers and soy prolon fibers to produce a fibrous cone; pressing the cone with the aid of vibration and moisture; and treating the cone to form a hat therefrom.

6. The process of manufacturing a hat which includes the steps of carding and forming about a conical form a mixture of wool fibers and soy prolon fibers to produce a fibrous cone about two inches thick; placing the fibrous cone between two conical dies, and subjecting it to vibration, moisture and pressure to reduce its thickness in excess of 75%; and treating the cone to form a hat.

7. A hat consisting essentially of a mixture of rabbit fur, wool and soy prolon fibers intimately felted together.

8. The process of manufacturing hats which comprises the steps of preparing a mixture of rabbit fur, wool and soy prolon fibers; sucking the fiber mixture onto a conical form; shrinking and felting the fibers into a hat bat; and treating the hat bat to form a hat therefrom.

9. In a hat body, the combination of up to 40% wool fibers; up to 40% fur fibers; and up to 20% soy prolon fibers, intimately felted together.

10. In a hat body, the combination of approximately 80% fur fibers and approximately 20% soy prolon fibers, thoroughly intermingled and felted together.

11. In a hat body, the combination of approximately 15% to 50% soy prolon fibers and 85% to 50% fur fibers, felted together.

12. In a fabric, the combination of up to 40% wool fibers; up to 40% fur fibers; and up to 20% soy prolon fibers, intimately felted together.

13. In a fabric, the combination of approximately 80% fur fibers and approximately 20% soy prolon fibers, thoroughly intermingled and felted together.

14. In a fabric, the combination of approximately 15% to 50% soy prolon fibers and 85% to 50% fur fibers, felted together.

15. A hat comprising a body consisting essentially of a mixture of rabbit fur fibers and prolon fibers suitable for felting derived from protein of relatively high molecular weight, said prolon fibers being approximately ¼ to 1 inch long, from 10 to 30 microns in diameter, and from 3.5 to 4 in acid pH, said mixture of fibers being intimately felted together.

16. A fabric consisting essentially of a mixture of wool fibers, rabbit fur fibers and prolon fibers suitable for felting derived from protein of relatively high molecular weight, said prolon fibers being approximately ¼ to 1 inch long, from 10 to 30 microns in diameter, and from 3.5 to 4 in acid pH, said mixture of fibers being intimately felted together.

17. A hat comprising a body consisting essentially of a mixture of fur fibers and prolon fibers suitable for felting derived from protein of relatively high molecular weight, said mixture of fibers being intimately felted together.

18. A fabric consisting essentially of a mixture of wool fibers, fur fibers and prolon fibers suitable for felting derived from protein of relatively high molecular weight, said mixture of fibers being intimately felted together.

GEORGE M. RICKUS.

CERTIFICATE OF CORRECTION.

Patent No. 2,322,255. June 22, 1943.

GEORGE M. RICKUS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 9, for "Heretofere" read --Heretofore--; page 3, first column, line 57, for "the skirt" read --a skirt--; page 4, first column, line 1, claim 3, for "four fibers" read --fur fibers--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of August, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

DISCLAIMER

2,322,255.—*George M. Rickus*, Norwalk, Conn. FABRIC, HAT, AND METHOD OF MAKING THE SAME. Patent dated June 22, 1943. Disclaimer filed Sept. 11, 1945, by the assignee, *Hat Corporation of America.*

Hereby enters this disclaimer to claims 15, 16, 17, and 18 of the patent.

[*Official Gazette October 9, 1945.*]