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METHOD FOR DETECTING AND SEPARATING FIBROUS VEGETABLE MATTER FROM ANIMAL FIBERS

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This application is a continuation-in-part of our application for patent on Method for detecting the presence of fibrous vegetable matter in animal fibers, Serial No. 46,630, filed October 24, 1935.

This invention is a novel method for detecting the presence of cotton, jute, hemp, rope, and other cord and like fibrous vegetable matters in wool, and other animal fibers, during the preparation of such fibers for use in woollens, worsted, and similar yarns. Our invention may also be used for detecting the presence of such undesirable matters in finished fabrics, or in shoddies, (reworked fibers).

Customarily the wool clipped from a sheep is tied into a "fleece" with rope string or cord made of cotton, jute or hemp. Such fleeces are then packed in burlap bags and shipped to a wool merchant for grading; that is, assembling the fleeces of like characteristics into lots, without untieing them. In the operations of tying the fleeces and of putting them into and removing them from the bags, detached pieces of the jute, hemp, sisal or cotton cord and fibers thereof and of the cord with which the bags are sewed, become entangled in the wool; and thereafter become intimately mixed with the wool as it is sorted by the wool grader, who cuts the string from the fleece and separates the wool into "sorts" of varying lengths, diameters and color.

The graded wool is usually again packed in burlap bags and shipped to a worsted or woolen mill or scouring plant, where it is processed by being scoured in water containing soap or chemicals; and then conveyed through dryers. Thereafter the washed wool is carded; and thereafter manufactured into woolen or worsted yarns, and these ultimately woven into fabrics as desired.

To save repetition we will hereinafter refer to the aforesaid cord, rope and like vegetable impurities as "string". Under the term "string" we include all the objectionable vegetable matters hereinbefore mentioned.

Heretofore after the scouring and prior to the carding operation some of the larger pieces of string entangled in the wool have been removed by operators who stand beside the wool conveyor and try to pick out any large pieces of string that they may see in the wool moving by them. But as the string is similar in the appearance to the wool, and much string is in small pieces, only the larger pieces of the string are removed by such operators, and the smaller pieces of string remain in the wool; and thereafter, when the

wool is carded, the small pieces of string are disintegrated and drawn out into fine slivers which are intimately and inseparably entangled in the wool fibers and remain therein when it is made into woolen and worsted yarns, and in the cloth or other final product made from such yarns.

When wool, either in unfabricated or fabricated state, containing any string or string slivers, is put in a wool dye bath, the string and string slivers will not take the wool dye, and later appear as defects in the finished fabric. As the string slivers will not take the dye employed for the wool, it is necessary in the manufacture of finer woolen fabrics to subject the fabric to minute inspection by employees who, if they can, remove such string slivers as they may detect by hand specking, (that is picking out the pieces of string fibers with tweezers), or penciling, (that is coloring the string fibers in the finished fabric with a colored pencil), or by so-called speck dyeing, (that is passing the fabric through a vegetable dye bath that will dye the string fibers the same shade and color as the wool fibers). In some cases it is necessary to subject the finished cloth to a carbonizing process to remove the string. The operations of picking out or speck dyeing the string in the finished cloth or carbonizing the cloth, are items of large expense in the woolen and worsted manufacture.

Our invention provides a novel method of and means for facilitating the removal of the string from the wool (preferably previous to the wool dyeing operation), and obviates, or materially lessens, the necessity for any subsequent hand specking, penciling, speck dyeing, or cloth carbonizing operations. The present application has particular reference to a process in which the wool contaminated with string is subjected to a solution of a chemical compound, such as "Primuline", which will cause the string to appear luminous or fluorescent when the wool is subjected to certain artificial light, as hereinafter explained, although actually the string and string fibers are not luminous or fluorescent in the sense that they give off light.

In our present process the wool containing the string is subjected (preferably during the scouring operation) to a bath comprising a solution of Primuline, a dyestuff of the Thiazole type consisting mainly of a compound having the empirical formula $C_{21}H_{14}N_3O_3S_3Na$ together with another compound having the empirical formula $C_{25}H_{17}N_4O_3S_4Na$ and described as No. 812 in

the Color Index, (a publication of the British Society of Dyers and Colorists); or Titan Yellow G, known as Mimosa Z, a dyestuff of the Thiazole type consisting of a compound having the empirical formula $C_{22}H_{19}N_3O_6S_4Na_2$ and described in said Color Index as No. 813; or Thioflavine S, a sodium salt of the sulphonic acid of methylated Primuline base, described as No. 816 in said Color Index; or other chemical compound containing Primuline as a component and which maintains its properties of producing apparent fluorescence or luminosity under certain light rays, and will produce the desired effect on the string when dissolved in water or other suitable solvent. The chemical in said solution will be absorbed or adsorbed by the string so that on subsequent exposure to artificial light rays, as hereinafter mentioned, the string can be readily visually differentiated from the wool or other animal fibers.

We have found that Mimosa Z, Thioflavine S, and Primuline can be successfully dissolved in water; water and soap; water and alkali; water, soap and alkali; without in any way changing their property of producing apparent fluorescence or luminosity of the string as above explained.

After subjecting the wool to the aforesaid bath, the wool (either while wet, or after drying; and either before or after fabricating), is exposed to artificial near ultra violet light rays. We preferably use the near violet light rays given off by a mercury arc nickel cobalt tube, or like rays, and under such light the string and vegetable fibers will appear luminous and distinctly different from the wool or animal fibers; and (while exposed to such light rays) the string can be readily detected and removed from the wool. The mercury arc light has a wave length of approximately 375μ . The frequency of the mercury light shining through a nickel cobalt tube is approximately 355μ . Near ultra violet light having a wave length of approximately 355μ will produce very high intensity of apparent luminosity of the treated string viewed under such light in a darkened room. It is preferable when subjecting the wool to the light to have the room dark or somewhat darkened, as the wool can then be examined farther away from the source of light, and under such conditions the string and string fibers will have a luminous or fluorescent appearance and be readily distinguishable from the wool.

It is desirable that the amount of chemical used should not be sufficient to affect the subsequent dyeing of the wool. It is also important that the chemical employed or the amount of the chemical employed in our process should not interfere with or effect the subsequent ordinary factory dye treatments of the wool in the manufacture thereof.

In practice we find it satisfactory and economical to add the chemical to the water or solution in one of the bowls used in scouring the wool, so that the mixture of wool and string is subjected to the chemical during the scouring, and no time lost as the solution is applied during and simultaneously with the washing or scouring operation. Preferably we place the solution in the rinsing bowl; and ordinarily it takes about three minutes for the wool to pass through the rinsing bowl. The chemical could be more quickly applied by dipping the wool in a solution thereof. We find that the chemical effects the string almost instantaneously, and therefore do

not consider our process restricted to any particular time of treatment.

The string can be most readily removed from the wool as it is conveyed away from the dryer. The string fibers can be readily detected by our method after the wool is carded or combed or formed into yarn or fabric, but it is more difficult and expensive to remove the string slivers from the finished yarn or fabric than to remove the string before the yarns are made.

After treatment with the solution we preferably subject the wool to the light rays as it is being conveyed from the dryer toward the carding machine, as the string can then be more quickly detected and more readily removed, because it has not then been shredded or reduced to mere slivers; whereas if the string is passed with the wool through the carding machine the string is reduced to individual slivers which become extensively entangled and mixed with the wool fibers and entails further expense and time required for hand specking, penciling, or speck dyeing, or cloth carbonizing as above referred to.

The treatment of the wool in the manner above described does not injure the wool fibers and does not appreciably discolor them. It is not necessary that the wool be exposed to the light ray while in a wet condition; it may be exposed either wet, as it comes from the scouring bowls, or dry, as it comes from the dryer, preferably at the latter point or at some subsequent time, because it would then be more open and fluffy and more readily handled and examined.

We have successfully used a solution comprising 2 oz. of Primuline dissolved in 150 gallons of water at a temperature of 110°F . The proportion of Primuline may vary. We have used from $\frac{1}{8}$ of an ounce of Primuline to 100 gallons of water up to 3 ounces of Primuline to 100 gallons of water. Tests at the mill have shown that 3 ounces of Primuline to 100 gallons of water has no deleterious effect on the subsequent color dyeing of the wool, but we do not limit ourselves to these amounts.

We prefer a temperature between 60°F . and 140°F ., when Primuline is used, but do not consider our invention limited to such temperature. Primuline may be used in a clear water bath, or it may be added to the scouring liquors containing soap or alkali, or other detergent used in scouring the wool. Ordinarily we subject the wool to this solution for about three minutes.

If desirable the operators examining the wool or fabric can wear spectacles with lenses which will only permit the passage of the light rays reflected from the vegetable fibers, so that no ultra violet rays can penetrate the operators' eyes; with such glasses the eye strain is lessened and the apparent intensity of the luminous string and string fibers is increased.

While we have referred to the chemical solution as adsorbed or absorbed by the string, in some cases there may be more or less chemical combination between the string and the chemical used, and therefore we include by the terms adsorbed or absorbed any physical or chemical reaction on or in the string which results from its treatment with the solution in our process.

We claim:—

1. The process of detecting and separating vegetable string from wool, consisting in treating the wool containing such string with a solution of Primuline whereby the vegetable fibers will

be caused to appear luminous and readily differentiated from the wool fibers when exposed to a light band of proper frequency; and thereafter exposing the wool and string to such light and while so exposed separating the string therefrom.

2. The process of detecting and separating vegetable string from wool or animal fibers, consisting in subjecting wool containing such string to a solution of "Primuline", whereby when the so-treated wool is exposed to near ultra violet light the string will appear to be luminous and readily differentiated from the fibers; and thereafter exposing such wool and string to such light and while so exposed separating the string therefrom.

3. The process of detecting and separating vegetable string from wool or animal fibers, consisting in subjecting the fabric or wool containing such string to a solution containing one or more of a group consisting of "Primuline", "Mimosa Z" and "Thioflavine S", whereby when the so-treated stock is exposed to the proper artificial light rays the string is caused to appear luminous and distinct from the wool fibers; and thereafter exposing such fibers to such light rays and while so exposed separating the string therefrom.

4. The herein described process of detecting and separating vegetable string from fabricated or unfabricated wool or animal fibers, by subjecting the wool containing such vegetable fibers to a solution containing one or more of a group consisting of "Primuline", "Mimosa Z" and "Thioflavine S", whereby when the fibers are subsequently exposed to near ultra violet light the string is caused to appear distinctly visually different from the fibers; and thereafter exposing the so-treated fibers to such light rays and while so exposed separating the string therefrom.

5. The process of detecting and separating vegetable string from wool and like animal fibers; consisting in treating animal fibers containing such string with a solution including a substance that is selectively adsorbed or absorbed by vegetable fibers and that becomes luminous when subjected to a light band of proper frequency, the concentration of said substance being insufficient to materially alter the appearance of the mixed fibers when viewed by white light; and thereafter exposing the so-treated fibers to an artificial light band of such frequency as will cause the string to appear luminous, and while so exposed separating the string therefrom.

6. The process of detecting and separating vegetable string from wool and like animal fibers; consisting in treating animal fibers containing such string with a solution including a substance that is selectively adsorbed or absorbed by vegetable fibers and that becomes luminous when subjected to a light band of proper frequency, the concentration of said substance being insufficient to materially alter the appearance of the wool fibers when viewed by white light; and thereafter exposing the so-treated fibers to artificial light of such frequency as will cause the string to appear luminous, and while so exposed separating the string therefrom.

7. The process of detecting and separating vegetable string from wool and like animal fibers; consisting in treating animal fibers containing such string with a solution including a direct vegetable fiber dyestuff that does not dye wool and that possesses the property of becoming luminous when subjected to a light band of proper frequency, the concentration of said solution being insufficient to materially color the fibers when viewed by white light; and thereafter exposing the so-treated fibers to artificial light of such frequency as will cause the string to appear luminous, and while so exposed separating the string therefrom.

8. The process of detecting and separating vegetable string from animal fibers; consisting in treating the animal fibers containing such string with a solution including a chemical that is selectively adsorbed or absorbed by vegetable fibers and will cause the string to appear to be luminous and thereby distinctly different from the wool fibers when exposed to a light band of proper frequency; and thereafter exposing the so-treated fibers to artificial light of such frequency as will cause the string to appear luminous, and while so exposed separating the string therefrom.

9. The herein described method of detecting and separating vegetable string from wool and like animal fibers; consisting in treating the wool containing such string with a weak solution of a dye material that will be selectively absorbed or adsorbed by the string and not deleteriously affect the subsequent dyeing of the wool; the chemical in such solution not being sufficient to give the string a readily distinctive color but will render the string apparently luminous when the mixture is subjected to a light band of proper frequency; and subsequently exposing the so-treated fibers to artificial light of such frequency as will produce such luminosity of the string, and while so exposed separating the string therefrom.

10. The process of detecting and separating vegetable string from wool, consisting in treating the wool containing such string with a chemical solution that is selectively adsorbed or absorbed by vegetable fibers and will cause the vegetable fibers to appear luminous and distinct from the wool fibers when exposed to near ultra violet light rays; and thereafter exposing the wool and string to such light rays, and while so exposed separating the string therefrom.

11. The process of detecting and separating vegetable fibers from wool and animal fibers consisting in treating a mixture of such fibers with a direct cotton dyestuff selectively adsorbed or absorbed by cellulose fibers and not absorbed by wool, in quantity insufficient to substantially alter the appearance in white light, and characterized by the property of becoming luminous when subjected to a selected light band of proper frequency; and thereafter exposing the so-treated mixture to a light band of such frequency as to render the cellulose fibers luminous, and separating the vegetable fibers from the mixture while so exposed.

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