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METHOD OF PRODUCING ARTIFICIAL STRAW AND PRODUCT THEREOF

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This invention relates to the manufacture of films, artificial straws, bristles and the like, of reduced luster or increased opacity from yarns, fabrics, filaments, bristles, straws and the like made of or containing organic derivatives of cellulose.

An object of our invention is to produce films, artificial straws, bristles and the like which are considerably duller than those that have been previously made.

A further object of our invention is to produce filaments, artificial straw and the like which have a substantially permanent dull or opaque effect. Other objects of our invention will appear from the following detailed description.

In accordance with our invention we prepare filaments, artificial straws, bristles or the like, all of which are referred to in the claims as straw or like products of flattened cross-section, by associating together a plurality of filaments, yarns, etc., made of or containing thermoplastic derivatives of cellulose, then apply to the same, a volatile liquid consisting of or containing a volatile solvent or restricted or latent solvent for the derivative of cellulose, and then cause the same to coalesce by the application of pressure at a temperature above the boiling point of the volatile solvent or restricted solvent, and the films, artificial straw and the like thus formed may then be wound by any suitable winding device, twist being imparted thereto if desired.

The material to be coalesced and containing the thermoplastic derivative of cellulose may be in the form of fine filaments, of say 2 to 25 denier, which filaments may be twisted in the form of a yarn or which may be untwisted. These filaments may be in the form of artificial bristles of say 50 to 2000 denier or more or they may be in the form of artificial straw. The material also may be employed in the form of braids, tapes, strips of fabric, tubes of knitted fabric, and the like made of or containing the thermoplastic derivative of cellulose.

The thermoplastic derivative of cellulose employed in the material to be treated in accordance with our invention is preferably an organic derivative of cellulose, examples of which are organic esters of cellulose and cellulose ethers. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate while examples of cellulose ethers are ethyl cellulose, methyl cellulose and benzyl cellulose.

If particular ornamental effects are desired, such as are produced by differential color effects or by differential lustre, yarns of non-thermoplastic material may be associated with the thermoplastic material prior to coalescing to form the artificial straw. Examples of such yarns are those made of natural silk, cotton, reconstituted cellulose, wool, etc. Often the presence of these nonthermoplastic materials improves the physical strength and knotting properties of the final straw produced. If metallized effects are desired, fine flat metal bands, such as are used in making tinsel, or metallized threads or yarns may be associated with the filaments of the thermoplastic material prior to coalescing. If desired a bronze or aluminum powder or other effect materials may be incorporated in the product at any suitable stage of manufacture to produce metallic or other effects.

The filaments or yarns or other materials to be coalesced may be drawn from bobbins or other suitable packages to be treated by our process, or they may be drawn directly from the spinning machine where they are produced.

The coalescing liquid applied to the associated yarns, filaments and the like containing an organic derivative of cellulose prior to subjecting the same to heat and pressure contains a substance which is either a solvent or a restricted solvent for the organic derivative of cellulose. Examples of such solvents or solvent mixtures are acetone, ethylene dichloride and ethyl or methyl alcohol, dichlorethylene and ethyl or methyl alcohol, etc. Often it is advantageous to add high boiling solvents or plasticizers such as triacetin, diacetin, dibutyl tartrate, tricresyl phosphate to the coalescing fluid. If desired, this solvent liquid may have dissolved therein a suitable desired proportion of an organic derivative of cellulose, and this organic derivative may be any of those above mentioned. The solvent liquid may be applied in any suitable manner thus by means of wicks, rolls, rods, by spraying the same onto the yarns or filaments, or by immersing the same in the liquid in their passage to the heat and pressure device.

Any suitable means may be employed for applying heat and pressure to the yarns or filaments of organic derivative of cellulose after the solvent liquid has been applied thereto. This pressure device may assume the form of a pair of rollers rotating at opposite directions at the same peripheral speed. At least one of the rollers is heated to a temperature substantially above, say 15 to 40° C. or more above the boiling point of the solvent or part of the solvent employed in the coalescing liquid. The rollers may

be heated by any suitable means such as steam, hot water, electrical resistances, etc. These rollers may have plain and smooth surfaces, or they may have interrupted surfaces. Thus they may be engraved, fluted or have other surfaces to crinkle, emboss or produce similar fancy effects upon the finished artificial straw. One of the rolls may be constructed and operated as a printing roll and be caused to apply a suitable printing paste to the artificial straws under formation, and thus produce a printed design on the product.

The use of pressure rolls or devices that are heated above the boiling point of the solvent in the coalescing, produces in the finished product an opacity or dullness that is substantially permanent due to the fact that the solvent evaporates at a high rate upon contact with the heated rolls, and produces minute distortions and irregularities on the surface of the straw. Straws made by this method are particularly suited for use in the making of hats and the like.

Instead of causing the coalescence of the filament after application of the coalescing liquid by means of rolls heated above the boiling point of the solvent in the coalescing liquid in one operation, as a modification of our process, the filaments may first be treated with a coalescing liquid and subjected to the action of pressure rolls which are not heated substantially above the boiling point of the solvent in the coalescing liquid, and then the material treated with a further quantity of coalescing liquid and passed between rolls that are heated substantially above the boiling point of the solvent in the coalescing liquid in order to obtain the dull effects. Such second treatment may or may not be included in the repressing of the straw to a greater width than obtained after the first pressing. Likewise, we may produce a bright straw on the first pair of rollers, and with a second or successive pair of rollers apply temperature substantially above the boiling point of the solvent employed and thus produce the required dullness.

This invention is not limited to the use of one pair of pressure rolls but two or more pairs may be employed. The successive pairs of pressure rolls at higher or lower temperatures may apply higher or lower pressures than the preceding pairs of pressure rolls. The associated filaments or straw may be caused to wind a plurality of times around one of a single pair of pressure rolls. Furthermore, two or more smaller rolls may be caused to bear on one of a larger roll at different positions around its periphery.

The repeated pressing of the straw makes the same progressively thinner and wider, and this process may be repeated as many times as desired. There is no particular limit as to the width of the film or straw that may be produced by this process, the width depending upon the desired thickness and the weight per unit length of the associated yarns, filaments or bristles initially employed. Where very wide bands or films, say of 6" or more are desired, heavy bands of yarns, bristles or the like, or braids, tapes or strips of fabric containing organic derivatives of cellulose may be employed, or a plurality of strawlike bands produced by the process of this invention, or otherwise, may be coalesced by applying solvent liquid and pressing at elevated temperatures.

The rate of production of films or artificial straws in accordance with this invention may be any desired up to 200 meters per minute or more, the speed being limited merely by the rate of feed and the mechanical limits of speed of the pressure rolls.

Where color effects on the film or artificial straws are desired, suitable dyestuffs may be applied at any suitable stage of the process of manufacture; that is, prior to the application of the solvent liquid, simultaneously therewith or after the same has coalesced to form the finished product. Where the dyestuff is applied prior or subsequent to application of the coalescing solvent, it is preferably in the form of a solution of the dyestuff in organic solvents, as described in the application of W. Whitehead, Serial No. 284,673, filed April 4, 1928. When the dyestuff is applied prior to the application of the coalescing liquid, the same may be applied by means of wicks, rolls and the like in a continuous manner to produce uniform color, or intermittently to form differential color effects. The dyestuff may be applied if desired on one or more of the pressure rolls. A convenient mode of application of the dye is in solution in the coalescing solvent. Other modes of applying the dyestuff may be used. Thus the finished straw may be dyed in hanks or in the form of other packages by any suitable known dyeing methods.

Many ornamental differential color effects may be produced on the straw made in accordance with our invention. Thus if striped color effects are desired, bands of dyed yarns of different colors may be coalesced. If desired, penetrative dye solutions of different colors may be applied to the different bands of yarns at any stage prior to their coalescence. In another form, dyed yarns of natural fibres or reconstituted cellulose of different colors may be associated with yarns of organic derivative of cellulose of another color, and the assembly coalesced, or these yarns may be dyed either separately or together before or after coalescence during the process. By employing a cord formed of yarns that are twisted together, the various plies of the cord of which are of different colors, and then coalescing such cord in accordance with our process, very pleasing differential color effects may be attained. If different colors are desired along the length of the final straw produced, these colors may be applied intermittenly to the yarn prior to coalescence in any suitable manner.

In order further to illustrate our invention, but without being limited thereto, the following specific examples are given.

Example I

140 filaments each of 10 denier are spun by a dry evaporative method from a solution consisting of one part by weight of acetone soluble cellulose acetate and 3 parts by weight of acetone. The filaments containing approximately 10 to 20% of residual solvent acetone are brought into contact with a wick, roller or other furnishing device supplying a further quantity of acetone in amounts approximating 80% of the weight of the filaments to the band of filaments. The filaments are then passed between a pair of rollers, the upper roller of which presses on the lower one with a flat face contact under a pressure of 10 pounds per square inch. The bottom roller is heated to a temperature of 85 to 90° C., which is approximately 30 to 35° C. above the boiling point of acetone. The straw thus produced is wound by any suitable means. This straw is quite dull due to irregularity of surface, has a width approximating $\frac{1}{16}$" and a thickness approximating 0.006".

Example II

140 filaments of 10 denier each of cellulose acetate has 80% of acetone applied thereto and is then passed between rollers as in Example I with the exception that the temperature of the rollers is not more than 65° C. The straw produced in this manner is moderately bright and of about the same dimensions as that produced in Example I. The straw is permitted to dry and then passed in contact with a furnishing device which applies thereto about 15% of its weight in acetone, the acetone being preferably applied to both faces of the straw, and then the straw is passed between heated pressure rolls at a temperature not less than 85° C. and preferably not more than 95° C. This second treatment produces a straw which is dull and similar in appearance to that produced in Example I. If desired the solvent in the second example of the process may be applied to only one face of the straw and in this manner a straw having a dull face and a bright face is produced.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we claim and desire to secure by Letters Patent is:

1. Method of producing dull artificial straw or like products of flattened cross section, which comprises causing a plurality of filamentary products, containing a plastic material and also a volatile liquid which is a solvent for at least part of the material of which the products are composed, to coalesce by the application of pressure at a temperature substantially above the boiling point of said volatile liquid.

2. Method of producing dull artificial straw or like products of flattened cross section, which comprises causing a plurality of filamentary products, containing a thermoplastic derivative of cellulose and a volatile solvent therefor, to coalesce by the application of pressure at a temperature substantially above the boiling point of said volatile solvent.

3. Method of producing dull artificial straw or like products of flattened cross section, which comprises causing a plurality of filamentary products, containing cellulose acetate and a volatile solvent therefor, to coalesce by the application of pressure at a temperature substantially above the boiling point of said volatile solvent.

4. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing a thermoplastic derivative of cellulose, applying thereto a liquid having at least a latent solvent action on the thermoplastic derivative of cellulose, and then coalescing the filaments by applying pressure thereto at a temperature substantially above the boiling point of the said liquid.

5. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing organic derivatives of cellulose, applying thereto a liquid having at least a latent solvent action on the organic derivatives of cellulose, and then coalescing the filaments by applying pressure thereto at a temperature substantially above the boiling point of the said liquid.

6. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing cellulose acetate, applying thereto a liquid having at least a latent solvent action on the cellulose acetate, and then coalescing the filaments by applying pressure thereto at a temperature substantially above the boiling point of the said liquid.

7. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing cellulose acetate, applying thereto a liquid having at least a latent solvent action on the cellulose acetate, and then coalescing the filaments by applying pressure thereto at a temperature at least 15° C. above the boiling point of said solvent liquid.

8. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing cellulose acetate, applying acetone thereto, and then coalescing the filaments by applying pressure thereto at a temperature at least 15° C. above the boiling point of acetone.

9. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing cellulose acetate, applying a liquid which has at least a latent solvent action on the cellulose acetate and having a dyestuff for the same dissolved therein and then coalescing the filaments by applying pressure thereto at a temperature substantially above the boiling point of said solvent liquid.

10. Method of producing dull artificial straw or like products of flattened cross section comprising associating a plurality of filaments containing cellulose acetate and strands of other material, applying a liquid having at least a latent solvent action on the cellulose acetate and then coalescing the filaments by applying pressure thereto at a temperature substantially above the boiling point of the said solvent liquid.

11. Film like material such as artificial straw and like products of flattened cross section containing organic derivatives of cellulose and having on at least one surface thereof minute distortions or irregularities whereby it presents a dull appearance.

12. Film like material such as artificial straw and like products of flattened cross section containing cellulose acetate and having on at least one surface thereof minute distortions or irregularities whereby it presents a dull appearance.

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