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DYEING OF YARNS

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This invention relates to a method of dyeing yarns while running to a winding or other packaging device.

An object of my invention is to dye yarns while they are running to a packaging device either from another package or from a spinning machine where they are formed.

A further object of my invention is to dye yarn by applying to the same a fluid containing a dye for the yarn dissolved in an organic solvent. Further objects of my invention will appear from the following detailed description.

I have found that when solutions of dyes in certain organic solvents are applied to yarns of various kinds, but particularly cellulose acetate yarns, the dyeing is so rapid and homogeneous that such solutions may be used to dye yarns while they are in rapid transit to a bobbin, cop or other package.

In accordance with my invention, I apply to yarn of any suitable material a fluid containing a dye for the yarn dissolved in an organic solvent by means of any suitable device, such as is used for applying a lubricant to yarns.

The yarns that may be dyed in accordance with my invention may be of any nature. While it may be applied to yarns of fibres such as silk, wool, cotton, reconstituted cellulose (rayon) flax, etc., it is particularly advantageous when applied for the dyeing of yarns containing organic derivatives of cellulose, such as 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. The yarns to be treated may consist of only one of the above named materials or it may be a composite yarn containing mixtures of these.

The organic solvent to be used may be of any suitable nature. Thus it may be a relatively volatile solvent such as benzene, toluene, xylene, dichlorethylene, trichlorethylene, ethylene dichloride, ethyl alcohol, methyl alcohol, propyl alcohol, emyl alcohol, butyl alcohol, etc. as is set forth in my prior application 223,239 filed Sept. 30, 1927, of which this application is in part a continuation.

However, I prefer to employ relatively nonvolatile solvents and particularly the polyhydric alcohols and their derivatives as set forth in my copending application 262,597 filed March 17, 1928 of which this application is also in part a continuation. I prefer these polyhydric alcohols and their derivatives because of the fact that they produce satisfactory dyeing and yet evaporate slowly, thus obviating the unpleasant and harmful vapors and fumes which result from the use of the volatile solvents.

Examples of such relative nonvolatile solvents are: polyhydric alcohols, such as glycerol, ethylene glycol, diethylene glycol, propylene glycol; the ethers of polyhydric alcohols, which include the mono ethers such as mono ethyl ether of ethylene glycol or the mono ethyl ethers of diethylene glycol; and the diethers of polyhydric alcohols, such as the diethyl ether of diethylene glycol. Obviously instead of using one of the above polyhydric alcohols or their ethers, a mixture of two or more of these may be used. The above and similar compounds are included in the term "polyhydric alcohols and their esters and ethers" as used in the claims.

While glycerol may be used as the solvent in the dyeing liquid, the glycols or other ethers are preferable since glycerol has the objectionable property of leaving sticky deposits on the apparatus, with which the treated yarn comes in contact, such as cap-edges, fliers, travellers, etc. whereas the glycols or their ethers do not behave in this manner.

If desired, water may be added in any suitable amount to the solution of the dyestuff in the organic solvent and also thickening materials such as starch, gum arabic, gum tragacanth, etc. may be added to form a paste. While these thickening agents may be employed with satisfaction in cases where the more volatile solvents are used; in those instances where the polyhydric alcohols or their derivatives are employed, the use of thickening agents is not essential and does not produce quite as satisfactory and excellent results as may be obtained by the use of simple solutions of the dyes in the organic solvent or solvents employed.

Since many of the polyhydric alcohols and their ethers are hydroscopic, I prefer to add sufficient water to the fluid to bring the aqueous concentration to at least that of the maximum amount of water these alcohols or ethers tend to absorb from the atmosphere, in order to prevent change of volume, viscosity and concentration of dyeing fluid. Thus glycerol absorbs water to the extent of about 33% of its original weight from the air, ethylene glycol absorbs 3 to 4% and diethylene glycol, 30% of water; and therefore, when either of these liquids are used, I prefer to add water in amounts corresponding to the respective percentages set forth.

I have found that the presence of these amounts

of water does not appreciably influence the solubility of the dyestuffs in these organic solvents, nor does it interfere with the uniformity of dyeing, despite the fact that the dyestuffs that I prefer to use are insoluble in water.

The dyestuffs to be employed in the dyeing fluid may be any suitable dye for the particular yarn to be dyed. Since many advantages are obtained by the use of this process in conjunction with the dyeing of yarns made of cellulose acetate, this invention will be more specifically described with respect to the dyeing of such yarns. The dyestuffs most suitable for the dyeing of cellulose acetate yarn are colored bodies that are relatively insoluble in water, and which, therefore, must be applied in some special solubilized form. A large number of such dyes are known as SRA dyes of which the following may be mentioned: dinitrodiphenyl amine (yellow) and dimethyl amino anthraquinone (blue). However, dyes that are soluble in water but which are also soluble in organic solvents such as rosaniline hydrochloride (red) cresyl blue and auramine (yellow) may be used.

The amount of dyestuff used will vary with the nature of the dyestuff and depth of color required. Generally I have found that the shades of sufficient depth may be obtained when employing amounts of dye solution to the extent of 2, 3 or 4% of the weight of the yarn and that such amounts tend to form a lubricant for the yarn and do not interfere with the textile operations such as ring spinning, cop spinning, etc. The concentration of the dyestuff in the solution is quite variable, and may vary say from 0.1% to 5.0% of the solvent used.

As stated before, the liquid containing the dyestuff may be applied in any suitable manner by the usual means of applying lubricating fluid to yarn. For instance, the yarn may be caused to pass across a wick which dips into a trough containing the dyeing fluid. Or else, the yarn may be caused to pass across a roller which rotates and dips into a trough of the dyeing fluid. Furthermore, the yarn may be caused to pass through a trough containing the dyeing fluid.

The yarn may be dyed while it is passing from one package to another package. By packages is meant cops, bobbins, pirns, hanks, etc.

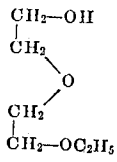
An important application of my invention is in the dyeing of artificial yarns or filaments during the process of their manufacture and prior to their being wound. For instance, in the manufacture of cellulose acetate yarn by the dry spinning process, a solution of cellulose acetate in appropriate volatile solvent such as acetone is passed through the orifices of a spinnerette in a metier or dry spinning machine to a heated atmosphere and the filaments thus drawn are wound and/or twisted onto an appropriate bobbin or cop spinning machine. When my invention is used in connection with the dry spinning process, the dyeing fluid is applied, to the filaments or yarns on the metier or spinning machine.

In one application of my invention, the dyeing liquid is applied by means of a wick which is dipping in a trough containing the dyeing fluid to the filaments just after their exit from the metier casing, both the wick and the trough being mounted on the metier or dry spinning machine. Because of the elevated temperature prevailing within the metier, the use of the high boiling solvents mentioned above in the dyeing fluid is particularly advantageous in reducing the amount of clogging of the wicks, and are therefore preferred to the more volatile solvents when used in this connection.

In order further to illustrate my invention the following specific example is given.

Example

The following is an example of a method of dyeing cellulose acetate yarn during the process of its manufacture. A dyeing fluid is made up by dissolving one part by weight of methyl amino anthraquinone in 50 parts by weight of mono ethyl ether of diethylene glycol having the following formula:



The solution thus formed is then poured into a small container from which protrudes a soft lamp wick, which dips into the dye solution. Cellulose acetate yarn, which is being formed from the spinnerettes of a dry spinning machine by the extrusion of a solution of cellulose acetate in acetone, is caused to pass across this wick in its passage from the spinning unit to or between rollers, etc. of a suitable winding device. The yarn is dyed a medium shade of red, which is fast both to light and scouring and is ready for any textile operation, such as knitting or weaving, since the ethyl ether of diethylene glycol acts as a lubricant.

If desired the yarn, prior to knitting or weaving, or the fabric after wearing may be given any desired finishing treatment such as washing, scouring, etc. to remove the mono ethyl ether of diethylene glycol. If it is desired to deluster the yarn, the washing or scouring may be done in hot water of a temperature of 75° C. or above, or any other delustering agency.

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 this invention.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. Method of dyeing yarn containing organic derivatives of cellulose comprising applying thereto a solution of a dyestuff in mono ethyl ether of diethylene glycol.

2. Method of dyeing yarn containing cellulose acetate comprising applying thereto a solution of a dyestuff in mono ethyl ether of diethylene glycol.

3. Method of dyeing yarn containing cellulose acetate comprising applying to said yarn while it is in transit to a winding device, a substance containing a solution of dyestuff in mono ethyl ether of diethylene glycol.

4. In the dry spinning of filaments or yarns containing cellulose acetate in a metier, the step of applying a dyeing fluid to the filaments or yarns on the metier casing, said dyeing fluid containing a dyestuff for said yarns and mono ethyl ether of diethylene glycol.

5. Method of dyeing yarn containing organic derivatives of cellulose comprising applying thereto a solution of a dyestuff in a compound selected from the group consisting of organic esters and ethers of polyhydric alcohols.

6. Method of dyeing yarn containing cellulose acetate comprising applying thereto a solution of

a dyestuff in a compound selected from the group consisting of organic esters and ethers of polyhydric alcohols.

7. Method of dyeing yarn containing organic derivatives of cellulose comprising applying to said yarn while it is in transit to a winding device, a substance containing a solution of a dyestuff in a compound selected from the group consisting of organic esters and ethers of polyhydric alcohols.

8. In the dry spinning of filaments or yarns containing organic derivatives of cellulose in a metier, the step of applying a dyeing fluid to the filaments or yarns at the metier casing, said dyeing fluid containing a dyestuff for said yarns dissolved in a substance selected from the group consisting of organic esters and ethers of polyhydric alcohols.

9. In the dry spinning of filaments or yarns containing cellulose acetate in a metier, the step of applying a dyeing fluid to the filaments or yarns at the metier casing, said dyeing fluid containing a dyestuff for said yarns and a compound selected from the group consisting of organic esters and ethers of polyhydric alcohols.

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