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DIFFERENTIAL DRYING OF RESIN-IMPREGNATED FABRIC TO OBTAIN DIFFERENTIAL DYEING EFFECTS

Croyden M. Whittaker, Cheadle Hulme, Henry A. Thomas, Hazel Grove, Clifford C. Wilcock, Salford, and Charles P. Tattersfield, Audenshaw, near Manchester, England, assignors to Courtaulds Limited, London, England, a British company

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This invention relates to the production of differential dyeing effects on fabrics, in which different portions of the fabric are differently colored. The invention can be carried out so that, for instance, one side of the fabric is colored differently from those of the other side, or so that different portions of the same side of the fabric are differently colored.

We have found that by impregnating a textile fabric with a solution or suspension of a non-volatile dyestuff or of resin-forming compounds which are capable of altering the dyeing properties of the fabric, said dyestuffs and resin-forming compounds having no affinity or a low affinity, or in other words at the most only a low affinity for the material of the fabric, and evaporating the impregnating liquid more rapidly from one portion of the fabric than from another portion, we can obtain differential effects on the two portions of the fabric, so that, in the case of a dyestuff, the portions are differently colored and, in the case of resin-forming compounds, different color effects are obtained on subsequently heating the fabric to effect condensation and then dyeing. If for instance the impregnating liquor be evaporated more rapidly from one side of the fabric than from the other by blowing air, either hot, warm or cold, onto one side of the fabric only, it will be found that the two sides are, or can be, differently colored. If it is desired to produce a differential effect on different portions of one side of the fabric, then suitable means for localising the evaporation on that side are employed; for instance a stencil or template or other means for assisting the production of a local drying can be employed. Thus, if a spun viscose rayon fabric be impregnated with a solution containing cyanamide, formaldehyde and ammonium thiocyanate, and the fabric be then dried by blowing hot air onto one side only, and the dried fabric be then heated to a temperature of about 140° centigrade until the condensation product has been formed, a very marked differential effect will be produced, as is shown when the fabric is dyed with a wool dyestuff.

In the treatment of fabrics with a solution containing cyanamide, formaldehyde and ammonium thiocyanate as just described, the ammonium thiocyanate acts in its known capacity as a catalyst, that is, it greatly increases the affinity of the material of the fabric for certain direct dyestuffs. Other known catalysts may be added to the solution or suspension of the resin-forming compounds.

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Generally speaking, if the material be squeezed more lightly, so as to leave therein a greater proportion of the impregnating liquid, more pronounced differential effects will be obtained when carrying out the drying process according to this invention.

If the impregnating solution has any considerable substantive affinity for the material, such for instance as that possessed by certain dyestuffs, the differential dyeing effect, which it is our object to attain, is not produced. For instance, viscose staple fibre cloth impregnated with a 0.1 per cent solution of Chlorazol Fast Orange G (Journal Society Dyers and Colourists, 1938, page 269) and then dried by blowing hot air onto one side only, shows practically no differential dyeing effect because this particular dyestuff has a good substantivity for the staple fibre at the low temperature of impregnation. On the other hand, on impregnating with a 0.3 per cent solution of Chlorazol Fast Orange AG (Journal Society Dyers and Colourists, 1938, page 270) and then drying by blowing with hot air on one side only, a very marked differential dyeing effect is obtained, because Chlorazol Fast Orange AG has a negligible substantivity for viscose staple fibre at the temperature of impregnation. Similarly, when used in a like process, a 0.5 per cent solution of Indigosol Blue IBC (Journal Society Dyers and Colourists, 1938, page 97) has low substantivity and therefore shows large dyeing contrast, whilst a 0.5 per cent solution of Soledon Jade Green (Journal Society Dyers and Colourists, 1927, page 100) shows no substantial contrast because it has a high substantivity for viscose staple fibre at the temperature of impregnation.

It is thus evident that, when carrying out our invention, the compound or compounds with which the fabric is impregnated must not have a pronounced affinity for or even chemical action on the material of the fabric, under the conditions of impregnation, but not necessarily under the conditions of any subsequent treatment.

It is also desirable or even necessary, when carrying out the process of this invention, to take care that the current of air, especially if this be hot, be prevented from impinging on or surrounding the reverse side of the fabric. Thus, an enclosed stenter, where the hot air cannot get away from the material quickly, does not give anything like as good differential effects as a completely open stenter in which the hot air blows on one side of the fabric only.

The process of our invention can be applied

to such textile fabrics as those obtained for instance by weaving, knitting or felting, and the fabrics may be made of any suitable fibres, such for instance as regenerated cellulose or other rayons such as cellulose acetate, casein, Vinyon and nylon in either continuous or cut lengths, or of natural fibres such as cotton and wool. Mixed fabrics may also be treated in a similar manner.

The invention is illustrated by the following examples in which the percentages are by weight. In the dyebaths a liquor to yarn ratio of 40:1 is used in each case.

Example 1

An aqueous impregnating solution is prepared by mixing 2.4 lbs. of 40 per cent (commercial) formaldehyde with 3 gallons of a 2 per cent aqueous cyanamide solution, adjusting the pH value of the solution so obtained to 6.0 by means of aqueous caustic soda solution of 72° Tw., and dissolving in the solution 0.3 lb. of ammonium thiocyanate. 10 lbs. of a tubular knitted viscose yarn fabric are impregnated in a pad mangle with the resultant solution and squeezed till the fabric retains its own weight of solution. The fabric is then differentially dried on a tubular drier with air at 60° to 70° centigrade blow into the interior of the fabric, and the fabric is then heated for 3 minutes at 148° centigrade in order to complete the condensation of the cyanamide and formaldehyde. The fabric is scoured for 10 minutes at 40° centigrade in an aqueous solution containing 2 per cent of "Lissapol" LS and 1 per cent of 0.880 ammonia. "Lissapol" is a registered trade-mark. It is then introduced into a cold dyebath containing 2 per cent of Azo Geranine 2GS (Colour Index No. 31) and 2 per cent of formic acid, the temperature of the dyebath is then raised in half an hour to 95° centigrade and dyeing continued at this temperature for 45 minutes. The interior surface of the fabric on which the hot drying air impinged is uniformly dyed a heavier shade than the other side of the fabric.

Example 2

An aqueous impregnating solution is prepared by mixing 800 cubic centimetres of 40 per cent formaldehyde with 10 litres of 2 per cent aqueous cyanamide solution, adjusting the pH value to 6.0 with aqueous caustic soda solution of 72° Tw., and dissolving in the solution 67 grams of ammonium thiocyanate. 1 kilogram of a woven cloth prepared from the viscose staple fibre as sold under the registered trade-mark "Fibro" is steeped in the solution, squeezed till the cloth retains its own weight of solution and dried differentially by blowing hot air at 60° to 70° centigrade on one side of the fabric only. The fabric is baked at 140° centigrade for 3 minutes, scoured for 10 minutes at 40° centigrade in an aqueous 0.5 per cent soap solution and dyed as described in Example 1.

Example 3

Three impregnating baths are prepared as follows:

(*a*) 10 litres of a 3 per cent aqueous dicyandiamide solution are mixed with 1.6 litres of 40 per cent formaldehyde, the pH value of the solution adjusted to 6.0 by means of aqueous caustic soda solution of 72° Tw., and 200 grams of ammonium thiocyanate dissolved in the resultant solution.

(*b*) 10 litres of a 2.5 per cent aqueous guanidine carbonate solution are mixed with 1 litre of 40 per cent formaldehyde and the pH value of the solution adjusted to 7.0 by means of concentrated hydrochloric acid.

(*c*) 10 litres of water, 800 cubic centimetres of aqueous 70 per cent ethylene diamine and 4 litres of 40 per cent formaldehyde are mixed together and the pH value of the solution adjusted to 7.0 by means of concentrated hydrochloric acid.

Three batches each weighing 1 kilogram of a woven cloth prepared from the viscose staple fibre "Fibro" are steeped one in each of the above baths, squeezed till the cloths retain their own weight of solution and dried differentially by blowing hot air on one side only of the cloth. The cloths are heated for 15 minutes at 140° centigrade to effect condensation and are scoured for 10 minutes at 40° centigrade with an aqueous 0.5 per cent soap solution. The cloths are then introduced into a cold dyebath containing 2 per cent of Alizarine Brilliant Green G (Colour Index No. 1079) and 2 per cent of acetic acid. The temperature of the dyebath is raised to 95° centigrade in half an hour and dyeing continued at this temperature for 45 minutes. In each case the side of the fabric which the hot air strikes first is dyed a heavier shade than the other side.

Example 4

An aqueous impregnating solution is prepared by dissolving one part of Chlorazol Fast Orange AG in 100 parts of water. A fabric prepared from "Fibro" staple fibre is padded in this cold solution and squeezed evenly till it retains its own weight of liquor. A hot air blast is then directed on to one side of the fabric until the fabric is thoroughly dried. The side on which the hot air blast has impinged is found to be dyed to a considerably heavier shade than the other side of the fabric.

Example 5

An aqueous impregnating solution is prepared by dissolving 1 part of Indigosol Blue 1BC in 100 parts of water. A cotton fabric is padded in this cold solution and squeezed evenly till it retains its own weight of liquor. It is then dried by passage over a hot air blast. The true shade is then developed by treating the fabric in an aqueous liquor containing 2 parts of sodium chloride. 1.85 parts of sulphuric acid of 168° Tw., and one-tenth part of sodium nitrite per 100 parts of water. After treatment for 15 minutes at 25° centigrade the fabric is washed free from acid and finally treated in 40 times its weight of a 0.1 per cent solution of soap at 90° centigrade for 20 minutes. The side which has received the direct impact of the hot blast is dyed more heavily than the other side.

Example 6

A fabric prepared from "Fibro" staple fibre is padded in a cold suspension of 1 part Caledon Green RCS (Imperial Chemical Industries Limited) in 200 parts of water. It is then squeezed till it retains its own weight of liquor and is dried by impinging a hot air blast on to one side only of the fabric. The dried fabric is steeped for 10 minutes in a solution at 60° centigrade containing per 100 parts of water 2 parts of common salt, 1.7 parts of caustic soda solution of 72° Tw. and 1 part of sodium hydrosulphite. Following this treatment the fabric is squeezed and plunged into cold water. It is again squeezed, treated for 15 minutes at 60° centigrade with

3 per cent of its weight of sodium percarbonate dissolved in 20 times its weight of water. Finally the fabric is treated at 90° centigrade for 15 minutes in a 0.1 per cent solution of soap.

Example 7

1 part of Indigosol Blue 1BC powder is dissolved in 35 parts of water and 65 parts of Industrial alcohol are added. A piece of 100 per cent cellulose acetate rayon sateen is padded in this liquor, squeezed evenly and then a hot air draught is blown on to one side until the fabric is thoroughly dry. The fabric is then immersed for 15 minutes in a cold liquor containing 2 parts of sodium chloride, 1.85 parts of sulphuric acid of 168° Tw. and one-tenth part of sodium nitrite, made up to 100 parts with water. The fabric is then rinsed in cold water and treated in 40 times its weight of a 0.1 per cent solution of soap. The side subjected to the hot air treatment is more heavily dyed than the other side of the fabric.

Example 8

A union fabric containing 50 parts of wool and 50 parts of casein fibre is padded in a cold 0.5 per cent aqueous solution of Chlorazol Dark Green PL conc. (Colour Index No. 583). It is then squeezed and hot air is allowed to impinge on one side only of the fabric until the fabric is dry. This side is then found to be more heavily dyed than the other side of the fabric.

Example 9

A wool fabric is padded in a suspension of 1 part of Monastral Fast Blue BS (Journal Society Dyers and Colourists, 1936, vol. 52, page 22) in 100 parts of cold water. The fabric is then squeezed and heated on one side only by a draught of hot air until completely dry. The pigment is then found to be more concentrated on this side than on the side not exposed to the draught.

Example 10

A wool fabric is padded in a solution of 1 part of Azo Geranine 2GS and 2 parts of ammonium sulphate per 100 parts of water. After squeezing, the fabric is dried by applying a hot air draught to one side only of the fabric. This side is more heavily dyed than the side not so treated.

In this specification and in the appended claims, the word "catalyst" is used to designate such agents as will accelerate the formation of the resin.

What we claim is:

1. A process for the production of differential dyeing effects on cellulosic textile fabrics which comprises uniformly impregnating the said fabric with a liquid composition containing nitrogenous resin-forming compounds, evaporating the liquid medium from the thus-impregnated fabric so that the liquid is evaporated more rapidly from predetermined portions than from the remaining portions of the fabric, heating the fabric to effect condensation of said nitrogenous resin-forming compounds, and dyeing the said fabric.

2. A process as claimed in claim 1 wherein the nitrogenous resin-forming ingredients are cyanamide and formaldehyde.

3. A process for the production of differential dyeing effects on cellulosic textile fabrics which comprises uniformly impregnating the said fabric with a liquid composition containing cyanamide and formaldehyde and a catalyst evaporating the liquid medium from the thus-impregnated fabric so that the liquid is evaporated more rapidly from predetermined portions than from the remaining portions of the fabric, heating the fabric to effect condensation of the cyanamide and formaldehyde, and dyeing the said fabric.

4. A process as claimed in claim 1 wherein the liquid medium is evaporated more rapidly from one side of the fabric than from the other side of the fabric.

5. A process for the production of differential dyeing effects on cellulosic textile fabrics which comprises uniformly impregnating the said fabric with a liquid composition containing cyanamide, formaldehyde and ammonium thiocyanate, evaporating the liquid medium from the thus impregnated fabric so that the liquid is evaporated more rapidly from predetermined portions than from the remaining portions of the fabric, heating the fabric to effect condensation of the cyanamide and formaldehyde, and dyeing the said fabric.

C. M. WHITTAKER.
H. A. THOMAS.
C. C. WILCOCK
C. P. TATTERSFIELD.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,211,861	Platt	Aug. 20, 1940
2,318,464	Cameron	May 4, 1943
2,033,836	Lantz	Mar. 10, 1936
2,093,651	Windmer	Sept. 21, 1937
2,123,152	Rivat	July 5, 1938
2,039,176	Locker	Apr. 28, 1936
2,340,577	Bradshaw	Feb. 1, 1944

FOREIGN PATENTS

Number	Country	Date
462,724	British	Mar. 11, 1937