

FIG. 1

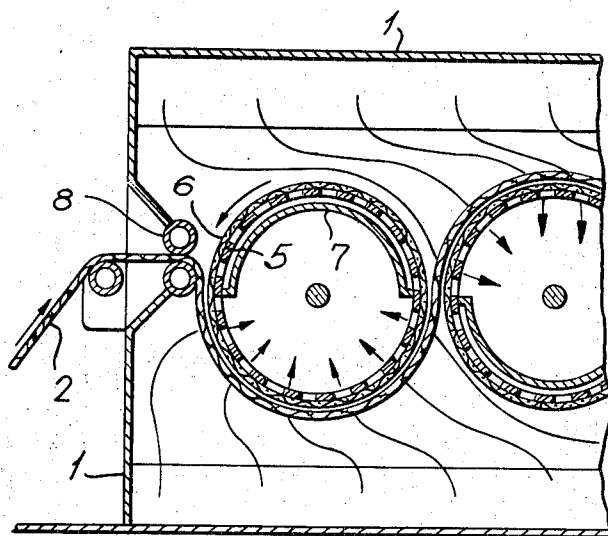
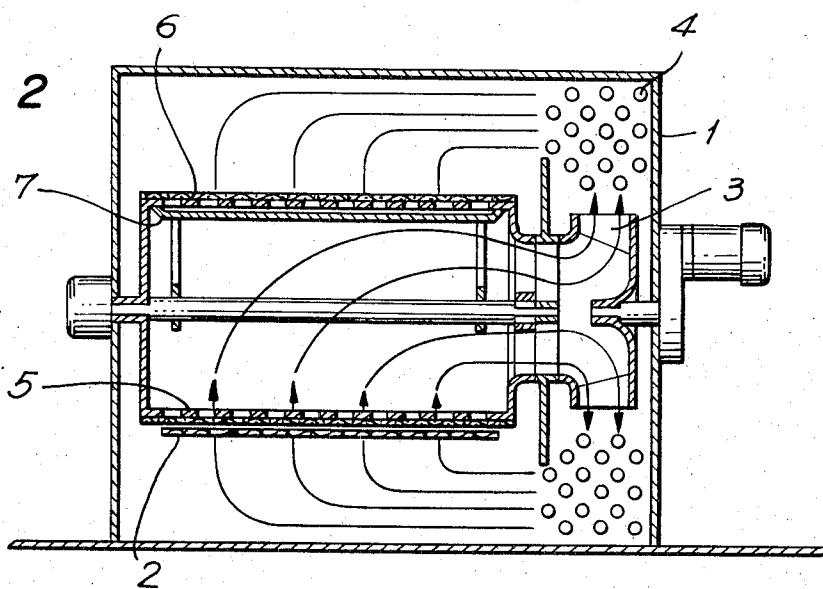


FIG. 2



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3,567,356

REACTIVE AND DISPERSE DYES FIXED ON CELLULOSE BLENDED FABRICS TRAVELING ON DRUM RADIALLY PASSING HOT GAS

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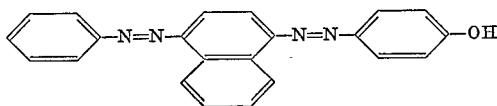
Int. Cl. D06p 3/82

U.S. Cl. 8-21

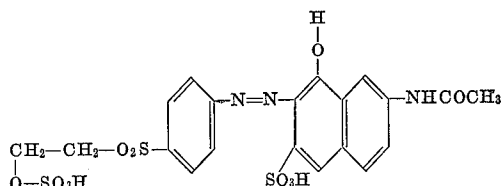
6 Claims

ABSTRACT OF THE DISCLOSURE

Process for the simultaneous fixation of disperse and reactive dyestuffs such as



and



respectively, on a fabric such as made of a polyester and cellulose fiber blend by passing a heated gas such as air through said fabric which is trained around a plurality of perforated drums covered with a fine mesh sieve material of a mesh size, of less than 1 mm. and wherein said fabrics are printed or padded with the aforesaid dyestuffs.

It is known that mixed fabrics made of cellulose and synthetic fibers, preferably of high molecular weight linear polyesters, can be simultaneously dyed or printed with reactive and disperse dyestuffs according to the thermosol process.

According to this process, the mixed fabric is padded with an aqueous preparation containing, besides disperse and reactive dyestuffs, alkalies and, if necessary, further auxiliaries, such as for example wetting substances and thickeners. The fabric is subsequently dried and then subjected, for 30 to 60 seconds, to a thermal treatment at temperature of about 185° to 230° C. By this thermal treatment the polyester portion of the mixed fabric is fixed in order to provide its optimal technological properties. At the same time, the fixation of the disperse dyestuffs in the polyester fiber and that of the reactive dyestuffs in the cellulose fiber takes place. The high temperatures and the long fixation periods are necessary to obtain, besides the fixation of the fabric, a maximum fixation of the disperse dyestuffs. In case reactive dyestuffs are used, however, the long fixation periods and the high fixation temperatures which are required, cause a partly high loss in yield of the dyestuff being fixed, sometimes accompanied by a marked change of the tint. By reducing the fixation time the fixation yield of the reactive dyestuffs could be increased, though this would reduce the yield of the disperse dyestuffs being fixed. By reducing the fixation temperature, the yield of the reactive dyestuffs being fixed could be increased like-

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wise, though this would reduce the yield of the disperse dyestuffs and, above all, impair the textile-technological properties of the polyester fibers. For carrying out the thermal treatment, the mixed fabric is generally transported horizontally through a so-called stretching frame, whereby heated gas, mostly heated air, sometimes also overheated steam or a mixture of air and overheated steam, is blown from both sides onto the fabric. The fabric is carried on through the stretching frame by means of pins and clips, so-called clamps, which fasten the material at the selvages and adjust the breadth of the material as desired. The heating time required for this process is usually about 30-60 seconds.

Now we have found that the aforementioned disadvantages of the simultaneous fixation of disperse and reactive dyestuffs on mixed fabrics made of synthetic fibrous materials and fibers of native or regenerated cellulose can be avoided and a complete thermosetting of the synthetic fibrous materials and of the dyestuff mixtures can be obtained at a shorter heating time, by passing gas heated to about 185°-230° C. through the textile materials which had been dried, if desired, and which had been printed or padded with preparations containing both dyestuffs, alkalies for the fixation of the reactive dyestuffs and, if desired, further usual auxiliaries and thickening agents.

Compared with the known methods, the process of the invention not only has the advantage of permitting better yield of the reactive dyestuff being fixed but it also permits a considerably higher production rate, since the fixing period can be essentially reduced, so that, depending on dyestuff and type of fabric, complete fixation of the synthetic fiber and of the dispersion dyestuff is obtained after a period of about 1-20 seconds; whereas the usual fixation on the stretching frame is obtained at the same temperature only after about 30-60 seconds. It is very surprising that by blowing heated gas through the textile materials from one side the fixing period is shorter than when the heated gas is blown over the material from both sides.

In the thermosetting process of the present invention, the textile material is passed over sieves, preferably, cylindrical sieves 5 which serve as carrying and transporting elements for this material. For carrying out the process of the present invention, it is necessary to use a practically hermetically closed casing 1 in which the textile material 2 lying on the sieves is exposed to hot gases which circulate in such a manner that the material is pressed on the sieves. Rotating perforated cylinders (cylindrical sieves), the interior of which is under suction draft or on the exterior of which an excess pressure acts, are preferred. The textile material is passed over the cylinders and is pressed and kept on the sieves by the heated gas which is forced through it, so that the textile material need generally not be transported by an additional means. In special cases, for example, to completely avoid the shrinkage of the textile material in the weft or to keep it within certain limits, the textile materials may additionally be fastened at both sides by means of appropriate devices, for example, pins, dents or clips.

When cylindrical sieves 5 are used which are under suction draft or excess pressure, the heated gas is sucked or pressed through the textile material into the cylinders and is expelled from the cylinder through the front side with the aid of ventilators 3. The gas is then passed over a heating device 4 and once more conducted towards the surface of the cylindrical sieves. The continuous circulation of the gas assures a constant temperature and thus a uniform and quick conveying of heat to the textile material.

In order to prevent the perforation of the sieves from leaving possible marks on the textile material, the perforation design may be finely shaped. It is, however, also possible and in many cases advantageous, to cover the

perforated cylinder mantle with a preferably seamless fine-meshed sieve 6 on which the textile material then lies. It is also possible to use several layers of sieve-fabric. It is suitable and advantageous that the sieve-fabric which comes in contact with the textile material, has the finest possible meshes, the distance between the wires of the sieve-fabric being advantageously less than 1 mm., preferably less than 0.3 mm. When perforated cylindrical sieves are used, it is advantageous to limit the stream of the heated gas to the surface of the cylinder which is covered by the textile material, by means of appropriate arrangements, for example, sheet covers 7 which have been installed and fixed in the interior of the cylinders. In general, the textile material is passed over the cylinders in such a manner as to cover about $\frac{1}{3}$ to $\frac{1}{2}$, advantageously, not more than $\frac{3}{4}$ of the cylinder mantle, or inversely, the cover generally screens about $\frac{1}{4}$ to $\frac{2}{3}$ of the cylinder mantle against the access of gas.

The diameter of the cylinder may be adapted to each individual case and to the industrial requirements. The cylinders chosen generally have a diameter within the range of from 50 to 350 cm., but cylinders of a greater size may also be used, for example, those having a diameter of about 10 m. The width of the cylindrical sieves depends on the textile material to be treated. In most cases, it is within the range of from 90 to 200 cm., but it may, however, be even greater or smaller if required. It is not an inconvenience if a part of the perforated cylinder mantle is not covered with the material. In extreme cases, i.e., a broad cylinder and a narrow width of the material, the margin of the mantle surface which is not covered with the material, may be covered with a correspondingly adjusted cuff.

It has proved to be advantageous to pass the textile material over several cylindrical sieves arranged in series, the number of the cylinders depending, at a certain production rate, especially on the diameter of the cylinders and on their rotation speed. The textile material is advantageously passed in such a manner that the hot gas is alternately blown through the material.

A preferred embodiment of a thermosetting apparatus with cylindrical sieves is shown in the accompanying drawing (FIGS. 1 and 2).

The number of revolutions of the cylinders is advantageously adapted to each individual case, and depends on, for example, the diameter of the cylinder, the number of cylinders used and the fixing period required. It is also possible to vary the number of revolutions of the cylinders arranged in series so that each cylinder rotates a little slower than the preceding one, whereby an over-feeding of the material is achieved and thus the material can shrink in its warps without tension as a result of the action of heat. Another possibility of achieving an over-feeding of the material is obtained by passing the material to the cylindrical sieves over a feeding arrangement 8, for example, a pair of rollers, at a speed which is greater than that of the first cylinder. Another decisive influence on the fixing period required and, thus, on the production rate is determined by the speed at which the heated gas is passed through the material. This speed can be regulated by adjusting the number of revolutions of the ventilators as required. This speed is furthermore determined by the thickness of the textile material lying on the cylinder, it is generally adjusted to 0.5–5 metres/second. It is advantageous to maintain the gas flow at a velocity of more than 2 metres/second.

The period of heat transfer to the textile material and of the fixing process may be shortened by further appropriate means. Thus, the material may be preheated before being introduced into the thermosetting apparatus, by passing it over heated rolls, by infrared irradiation or similar arrangements. It is also possible to additionally heat the cylindrical sieves by appropriate devices, for example, by infrared irradiators or by electric heaters. When the thermosetting apparatus has a sufficient output, it is also possible to dispense with the preheating of the padded

or printed textile material and to heat and fix the material within the apparatus.

Instead of rotating perforated cylinders, there may also be used other appropriate arrangements. Thus, for example, endless perforated bands (sieve-bands) which run in closed casings and on which the material lies and through which the heated gas is passed, sucked or blown in a similar manner as described for the cylindrical sieves. For this arrangement it is also advantageous to perforate the bands as finely as possible or to cover them, preferably with a fine-meshed sieve-fabric. It is also possible to arrange several of such casings in series and to transfer the arrangement described for cylindrical sieves in analogous manner to the casings containing the sieve-bands.

It is advantageous to cool the textile material after the thermosetting process. The textile material may be passed for that purpose, for example, over one or several cooling rolls or cold air may be blown on or passed through the material after its leaving the thermosetting apparatus.

As gases serving as heat transferring agents according to the process of the present invention, there may be used all inert, noninflammable gases or mixtures of gases. Suitable gases are, for example, nitrogen or carbon dioxide, preferably air. There may furthermore be used steam per se or steam in mixture with the gases mentioned, advantageously, with air.

The fixing temperatures to be applied in the process of the present invention are to be adapted to the conditions of each individual case. In general, they are in the range of from about 185° to about 230° C. The fixing period which depends above all on the dispersion dyestuffs to be fixed and, if required, on the fibrous materials to be fixed, is in the new method of the invention considerably shorter than that required in the known thermosetting process on stretching frames. In general, a fixing period in the range of about 1 to about 20 seconds is sufficient. In most cases fixing periods of about 3–15 seconds or preferably 5–10 seconds will be sufficient for obtaining complete fixation.

As reactive dyestuffs, organic dyestuffs can be used which contain at least one group capable of reacting with the cellulose fiber or a group capable of being converted into such a group or a substituent capable of reacting with the cellulose fiber. As parent organic dyestuffs those of the anthraquinone, azo and phthalocyanine dyestuff series are especially appropriate. Those of the azo and phthalocyanine series may be metal-free or may contain metal. As groups capable of reacting or groups capable of forming such groups in an alkaline medium the following may be mentioned as examples: the epoxy group, the ethyleneimide group, the vinyl radical in a vinyl sulfonic group or in an acrylic acid group and the β -sulfatoethylsulfonyl group. There may be used also such dyestuffs the reactive group of which, for example the vinyl group, have been converted into the hydroxy group under the action of alkalis. As substituents capable of reacting may be considered those which are capable of being easily split off and which form a residual electrophilic radical, for example halogen atoms in the following ring systems: quinoxaline, triazine, pyrimidine, phthalazine and pyridazine.

The disperse dyestuffs which can be used are those generally known for dyeing synthetic fibers, especially fibrous materials of linear polyesters, for example, those of the azo or anthraquinone dyestuff series.

The alkaline substances to be added to the preparations can be applied in the quantities usual in the dyeing with reactive dyestuffs, i.e., in quantities of about 5–25 g./kg. of printing paste or padding liquor. As alkaline substances it is advantageous to use inorganic compounds such as sodium carbonate, sodium bicarbonate, trisodium phosphate, sodium hydroxide, sodium silicate, the corresponding potassium compounds or mixtures of these alkaline substances. Preferably, sodium hydroxide, sodium carbonate or sodium bicarbonate is used.

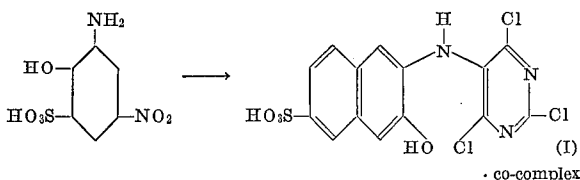
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The process of the present invention is preferably applied in the dyeing of mixtures of fibers of native or regenerated cellulose and fibrous materials of high molecular weight linear polyesters. It may also be used for the printing or dyeing of mixtures of cellulosic fibers with synthetic fibers, for example polyamide fibers. The process of the invention can be used for the thermosetting of pad dyeings or prints on fabrics or on textile materials of any other form, for example, knit fabric or fiber fleeces.

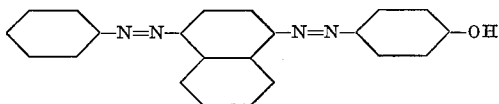
The following examples illustrate the invention but they are not intended to limit it thereto:

EXAMPLE 1

A mixed fabric of polyethylene terephthalate fibers and cotton in a mixing proportion of 67:33 was padded on the foulard, with a squeezing effect of 55% by weight, with a bath containing, per liter of water, 30 grams of the orange reactive dyestuff of the formula



having the form and composition usual in commerce, 30 grams of the disperse dyestuff of the formula



(Synthesis of which is shown in U.S. Pat. No. 1,618,413) identified as C.I. Disperse Orange 13, Color Index No. 26080.

having the form and composition usual in commerce, and 10 cc. of an aqueous 37.5% sodium hydroxide solution.

The padded fabric was dried for 40 seconds at 120° C. and then subjected for 10 seconds to a heat treatment at 220° C. in the thermosetting apparatus described hereafter.

In essential, the apparatus consisted of 4 rotating cylindrical sieves of a diameter of 140 cm. (diameter of the sieve perforation: 8 mm.) which had been covered with a finely porous seamless sieve-fabric (distance of the sieve-filaments: 0.12 mm.). The cylinders were arranged in series in a horizontal position in a closed casing. The interior of the cylinders was under suction draft which sucked the air heated to 220° C. from outside through the textile material, the sieve-fabric and the perforation, into the interior of the cylinders. The halves of the cylinder mantles which were not covered with the textile material, were screened against the draft by cover sheets which had been installed in fixed position in the interior of the cylinders.

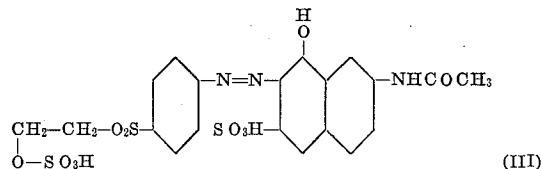
The fabric which had been padded and dried, was passed—without tension and provided with an overfeeding—to the rotating cylindrical sieves over a pair of rolls. It was passed over one-half each of the cylinders, it was transported to the next cylinder by means of the suction draft whereby face and back of the fabric lie alternately on the cylinders. The contents of material in the thermosetting apparatus amounted to 8.8 m. and the production rate of the apparatus was about 50 m./min. when a fixing period of 10 seconds was chosen.

After having left the thermosetting apparatus, the fabric was rinsed in the usual manner, acidified with a solution containing, per liter, 2 cc. of acetic acid having a strength of about 50%, rinsed again and soaped for 5 minutes at 95° C. with a bath containing, per liter, 2 grams of a non-ionic surface-active agent.

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When the thermosetting was carried out in the usual manner on a stretching frame and likewise at 220° C., 45 seconds were necessary to dye the polyester portion the same deep shade. The cellulose fiber portion, however, showed a considerably lighter shade than that obtained by the thermosetting process of the present invention.

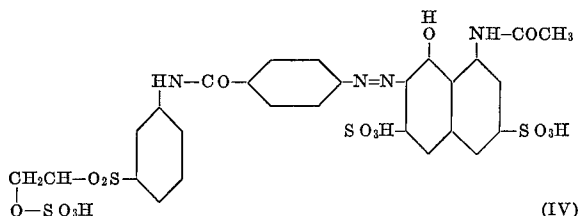
Similar advantageous results are obtained when using in the method of operation described above instead of the above-mentioned reactive dyestuff 30 g. of the dyestuff of the Formula III



(Synthesis shown in Collection of Czechoslov. Chem. Commun. vol. 27, 1962, pages 268-275) identified as C.I. Reactive Orange 16, cf. U.S. Pat. 2,670,265.

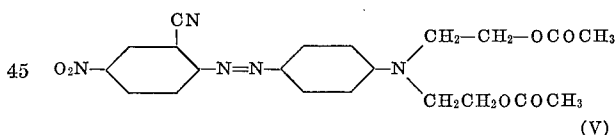
EXAMPLE 2

A mixed fabric of polyester and cotton in a mixing proportion of 67:33 was padded on the foulard, with a squeezing effect of 55% by weight, with a bath, containing per liter 30 g. of the reaction dyestuff of the following formula



identified as C.I. Reactive Red 21, cf. U.S. Pat. 3,008,950

having the form and composition usual in commerce and 30 g. of the disperse dyestuff of the following formula



(Synthesis shown in U.S. Pat. No. 3,207,568), the preparation of which is shown in Belgium Pat. 636,010 in Example 1 thereof.

having the form and composition usual in commerce and 5 g. of calcinated sodium carbonate.

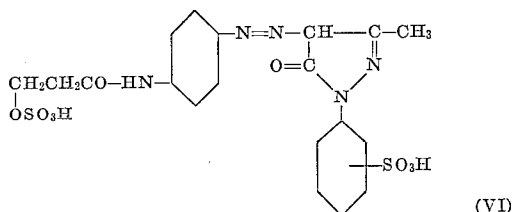
The padded fabric was dried for 40 seconds at 120° C. and then subjected, as described in Example 1, for 10 seconds at 220° C. to a heat treatment consisting of conducting hot air through it. The fabric was rinsed in the usual manner, acidified with a bath containing, per liter, 2 cc. of acetic acid having a strength of 50%, rinsed again and soaped for 3 minutes at 95° C. with a bath containing, per liter of water, 2 g. of a nonionic surface-active agent, whereafter the fabric was rinsed again. Prints having deep red shades on both kinds of the fibrous material were obtained.

When the thermofixation was effected in usual manner on a stretching frame and likewise at 220° C., 40 seconds were necessary to dye the polyester portion the same deep shade as that obtained by the fixation described above. The cotton portion, however, showed a considerably lighter shade.

EXAMPLE 3

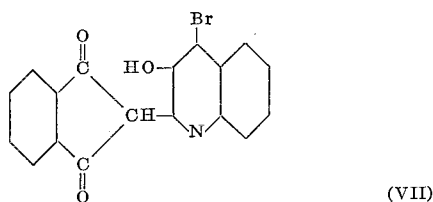
A mixed fabric of polyethylene terephthalate and cotton in a mixing proportion of 67:33 was padded on the foulard with a squeezing effect of 55% by weight, with

a bath containing, per liter 30 g. of the reactive dyestuff of the formula



the preparation of which is shown in German Pat. 1,239,420 in Formula XVI.

having the form and composition usual in commerce and 30 g. of the disperse dyestuff of the formula



and identified as C.I. Disperse Yellow 64, cf. U.S. Pat.
3,036,876

having the form and composition usual in commerce and 10 cc. of an aqueous 32.5% sodium hydroxide solution.

The padded fabric was dried for 40 seconds at 120° C. Subsequently, air which had been heated to 200° C. was passed through it for 10 seconds in the apparatus described in Example 1. The fabric was rinsed in the usual manner, acidified with a solution containing, per liter, 2 cc. of acetic acid having a strength of 50%, rinsed again and soaped for 3 minutes at 95° C. with a bath containing, per liter of water, 2 g. of a nonionic surface-active agent, whereafter the fabric was rinsed again. Prints having yellow shades of medium depth on both kinds of the fibrous material were obtained.

When the thermofixation was effected in usual manner on a stretching frame and likewise at 220° C., 40 seconds were necessary to dye the polyester portion the same deep shade as that obtained by the thermosetting process of the present invention described above. The cotton portion, however, showed a considerably lighter shade.

We claim:

1. A process for the simultaneous fixation of disperse and reactive dyestuffs on mixed fabric made of fibrous materials of high-molecular weight linear polyesters and fibers of native or regenerated cellulose, or made of cellulosic fibers and linear polyamide fibers, which comprises: passing an inert gas heated to temperature between about 185° C. and 230° C. through said fibrous materials spread on a perforated drum, covered with a fine mesh, sieve like material having a mesh size of less than 1 mm. from one side of said fabric into said drum and from the other side into said drum when said fabric rests on another, adjacent perforated drum covered with said sieve material, and wherein said fabric has been printed or padded with preparations containing a disperse and reactive dyestuff and an alkaline substance for fixing the reactive dyestuff.

2. A process as claimed in claim 1, wherein as heated gas heated air is used.

3. A process as claimed in claim 1, wherein the materials to be treated with heated gas have been dried.

4. A process as claimed in claim 1, wherein the textile materials are spread on sieve zones which serve as carrying and transporting element for said material and wherein the heated gas is passed through the materials so that the said materials are pressed on the sieve zone.

5. A process as claimed in claim 1, wherein the fixing process is carried out on a rotating cylindrical sieve zone over which the fibrous material is passed.

6. A process as claimed in claim 1, wherein the fixing process is carried out on several rotating cylindrical sieve zones arranged in series, over which the textile material is passed, hot gas passed alternatively streaming through the fabric from two sides.

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DONALD LEVY, Primary Examiner

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8—163, 149.2, 149.3