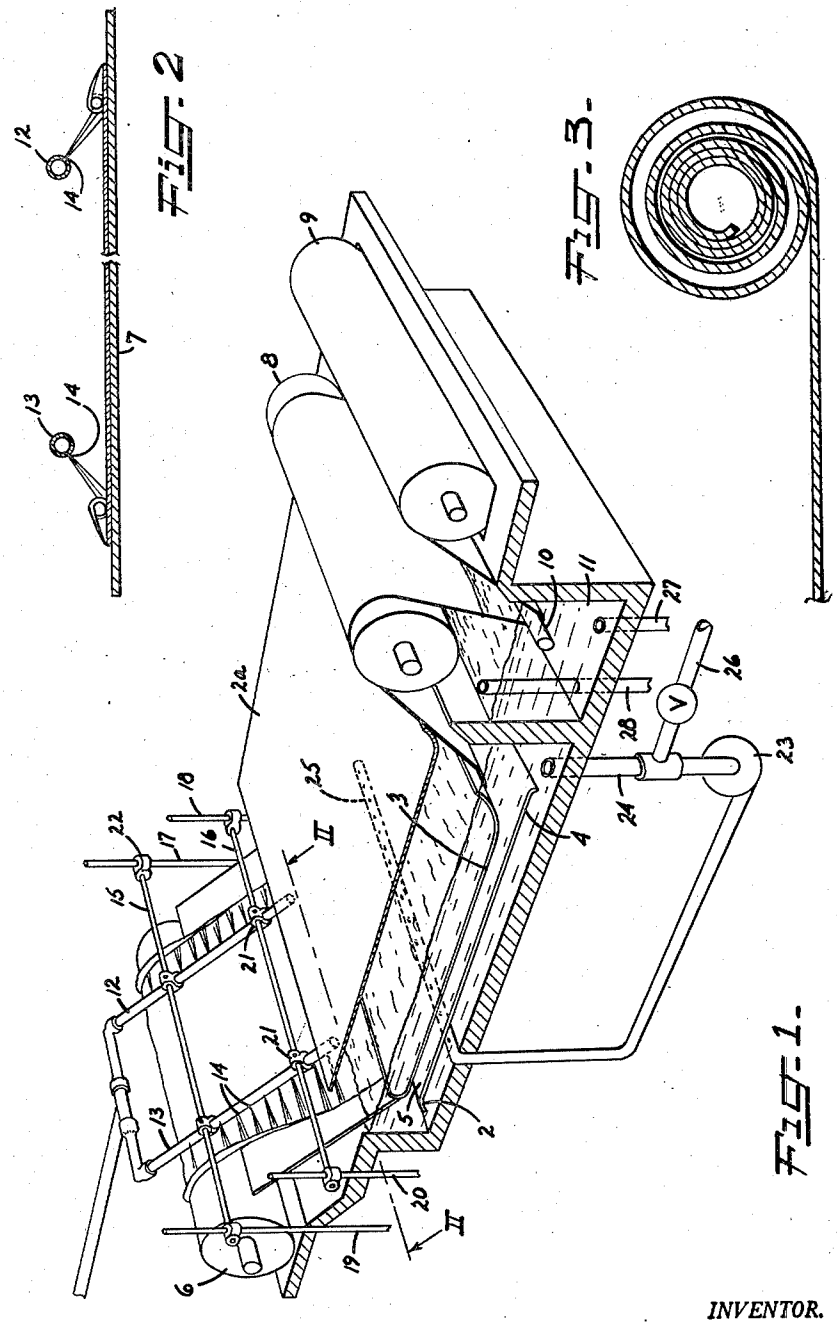
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METHOD FOR DYEING AND PRESETTING TRICOT FABRICS

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METHOD FOR DYEING AND PRESETTING TRICOT FABRICS

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This invention relates to a method for simultaneously dyeing and presetting, at full open width, tricot fabrics the edges of which normally tend to curl spontaneously during dyeing of the fabric.

Tricot fabrics have not been dyed at full open width heretofore because, as is well known, the selvages of a tricot fabric normally tend to curl or roll inwardly as much as 4 to 12 inches on either side of the fabric, when it is relaxed, and in order to prevent such curling during dyeing of the fabric it has been the practice to sew the edges of the fabric together before entering it into the dyebath. The precaution of sewing the edges together prior to dyeing a tricot fabric in a hot dyebath has been particularly important in the case of fabrics of thermoplastic materials such as cellulose acetate since there it is necessary to avoid setting of the edges in the curled condition by the heat of the bath in order to avoid the waste of material which would result if the edges were set in the curled condition and the curled fabric had to be cut away.

It is obvious that although dyeing the tricot fabrics in tubular condition prevents edge-rolling or curling thereof during the dyeing operation, the need for sewing the edges together and then removing the stitches after the fabric has been dyed is time-consuming and expensive.

One object of the present invention is to provide a method for dyeing a tricot fabric the edges of which tend to roll spontaneously at full open width while simultaneously presetting the fabric in the flat, open width condition.

The tendency of the edges of a tricot fabric to curl spontaneously as soon as the fabric is taken from the knitting machine is due to strains which are introduced into the fabric by looping of the yarns upon the needles during knitting thereof. Since this tendency is inherent, it will persist until the strains responsible for it are completely relieved.

By "presetting" the tricot fabric as used herein is meant that, simultaneously with dyeing thereof, the strains in the fabric which cause the edges to roll or curl spontaneously are relieved with elimination of the tendency of the edges to curl.

I have found that it is unnecessary to sew the edges of a tricot fabric together prior to dyeing it, if the dyeing is performed at full open width under conditions such that the strains responsible for the edge-rolling are permanently relieved. This is accomplished, in accordance with the invention, by uncurling the edges of the tricot fabric having curled edges and which is to be dyed, and then passing the uncurled fabric longitudinally through a dyebath which is also

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a setting or stabilizing bath for the fabric under conditions such that curling of the fabric edges is prevented until the strains in the fabric are relaxed, after which the edges will no longer curl spontaneously to any appreciable extent. During relaxation of the strains in the dyebath, the fabric, which is maintained in flat condition, picks up the dye from the bath and the fabric withdrawn from the bath is dyed to the desired color and depth of shade and stabilized in the substantially flat condition.

In practicing the invention, the tricot fabric in the dry condition and having curled edges which is to be dyed is advanced continuously to and along a path through the dyeing and setting bath under a tension sufficient only to draw the fabric through the bath, and as the fabric advances to the path through the bath the edges thereof are uncurled, the fabric being passed into the path in the uncurled condition and held in that condition until it is dyed and stabilized or preset.

The fabric may be dyed and preset concurrently with the dyeing by passing it only once through a solution or dispersion of the selected dye in a partial solvent or swelling agent for the yarns. For example, a tricot fabric of regenerated cellulose yarns may be dyed and preset by passing it through an aqueous solution of a direct dyestuff containing 20 to 30% of sodium hydroxide. In the case of tricot fabrics comprising yarns of a thermoplastic material, however, it is preferred to dye and preset the fabric using a hot aqueous solution or dispersion of the selected dyestuff, the heat of the bath inducing the relaxation of the strains required for setting of the fabric in the flat condition. The temperature of the bath will depend on the length of time required for the fabric to pass through it but generally will not be less than 180° F. nor higher than about 25° F. below the melting point of the yarns. For example, a tricot fabric comprising yarns of commercial secondary cellulose acetate can be dyed and set by uncurling the edges of the fabric and passing the uncurled fabric through an aqueous dispersion of one of the available water-insoluble cellulose acetate type dyestuffs (known also as "Dispersol" type dyes) maintained at a temperature between 180° F. and 212° F. when the time required to pass the fabric through the bath is from 2 to 5 seconds. The bath may contain one or more of the swelling agents, for example alcohol, which are commonly used as assistants in the dyeing of cellulose acetate. Also, substances which permit the use of higher operating temperatures, i. e. substances which increase the boiling point of the bath may be used, and may be desirable

in dyeing and presetting tricot fabrics of nylon or the like. Further, the dyeing and setting bath may contain small amounts of finishing or lubricating agents for the fabric, or such agents may be added to a cold water bath through which the dyed and preset fabric is passed after it emerges from the dyeing and presetting bath.

The conditions of the treatment, including the concentration of the dyestuff in the bath and the temperature of the bath, are selected taking into account the shade it is desired to dye the fabric, the thickness of the fabric, the length of the bath, and the fact that the rate at which the fabric is withdrawn from the bath must be correlated with the rate at which it is fed into the bath to insure free passage of the fabric through the bath without placing it under a tension which would inhibit relaxation of the strains therein.

Any suitable uncurling device may be used to uncurl the edges of the fabric as it passes into the dyeing and presetting bath. However, the use of liquid jets or sprays for uncurling the fabric is to be avoided in order to prevent the dyeing variations which would result from wetting of portions of the fabric prior to its introduction into the dispersion of the dyestuff.

It is essential to the successful practice of the invention that the uncurling means is so located with respect to the dyeing and presetting bath that the fabric enters the path through the bath in the flat, uncurled condition, and that the fabric be prevented from recurling in the bath before the strains responsible for the curling are relieved.

The fabric may be prevented from recurling after it passes into the bath by providing a member or members having a width at least as great as the width of the fabric and which define the path for the fabric and exert downward pressure on the fabric in the dyebath across the entire width thereof to prevent recurling of the edges, to keep the fabric submerged, and to assist in guiding it along a path through the bath consisting of an initial portion downwardly inclined from the fabric entrance and extending to a depth of at least two inches below the top surface of the dyebath, a generally horizontal portion extending from the initial portion along a substantially straight line at a depth of at least two inches below the top surface of the dyebath, and an upwardly inclined portion extending from the generally horizontal portion out of the dyebath. Thus, the uncurled fabric may be passed under a guide plate having a width at least as great as the width of the fabric, which is supported generally horizontally in and below the level of the bath, and the lower surface of which defines the upper side of the path for the fabric and prevents recurling thereof. Or two plates or equivalents thereof may be generally horizontally supported one above the other in spaced relation in the bath to define a path for the fabric therebetween having a depth greater than the thickness of the fabric but less than the depth which would permit curling of the fabric edges.

In the attached drawing,

Figure 1 is a view in perspective of apparatus for carrying out one preferred embodiment of the invention;

Figure 2 is a section taken on line II—II of Fig. 1; and

Figure 3 is a cross-section through the curled selvage of a tricot fabric showing the coils in the "edge-roll" or "edge-curl" thereof.

Referring to the drawing, there is shown a vessel 2 provided with a removable cover 2*a* and containing a dyeing and presetting bath for the tricot fabric. Two guide plates 3 and 4 are supported generally horizontally in the vessel as shown. The plates, which in a specific embodiment of the invention are each 12 inches wider than the fabric, are disposed one above the other, in spaced relation, to provide a guideway or tunnel 5 of substantially uniform cross-section for the fabric below the level of the liquid. The distance between the adjacent, smooth flat surfaces of the plates is sufficient to permit free passage of the fabric between them, but is insufficient to permit curling or rolling of the fabric edges. This distance may be varied, depending on the thickness of the fabric. The smooth lower face of the upper plate 3 defines the upper side of the path for the fabric through the bath; the smooth upper surface of the lower plate 4 defines the lower side of the path for the fabrics. The opposite ends of plate 3 are curved or flared upwardly, and the opposite ends of plate 4 are curved or flared downwardly to facilitate feeding of the fabric to the space between the plates and withdrawal of the fabric from the vessel, and to prevent undue tension on the fabric as it is advanced through the bath.

The dry tricot fabric having curled edges is advanced longitudinally at open width (with that face of the fabric which forms the inside face of the coils in the edge-curls facing upwardly as shown) to vessel 2 over the driven feed roll 6 downwardly over the inclined guiding and supporting surface 7, fed between the plates 3 and 4, withdrawn from vessel 2 by the driven rolls 8 and 9, a guiding roll 10 being supported in the vessel 11 containing cold water and supported between rolls 8 and 9. As shown, the guiding and supporting surface 7 is a flat, plate-like member and both it and the guide plates 3 and 4 are made of any suitable material, preferably a polished metal such as stainless steel. Guiding surface 7 extends into vessel 2 and is fixed in inclined relation to feed roll 6 and the guideway or tunnel 5 between plates 3 and 4 so that the fabric passes from the guiding plate 7 directly into the tunnel 5.

In order to uncurl the edges of the fabric and maintain the fabric in the uncurled flat condition until it enters the guideway 5 in which recurling is prevented by the guide plates, jets of a gaseous fluid under pressure are projected in opposite directions extending laterally outwardly from the central portion of the upper face of the fabric against the opposite edges of the fabric at successive points along the path of travel of the fabric downwardly over guiding and supporting surface 7 (see Fig. 2) to the guideway 5. For this purpose, as shown in the drawing, two pipes or conduits 12 and 13, each provided with a row of perforations 14, are supported above and parallel to the guiding surface 7 on the cross-bars 15 and 16 which are in turn supported on the standards 17, 18 and 19, 20. Pipes 12 and 13 are adjustable horizontally on the cross-bars 15 and 16 by adjustment of the clamps or brackets designated generally at 21, and cross-bars 15 and 16 are adjustable vertically on the standards 17, 18 and 19, 20 respectively by adjustment of the clamps or brackets designated generally at 22. Air or other gaseous fluid under pressure is fed to pipes 12 and 13,

which are positioned above the fabric and at a distance of six inches from either side or edge of the fabric, the perforations therein being so drilled that each jet of air emerging from each perforation strikes the fabric edges at a right angle. The arrangement of the pipes and the distribution of the perforations therein are such that the opposite edges of each succeeding portion of the fabric entering guideway 5 are subjected to a jet of air which prevents recurling of the edges before the fabric passes between guide plates 3 and 4 and facilitates feeding of the fabric to the guideway. The fabric floats through the guideway 5 in a generally horizontal, substantially straight-line path.

The dyeing and presetting bath is kept in circulation by drawing it from one end of tank 2 by means of pump 23 into conduit 24 and returning it to the tank at the opposite end thereof. The liquid may be introduced into the tank through a perforated pipe 25 extending transversely of the tank adjacent the bottom wall thereof.

In a continuous operation, the portion of the dyeing and presetting bath taken up by the fabric must be replaced. This may be accomplished by supplying a regulated stream of the bath to the conduit 24 through the valved pipe 26 associated with a suitable source of supply.

It is desirable to arrange the guide plates 3 and 4 in tank 2 so that the distance from the level of the bath to the guideway 5 is such that undue turbulence at the entrance to the path or guideway is avoided. Arrangements in which the distance from the level of the bath to the guideway is at least two inches are satisfactory.

The arrangement shown in the drawing may be modified in certain respects. For instance, a pair of endless bands or belts arranged one above the other in spaced relation and supported on suitable pulleys for travel in the direction of travel of the fabric may be substituted for the guide plates 3 and 4. Also, guide plate 4 may be dispensed with, a single plate 3 being used, the lower surface of the plate defining the path for the fabric and preventing curling of the fabric as it passes through the bath. Other suitable means for defining the path of the fabric through the bath and preventing recurling thereof in the bath may be used.

Any suitable means for maintaining the temperature of the bath constant may be associated with vessel 2, such as electrical heating coils, a jacket in which hot water or other heating fluid is circulated, etc.

The flat, dyed and preset fabric is withdrawn over the roller 8, under the roller 10 supported in the water or aqueous medium containing a conditioning agent for the fabric in vessel 11, and over the roller 9 to a suitable drying device. The water or aqueous medium in vessel 11 is maintained at room temperature and serves to remove excess dye from the fabric as well as to fix the yarns of the fabric in the relaxed condition if they are of the thermoplastic type. Fresh water or aqueous medium of the predetermined composition is continuously introduced into vessel 11 through a conduit 27 and leaves the vessel through an overflow pipe 28.

The following detailed example illustrates the simultaneous dyeing and presetting of a tricot fabric knitted from yarns of commercial secondary cellulose acetate, by the method of the invention.

Example

Using apparatus as shown in the drawing, a 55 denier, 14 filament dull acetate tricot fabric of quality 8½" (480 courses to each 8½" of fabric) and having curled edges was advanced over the guiding surface 7 and subjected to air jets to uncurl the edges. The uncurled fabric was passed into an aqueous dyebath containing 0.1% of Celliton Yellow 4RL, 0.08% of Igepon T gel, and 0.0125% of Calgon (sodium hexametaphosphate) maintained at 200–203° F., and guided through the path between the guide plates 3 and 4. The dyebath had a length of 48", and the fabric was passed through it at a speed of 15 yds./min. The time required to pass the fabric through the bath was 5 seconds. The dyed, preset fabric was withdrawn, passed under the guide roll 10 immersed in water at room temperature in vessel 11, and withdrawn to a drying drum. The fabric was dyed to a uniform shade of yellow, and stabilized in the flat, dyed condition. Since the strains responsible for edge-rolling of the fabric were relaxed during passage of the fabric through the bath, in which curling was prevented, the edges of the dyed, preset fabric did not tend to curl spontaneously to any appreciable extent.

Although the method of the invention is exemplified as applied to the dyeing and presetting of a cellulose acetate tricot fabric at full open width, it is not limited to the treatment of those fabrics but may be used to simultaneously dye and preset tricot fabrics made from other fiber-forming materials, particularly thermoplastic fiber-forming materials such as the vinyl resins, nylon, fiber-forming polyesters from dicarboxylic acids and polymethylene glycols such as polymeric polymethylene terephthalates, and fiber-forming acrylonitrile polymers including copolymers or interpolymers of acrylonitrile containing up to 25% of one or more other polymerizable ethylenically unsaturated monomers, when such polymeric materials are receptive to dyestuffs.

The method described has special advantages from the viewpoint of production efficiency. For the first time, a tricot fabric may be dyed on a commercial scale without tacking the edges together prior to entering it into the dye bath and therefore the time-consuming and expensive steps of stitching the edges of the undyed fabric and removing the stitches from the dyed fabric are entirely eliminated. Another advantage is that the dyeing and presetting at full open width are accomplished in a single operation, with permanent elimination of the tendency of the fabric edges to curl to any appreciable extent, so that a separate presetting treatment before or after the dyeing operation is unnecessary. A further advantage is that the deep-set crease marks or crows-feet which are normally developed in tricot fabrics knitted from thermoplastic yarns during the dyeing thereof do not develop in tricot fabrics of cellulose acetate or the like which are dyed and preset in accordance with this invention.

Since some changes and modifications can be made in the above details without departing from the spirit of the invention, it is to be understood that the invention is not to be limited thereto except as set forth in the appended claims.

I claim:

1. A method of simultaneously dyeing and stabilizing against edge-curling a tricot fabric comprising yarns of cellulose acetate and having strains which cause the edges to curl which com-

prises the steps of continuously advancing the aforesaid fabric in the dry condition longitudinally toward a dyebath at open width downwardly over a flat, inclined supporting surface with that face of the fabric which forms the inside face of the coils in the edge-curls facing upwardly, said dyebath comprising an aqueous dispersion of a water-insoluble cellulose acetate dyestuff and a swelling agent for cellulose acetate and being maintained at a temperature between 180° F. and 212° F., uncurling the edges of the fabric advancing to the dyebath as it approaches and immediately before it enters the dyebath by continuously projecting air jets in opposite directions extending laterally outwardly from the central portion of the aforesaid face of the fabric against the opposite edges of the fabric while it is supported on said supporting surface, continuously drawing the thus-advanced fabric with its edges uncurled in full open width only once through the dyebath, exerting downward pressure on the fabric in the dyebath across the entire width thereof to prevent recurling of the edges and to keep the fabric submerged therein, guiding the fabric along a path therein consisting of an initial portion downwardly inclined from the fabric entrance and extending to a depth of at least two inches below the top surface of the dyebath, a generally horizontal portion extending from the initial portion along a substantially straight line at a depth of at least two inches below the top surface of the dyebath, and an upwardly inclined portion extending from the generally horizontal portion out of the dyebath, the fabric during said drawing step being under a tension sufficient only to draw the fabric through said path whereby to provide free passage of the fabric through the dyebath without placing it under a tension which would inhibit relaxation of the strains therein, and circulating the dyebath by continuously withdrawing a portion thereof adjacent the end from which the fabric is discharged and introducing the portion withdrawn adjacent the end into which the fabric enters at a plurality of points distributed the full width of the dyebath adjacent the bottom thereof.

2. A method of simultaneously dyeing and stabilizing against edge-curling a tricot fabric comprising yarns of cellulose acetate and having strains which cause the edges to curl which comprises the steps of continuously advancing the aforesaid fabric in the dry condition longitudinally toward a dyebath at open width downwardly over a flat, inclined supporting surface with that face of the fabric which forms the inside face of the coils in the edge-curls facing upwardly, said dyebath comprising an aqueous dispersion of a water-insoluble cellulose acetate dyestuff and a swelling agent for cellulose acetate and being maintained at a temperature between 180° F. and 212° F., uncurling the edges of the fabric advancing to the dyebath as it approaches and immediately before it enters the dyebath by continuously projecting air jets in opposite directions extending laterally outwardly from the central portion of the aforesaid face of the fabric against the opposite edges of the fabric while it is supported on said supporting surface, continuously drawing the thus-advanced fabric with its edges uncurled in full open width only once through the dyebath at a rate such that the time of passage of the fabric through the dyebath is of the order of five seconds, exerting downward pressure on the fabric in the dyebath across the entire width thereof to prevent recurling of the edges and to keep the fabric submerged therein, and guiding the fabric along a path therein consisting of an initial portion downwardly inclined from the fabric entrance and extending to a depth of at least two inches below the top surface of the dyebath, a generally horizontal portion extending from the initial portion along a substantially straight line at a depth of at least two inches below the top surface of the dyebath, and an upwardly inclined portion extending from the generally horizontal portion out of the dyebath, the fabric during said drawing step being under a tension sufficient only to draw the fabric through said path whereby to provide free passage of the fabric through the dyebath without placing it under a tension which would inhibit relaxation of the strains therein.

3. A method of simultaneously dyeing and stabilizing against edge-curling a tricot fabric comprising yarns of cellulose acetate and having strains which cause the edges to curl which comprises the steps of continuously advancing the aforesaid fabric in the dry condition longitudinally toward a dyebath at open width downwardly over a flat, inclined supporting surface with that face of the fabric which forms the inside face of the coils in the edge-curls facing upwardly, said dyebath comprising an aqueous dispersion of a water-insoluble cellulose acetate dyestuff and a swelling agent for cellulose acetate and being maintained at a temperature between 180° F. and 212° F., uncurling the edges of the fabric advancing to the dyebath as it approaches and immediately before it enters the dyebath by continuously projecting air jets in opposite directions extending laterally outwardly from the central portion of the aforesaid face of the fabric against the opposite edges of the fabric while it is supported on said supporting surface, continuously drawing the thus-advanced fabric with its edges uncurled in full open width only once through the dyebath, exerting downward pressure on the fabric in the dyebath across the entire width thereof to prevent recurling of the edges and to keep the fabric submerged therein, and guiding the fabric along a path therein consisting of an initial portion downwardly inclined from the fabric entrance and extending to a depth of about two inches below the top surface of the dyebath, a generally horizontal portion extending from the initial portion along a substantially straight line at a depth of about two inches below the top surface of the dyebath, and an upwardly inclined portion extending from the generally horizontal portion out of the dyebath, the fabric during said drawing step being under a tension sufficient only to draw the fabric through said path whereby to provide free passage of the fabric through the dyebath without placing it under a tension which would inhibit relaxation of the strains therein.

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