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METHOD OF PRODUCING PRINTED FABRICS

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1 Claim. (Cl. 117—15)

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This invention relates to printed fabrics and methods of producing the same.

A figured weave may be made on a jacquard loom by means of special weaving apparatus comprising a controlling perforated card which causes the warp threads to be lifted in a desired pattern sequence. One object of this invention is to print a monotone fabric of a uniform weave in such a manner as to present a jacquard appearance.

A glazed chintz has been made by coating a printed fabric with a sizing composition comprising a synthetic resin. The sizing has been applied by a spraying or brushing operation or by immersing the fabric in the sizing. The depth of penetration has been limited by a preliminary calendering step and by incorporating fillers and repellents in the fabric, so that the sizing has appeared largely as a thin coating. After the resin has been hardened by heat treatment, various expedients have been employed to render the cloth more pliable; nevertheless, the product has had only a limited field of utility. Also, it has been proposed to make a glazed pattern effect by printing a fabric with a solution of urea formaldehyde resin, then glaze calendering the fabric while wet and finally heat hardening the resin. In this procedure, the printed fabric must be calendered while the imprint is moist, since the dry resin would be polymerized too quickly and the desired glazed effect could not be produced. Yet, the wet resin tends to stick to the hot roll and to smear over the fabric or to mark off or reprint on another portion of the fabric and thus defeat the purpose of the process.

It has also been proposed to incorporate a resin in a printing paste in which the coloring matter is not a dye but is a dispersion of a pigment in a suitable medium. The resin in that case is used as a mordant or binder to hold the pigment in place. The printed fabric, however, has the same dull appearance that would be presented by the coloring matter without the use of the resin. It is, on the other hand, highly desirable to have the printed pattern stand out boldly and to present a luster which contrasts strongly with the appearance of the unprinted background of the cloth.

Another object of this invention is accordingly to provide a printed fabric with a pattern which alone has a lustrous appearance.

A further object of the invention is to provide a printed fabric having a pattern printed in colors thereon and in which only the printed portion has a luster or glaze.

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A further object is to provide a simple and economical method of making such fabrics and which improves the appearance and gives pleasing and artistic effects. Other objects will be apparent in the following disclosure.

In accordance with this invention, we propose to print designs on fabric by means of a printing paste which is capable of holding the loose-ended or surface fibres immobilized in a glazed arrangement and which may be hardened after the printing operation to a substantially insoluble and permanent condition. The fabric is subjected to a polishing or glazing operation, such as by passing the printed fabric between heated friction or pressure rolls which smooths over the surface fuzz and closes pore spaces in the weave, thus providing a shiny or lustrous effect. The printing paste employed for printing the design adheres to and intermatts with the glazed surface fibres under the conditions of the process. When the printing paste is subsequently hardened or rendered insoluble, the printed portions of the fabric remain in the glazed condition, while the remainder of the fabric is permitted or caused to resume its normal unmatted appearance with its loose-ended fibres or nap in haphazard arrangement. The pattern may be printed with a transparent or translucent printing paste, and thus provide a jacquard appearance, or coloring matter may be added to the paste and the product is one having the colored pattern emphasized by a luster or glaze.

For the printing composition we utilize a printing paste containing melamine formaldehyde resin or homologues as an essential ingredient which has such pliability, thermoplasticity and adhesive characteristics that it will hold the polished or glazed fibres immobile and will not mark off under the heat treatment involved in drying and calendering or glazing the fabric and in polymerizing the resin to an insoluble condition. This resin is not detrimentally affected when the fabric is subjected to the alkaline solutions and treatments involved in the normal textile usages, such as laundering, ironing and cleaning operations. This resin is the condensation product formed by combining 1.5 molecular parts of aqueous formaldehyde with 1 part of melamine in alkaline solution. This methylol melamine resin hardens by further condensation when heated. It melts at a temperature above 200° C. and thus is thermoplastic but resistant to ordinary temperature conditions involved in laundering operations. It is highly resistant to water absorption.

A Jacquard loom appearance may be given to a piece of cloth having a plain or non-creped weave by proceeding in the following manner. The cloth, which may be a piece of cotton or other material having a white or any desired color, may be initially given any suitable treatment, such as the standard methods for bleaching and shrinking the cloth to a desired size. The printing operation may be accomplished by means of any suitable type of printing machine, such as one employing an intaglio engraved copper plate. Our preferred printing paste may comprise a water solution of melamine formaldehyde in a monomeric form capable of being converted to an inert or insoluble or a partially polymerized condition. The resin may be combined with any suitable medium, such as a starch paste, which gives the proper consistency to the printing composition and renders it suitable for the purpose. A desired pattern is printed on the cloth by means of the printing paste comprising the resin, and with or without coloring matter, such as a dye or pigment. If no coloring matter is employed in the paste, the jacquard effect is more pronounced, since the final product gives the appearance of two different types of weave. If coloring matter is used in the printing paste, then the product has a glazed or shiny printed pattern on a cloth having a uniform weave. This printing operation is carried on in accordance with standard conditions well known to printers skilled in the art.

After the printing operation, the cloth is dried in order that it may be subsequently handled and the resin or any color included therewith will not mark off. This drying operation may be accomplished by suitable procedure such as passing the printed cloth through a heated chamber or over one or more drying drums suitably heated, as by means of steam. The drying operation may be carried on to such an extent as to dry the cloth to a substantially dry condition in which there is usually not over 5% moisture or to such a dry condition that the paste will not be wet enough to mark off materially during the subsequent operations. The temperature of the drums or the atmosphere of the drying chamber and the duration of heat treatment is such as not to polymerize the resin materially at this stage.

The printed cloth with its dried printing paste thereon is now subjected to a polishing operation which provides a luster or glaze on the surface of the cloth. This polishing operation may be accomplished in accordance with standard procedure by passing the cloth through calendering rolls and subjecting it to suitable pressure, which may be as high as 40 tons, and one or both rolls may be heated to a temperature of 320° to 400° F. or other suitable temperature which will aid in giving the desired effect. Polishing is preferably accomplished by means of the heated calendering rolls, one of which is driven faster than the other, so that there is a friction slippage of the high speed roll against the surface of the cloth. The rate of movement of the cloth will be controlled by supplemental driven rolls or a drum. If the temperature of glazing is high enough to cause polymerization of the resin, then the heat treatment may be maintained for only a limited duration so that the polymerization is controlled or prevented. However, a partial or a full polymerization may be caused at this stage, as is preferred, since the thermoplastic polymerized resin flows under the heat and pressure into an intimate contact with the nap and the surface portions of the warp and weft and thus immobilizes them permanently in the single stage operation.

This polishing operation serves to crush the fibres on the surface and to fill in the pore spaces. At this time, the appearance of the entire surface of the cloth is substantially the same, since all of the fibres have been subjected to the glazing operation. If the glazed cloth were washed before polymerization, the glaze would disappear on both the printed and the unprinted portions of the cloth, since the water and chemicals and the laundering treatment would tend to remove the resin and associated elements of the printing paste, and cause the nap to rise to a normal loose-ended condition, just as such treatment removes the glaze where starch alone is employed. Hence it is necessary to complete the polymerization step before the glaze is disturbed.

Following the polishing step, or coincident therewith, the unpolymerized portion of the melamine formaldehyde resin is subjected to such heat treatment as will convert it to an insoluble or stable condition and render it inert to the normal usages of the fabric. This polymerization may be effected by passing the cloth through a heated chamber or over a heated drum or between heated calendering rolls, which provide suitable polymerization temperature conditions, such as a heat treatment of 290° to 300° F. for five minutes. This operation serves to make permanent the crushed condition of the fibres in the localized printed areas. The remainder of the fabric is not thus held immovable, as it were, and the unprinted glazed fibres may resume a normal non-glazed condition during subsequent washing and shrinking or other desired treatments.

The polymerization should be carried on under temperature conditions which will not burn or scorch the cloth or otherwise affect it detrimentally. There is wide latitude, however, in this particular, since a cloth may be subjected to a temperature of 450° F. for a fraction of a minute without being seriously affected, whereas, if the temperature of conversion of the resin is in the neighborhood of 300° F., then the cloth may be subjected to that temperature for a considerable period of time, such as 3 to 5 minutes.

Following the operation of polymerizing the resin, the cloth may be treated in a laundering operation with water or other suitable washing agents to remove the glaze except on the localized printed portions. It may also be framed or shrunk, either before the printing operation or after polymerization, by suitable procedure, such as tentering and the standard sanforizing treatments. It may be brushed after polymerization of the resin to raise the nap of the unprinted areas. These subsequent treatments of the cloth do not affect the resin held portions of the printed pattern.

A satisfactory formula for a printing paste which will give a jacquard effect on cloth having a uniform weave or a lustrous printed effect in a colored pattern may be made of cornstarch and melamine formaldehyde. To this end, we may provide a paste by cooking 0.75 pound of cornstarch in one gallon of water. Fifteen parts by weight of melamine formaldehyde, which is a heavy liquid, is combined with 75 parts by weight of the cornstarch paste. To this mixture is added 10 parts by weight of a 10% solution of NH_4Cl in cold water, the salt serving as a catalyzer for polymerization of the resin. These proportions

may be widely varied and are not critical except as required to give a satisfactory printing paste. If a color design is to be printed and provided with a glazed effect, then we may add to the above printing paste 5 parts by weight, more or less, of a suitable coloring matter, such as benzidene yellow. This provides the required consistency or viscosity for the printing operation.

The starch paste is a thickener employed to give a desired consistency to the printing paste, since the liquid resin is not adapted for printing when used alone. It will, therefore, be appreciated that many substances well known to the printer may be employed in place of the starch. Various plasticizers, such as di-butyl phthalate may be used to give a required viscosity to the resin paste. We may employ gum tragacanth paste, or a protein thickener.

If the resin paste is employed without coloring matter, the final product has a light and shadow effect in which the normally loose-ended fibres of the printed portion remain immobilized, while the remainder of the cloth, or the background, has a normal nap surface. The resin is pliable and used in such a small amount that the normal flexibility of the weave of the cloth is not materially affected. If coloring matter has been introduced, the printed portion has both the glazed or shiny effect and the color appearance, while the unprinted portions present the appearance of a standard rough surface or a nap having projecting loose ends. The colored glaze is much more pronounced and striking in appearance because the glazed condition is emphasized by the non-glazed unprinted portion. The weave of the cloth may be either uniform or as desired. If the resin has caused the cloth to crinkle, this may be removed by an ironing operation. This is largely prevented by shrinking and framing the cloth to a desired size before printing it, and by not stretching the cloth unduly during printing. Many multi-color combinations may be obtained in which the resin is employed in each of the colors or in only a portion of them.

It will now be appreciated that many modifications in the process and in the composition of the printing paste may be made, hence the above disclosure is to be interpreted as setting forth the general principles of this invention and our preferred methods and products and not as limitations on the claim appended hereto.

This case is a continuation in part of our prior application, Serial No. 511,348, filed November 22, 1943, and now abandoned.

We claim:

The method of producing pattern effects on textile fabrics comprising the steps of printing a pattern on the cloth with a wet printing paste containing essentially a polymerizable melamine formaldehyde resin resist which, upon polymerization, immobilizes the glazed fibres of a polished cloth, subjecting the cloth to heat without polymerizing the resin enough to immobilize the surface fibres so as to dry the printed cloth to a substantially dry condition and with such a low moisture content that the paste will not adhere materially to the rolls during polishing and be removed and transferred to other portions of the cloth, frictionally polishing the cloth between rotating, heated pressure rolls while it is in said dry condition and producing primarily a unidirectional glaze on the entire printed and unprinted areas of the cloth surface, heating the polished cloth and polymerizing the resin and thereby immobilizing the glazed surface fibres of the printed areas, and subsequently washing and drying the cloth and restoring a non-glazed condition to the unprinted areas, and thus forming a pliable printed cloth having a permanent pattern resulting from the contrast between the glazed and non-glazed areas.

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