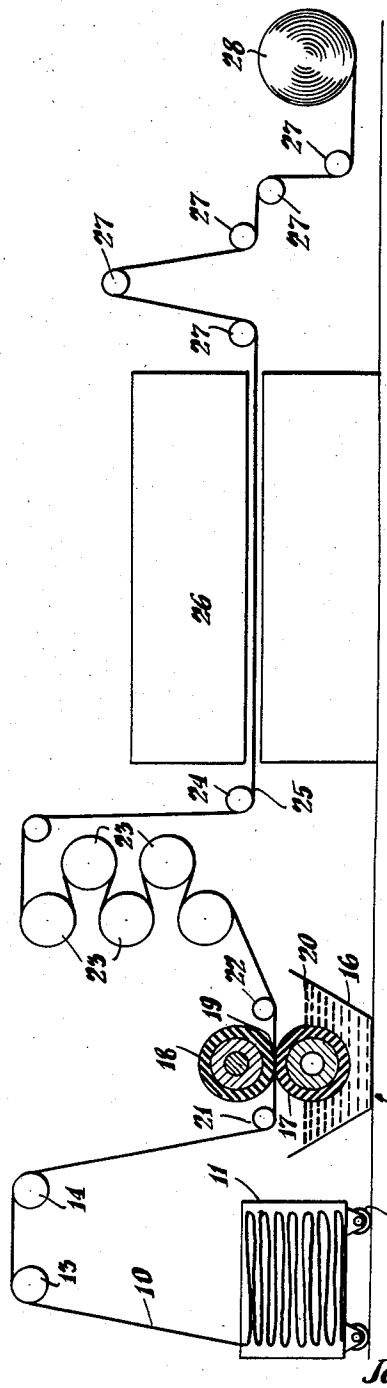
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RESIN PRE-TREATMENT OF PLISSE FABRICS

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INVENTOR
Joseph W. Houth
BY
John J. McGarvey
ATTORNEY

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RESIN PRE-TREATMENT OF PLISSE FABRICS

Joseph W. Houth, New York, N. Y., assignor to United Merchants and Manufacturers, Inc., New York, N. Y., a corporation of Delaware

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This invention relates to the processing of web-form material such as for example, textiles or the like, and more particularly to a method and apparatus for the production of the type of ornamental effects which commonly are known and referred to as "plisse effects" when applied to cloth, textiles, plastic film or other web-like material.

The plisse effect is characterized by crinkles, or disruption of the normally smooth even plane surface of the material, and one way of obtaining it is by shrinking abnormally selected portions of the fabric while leaving unaffected adjacent portions thereof. The shrinking may be carried out by the application of a shrinkage agent to selected areas only. Sodium hydroxide or caustic is a well-known shrinking agent. After the caustic has acted on the fabric, that is, on the portions thereof that have been printed or otherwise subjected to the shrinking agent, it is found that the untreated or unprinted portions are puckered, thus producing the fullness characteristic of the seersucker or wavy, plisse effect desired.

One object of the present invention is to produce plisse goods with washfast pucker effects by a method that comprises or includes the steps of applying resin to the cloth and framing it widthwise before the shrinkage agent is applied and before the plisse pattern is formed therein.

A further object is to control effectively widthwise dimensions of cloth intended to be plissed, by the application thereto of synthetic resins of the thermosetting and/or thermoplastic type prior to the step of applying the shinkage agent that causes the crinkle in the fabric.

A still further object is an improved method of plisseing cloth, especially cottons or cotton-containing goods in the piece, which involves substituting the step of applying synthetic resin, by printing it onto the material or applying it all over as by dunking the cloth in an all-over bath, for the conventional step of final framing after shrinkage has taken place.

Another object is the elimination of the step of framing the cloth out to full width subsequent to the plisse shrinking.

A still further object is to obtain increased washfastness or permanence of the plisse pucker effect over normal and conventional methods, while shortening the steps of the procedure and eliminating at least one of the usual steps of such procedures.

It has been found that where the resin is not applied to the cloth, it is necessary to frame the goods to the desired width after plisseing; and two disadvantages of this step are that this framing has the effect of damaging the pucker by pulling it out upon the application of widthwise tension to the sides or selvage edges of the fabric being processed, and secondly, this framing constitutes another step which really is unnecessary if the resin is applied before the shrinking. It further appears that where framing after plisseing is employed, such framing renders the plisse effect less washfast than it is where the resin is applied and there is no framing after the step of shrinking.

With the above and other objects in view, as will be apparent, this invention consists in the construction, combination, and arrangement of parts, all as hereinafter more fully described, claimed, and illustrated in the accompanying drawings, wherein:

The drawing comprises a diagrammatic illustration of a method and means for applying the plisse stabilizing resin to the cloth before the shrinkage agent, thus in effect pre-finishing the fabric before it is plissed.

As is known in the trade, the art of plisseing involves a considerable number of steps from the time the bale of cloth in the greige is opened until the last step of packing the plissed good. For example, the first step normally is referred to as the "layout," i. e., the bale containing a plurality of pieces of cloth in the greige, that is, unprinted and undyed as it comes from the weaving mill or loom to the printing or dye house, is opened up and the several pieces of cloth therein are sewn end-to-end together so as to make one long, continuous length of material to be processed.

After joining the pieces to form only one of extended length, the goods are run through a greige washer in the bleach house. If the material is intended to be subsequently printed instead of being dyed, then it is customarily run through what is called a continuous J-box bleaching unit of the type illustrated in U. S. Patents 2,482,497 and 2,613,338. If the cloth is later to be dyed instead of printed, it is normally boiled and bleached in a stationary kier.

Following the bleaching the cloth being processed may be dried on drying cans, running over a series or bank of these heated cans which quickly removes all or a good portion of the moisture remaining after the step of bleaching in the J-box or in the kier. After drying, the goods are ready for printing or dyeing into plain shades, as may be desired.

Then according to the present invention, in the case of plain shade material, the dyed cloth in the piece is impregnated with resin, as for example in a padder or other resin-applying means, and framed out to full width; that is to say, the fabric is put under widthwise tension after it comes out of the padder.

Simultaneously with the framing, the resin impregnated cloth may be cured as by means of its passage through an oven or other heated chamber. Alternatively, the step of curing the resin in the pre-treated cloth may take place after the goods have been framed out to width. It will be understood, of course, that the curing or insolubilizing of the resin within the fibers of the impregnated cloth is indicated or required only in the event that the resin compound or substance is of the so-called thermosetting type requiring the application of heat, with or without a catalyst, to effect resin hardening or setting. As will appear hereinafter, in practising the present invention the preferred impregnating bath contemplates not a thermosetting resin, but rather a treating bath comprising polyvinyl alcohol, which, for convenience herein, may also be termed a resin, but which definitely does not require a heat setting. The invention also proposes running the material to be pre-finished through a bath containing thermosetting resins; for example, those of the ethylene urea type or urea formaldehyde, and/or melamine formaldehyde type; and, of course, resins of such character are thermosetting and call for the step of curing following the impregnation, or, if desired, simultaneously with, or following the framing of the goods subsequent to impregnation and partial drying, as previously set forth above.

If the goods are printed rather than plain shade dyed, there is a variation in the procedure whereby the cloth first is aged in order to fix therein its printed color, and then is soaped so as to remove the printing gums and

excess deposits of color printing composition. Then the printed, aged, and soaped goods are impregnated as by passage through a bath containing any suitable resinous impregnating agent, just as in the case of the dyed cloth. After emerging from the impregnating zone the print goods may be partially dried as on a bank of drying cans, and then framed out to width by means of a tenter or other width tensioning device. At the same time, or subsequently, as may be desired, further heat may be applied to the printed goods as in an oven or other heating chamber for the purpose of completing the drying, and also to cure the resin in situ within the fibers making up the cloth. It will be understood, of course, that the curing step is not required if the preferred impregnating agent, namely, polyvinyl alcohol, is used in the treating bath, and it will be further understood, conversely, that if the impregnating bath comprises one or more thermosetting resin agents, then the step of heat-curing is required.

After the consecutive or simultaneous steps of framing and curing, or after the single step of framing without curing (in the case of polyvinyl alcohol or other non-thermosetting impregnating composition) both the dyed and printed goods may go directly to the plisse range and the plisseing apparatus proper. Alternatively, before being fed into the plisse apparatus, the goods may be pre-shrunk as by sanforizing on a Palmer machine, or by any other pre-shrinking device or composition. Additively, the cloth may otherwise be finished or treated, according to the customers' orders or specified instructions.

Thus according to the present invention, there is provided what is essentially a one step operation, namely, pre-treatment of the cotton goods with resin prior to forming a plisse pattern therein, with the result that the conventional final framing can be, and is omitted. Furthermore, according to the sequence outlined above, after the goods are bleached and dyed, or bleached and printed, there is provided, if desired, a continuous and uninterrupted sequence of operation comprising resin impregnation, partial drying, tentering, and curing (if a thermosetting impregnating agent is used), and plisseing without final framing.

Following the passage of the goods through the plisse range, the material may be oven dried and then "yarded" as by a reciprocating arm or swing, inspected, folded, shaded, and packed for shipment, which is the last step in the manufacture of the cloth.

Referring now to the drawing, this indicates more or less schematically a modus operandi for applying resin to the cloth and framing it out to width, before it enters the apparatus which imparts the plisse or seersucker effect. As shown therein, the cloth is removed in the piece from a storage cart or other source of supply, and then is sent through the padder, over a bank of drying cans to remove latent moisture, through a framing device and through a curing chamber, if the cloth has been impregnated with a heat settable stabilizer, and from thence onto a take-up roll for temporary storage or subsequent transfer to the plisse range or apparatus. In practice, of course, if desired, the whole operation may be a unitary and uninterrupted one, with the cloth moving directly from the printing units or dyehouse or other steps immediately following the printing or dyeing to the padder, without being brought to an intermediate rest on a cart or truck just prior to entering the padder. Similarly, if desired, the framed and cured goods may, without interruption or stoppage, go directly to the entrance end of the plisseing apparatus without being rolled up on a take-up roll after the framing and curing, as is shown.

As further seen in the drawing, the cloth **10** to be plissed after its pre-treatment by resin impregnation, framing and curing may be pulled up out of a stationary truck **11** mounted on swiveling casters **12**. It will be understood that at this stage or point, the cloth **10** already has been bleached and dyed, or bleached, printed, aged and soaped, as the case may be, and at least partially dried, so as to prevent smearing or migration of the dyestuff or printing composition. Any suitable power means, for example a motor (not shown) may be utilized for pulling the cloth **10** out of the box or truck **11**. As the cloth **10** leaves the box **11** it is carried or trained over fixed guides **13, 14**, the arrangement thereof being such as to convey the traveling cloth **10** from the truck **11** to a padder unit **15** comprising a resin or other pre-finishing composition containing box **16** accommodating a pair of coacting rollers **17—18** rotatably driven by any suitable means (not shown) so as to form a nip **19** therebetween through which the cloth **10** passes and wherein it picks up and is impregnated with a deposit of the resin composition **20** contained in the pad box **16**.

A typical pre-finishing or resin-mix formula and method of preparing the same is as follows:

18 lbs. of Elvanol 72–60; and
5 lbs. of Catalyst AC; and
10 lbs. of S. T. Softener 421; and made up to 150 gallons total, by adding water according to the procedure below.

Draw about 25–30 gallons of water at 60–70° F. into the mixing tank, add the 18 lbs. of 72–60 Elvanol and disperse thoroughly by agitating with compressed air or with a "Lightnin" mixer. Bring to volume of 100 gallons by adding more water, and heat to 180–190° F. with live steam until the Elvanol is dissolved. Dissolve the 10 lbs. of Softener 421 in 10 gallons of boiling water and add to the mix. Bring the mix to 150 gallons by adding cold water. Add the 5 lbs. of Catalyst AC and mix thoroughly.

"Elvanol" is a trademark name given to a product of the E. I. du Pont de Nemours & Company, Inc. covering a group of water soluble polyvinyl alcohol synthetic resins which are white to creamy-white powders. The numbers "72–60" refer to the degree of hydrolysis in a certain viscosity. "Catalyst AC" is a product of Monsanto Chemical Company comprising mixed isopropanol amines, concentrated (36%) HCl and water. "S. T. Softener 421" is a product of the Southern Chemical Company and comprises diethanolamine, stearic acid, urea, glacial acetic acid, and water. "Lightnin" is a trademark name of a high speed agitator manufactured by the Mixing Equipment Co., Inc. of Rochester, New York.

An alternative suitable formula for the resin application is as follows:

3% by weight of 123 Rhonite R–1 (70% solids), an ethylene urea type thermosetting resin sold by the Rohm & Haas Co. of Philadelphia, Pa.
4% by weight of Rhoplex AC33, which is an emulsion of an acrylic thermoplastic resin, also made by Rohm & Haas Co.
3% Catalyst AC (supra).
¼% of Triton GR5, a penetrating or wetting out agent, also produced by Rohm & Haas Co.
Balance water.

Another formula found satisfactory, especially if it is desired to give the cloth firmness of hand, is as follows:

60 lbs. of Diapene U, a thermosetting resin made by the Quaker Chemical Co.
6 lbs. of Diapene U Catalyst, namely, di-ammonium phosphate.
35 lbs. of corn starch.
Add water to a volume of 150 gallons total solution.

One relative advantage of the last two formulas of resin treating solution is that both require curing, since both the Diapene U resin and the Rhonite are of a

thermosetting character, whereas the resin Elvanol of the first formulation is not thermosetting but thermoplastic, and does not require curing as such.

As previously mentioned, a preferred treating solution is that which comprises Elvanol, or polyvinyl alcohol, Catalyst AC and Softener 421, in an aqueous solution, and without the corn starch. Sometimes, as for example in the case of sulphur blacks, naphthol navies, reds and wines, and heavy "aridye" prints, an additional penetrating accelerator or re-wetting agent is used. For this purpose, Twitchell Oil 7260, which is an oil emulsion mixture of mineral and vegetable oils, is employed. The No. 421 Softener is not a water softener, but rather a fabric handle softener. Washing is not always necessary after impregnation of the cloth with resin, and is definitely not required if Elvanol or polyvinyl alcohol is used.

There are, in general, only two methods of applying the stabilizing resin, either all-over, in the form of a bath in which the cloth being pre-finished is dunked or immersed, and by local application of the resin as by printing. The all-over application with a padder device is the preferred method of application. Other re-wetting agents besides the Twitchell Oil 7260 may be used for the sulphur blacks, etc. Examples of suitable substitutes are Triton X–100, made by Rohm & Haas Company, and Ahcowet RS, made by the Arnold Hoffman Company.

It is further noted that by using Elvanol or polyvinyl alcohol as the resin in the treating bath prior to framing and subsequent plisseing, not only is the curing step which the urea formaldehyde type resins involve avoided, but also the objectionable odors sometimes attendant upon the UF resins are also absent. Furthermore, it appears that where the UF resin is used with corn starch in the treating solution, such resin reacts with the starch and thereby forms a polymer-coating on the surface of the fibers of the cloth which makes it difficult for the caustic soda subsequently applied to penetrate the fabric.

In the preferred treating solution, comprising polyvinyl alcohol, Catalyst AC and Softener 421, the catalyst is not used for the purpose of polymerizing the resin, for that type of resin, as stated, requires no curing, but the catalyst serves the function of rendering the resin partially water insoluble on drying of the resin-impregnated cloth. This is not the same thing as curing, although the result may be very similar, namely, insolubilization of the resin in situ.

With regard to the suitability of resins other than polyvinyl alcohol, urea formaldehyde and/or melamine formaldehyde type resins have been found satisfactory in the practice of the present invention, as are also the ethylene urea type resins, that is to say, dimethylolethyleneurea, and certain other dimethylol derivatives, namely, dimethylol, 1,2-propyleneurea, dimethylol 1,3-propyleneurea, dimethylol 1,3-butyleneurea, and dimethylol 2,3-butyleneurea. Moreover, mixtures of such compounds may be incorporated in the resin pre-treating bath.

Referring again now to the drawing, the cloth **10** may be conducted into or toward and away from the nip **19** of the padder rolls **17—18** by means of small guides **21** and **22**; and after passing under the latter guide **22** the fabric, now pre-treated or impregnated with a stabilizing resin of the character described may be led up into a bank of drying cans **23** which are heated to a temperature sufficient to remove at least the major portion of the moisture in the fabric. From thence the material is led under another small guide **24**, after which it is gripped by a conventional pin or clip tenter frame **25** which passes through a heated oven **26** for further drying and/or curing by heating. After its emergence from the framer or tenter **25**, the cloth **10** is taken past a series of guides **27** to a take-up roll **28**. The pre-finished cloth **10** remains on the take-up roll **28** until it is ready to be plissed. If desired, of course, the material **10** may go directly from the framer **25** and oven **26** to the plisse range without being temporarily wound up on the take-up roll.

In practising the present invention, it has usually been found desirable to incorporate with the caustic in the plisse bath a penetrant, or an assistant agent for insuring that the alkali effectively reaches and contacts the cloth being treated. To that end, the penetrant known as Eumercin HRH, made by the Warwick Chemical Company, has been found suitable for the purpose. From about ¼ percent to about 1 percent by volume of the Eumercin is added to the aqueous caustic solution. The chemical composition of the Eumercin penetrant for the cloth is as follows:

70% or 700 parts of 90% naphthol
20% or 200 parts of naphthonic acid
10% or 100 parts of hexylene glycol

It will be understood, of course, that penetrants other than Eumercin may also be utilized to assist the action of the caustic on the fabric.

The concentration of the caustic is usually a little below 50 per cent, and within the effective range of from about 40 percent to 50 percent by weight maximum. The temperature of the caustic solution preferably should be of the order of from about 90° to about 110°. On adding the caustic to the water, in preparing the plisse mix, heat is generally exothermically generated, thereby raising the temperature of the water, and ordinarily no other heating is required. In case it is necessary to supply heat, then the caustic may be heated with a closed steam coil in a small feed tank at the plisse apparatus where the caustic solution is prepared.

It is further pointed out that other known swelling agents for cotton may be substituted for the caustic. When used on rayon or rayon containing fabrics, however, the results are not as satisfactory as those obtained with cotton material.

Before summarizing, it may be in order to point out that according to the present invention, after the goods have been pre-treated with a stabilizing agent and put under widthwise tension, as by tentering, and, in the case of thermosetting applications, heated cured or insolubilized, the widthwise tension may be relaxed, and the fabric can then be subjected to lengthwise tension during its passage through the plisseing apparatus. As previously indicated, only selected portions of the cloth are subjected to the caustic or shrinkage agent, and while the shrinkage agent is being applied the fabric is kept under lengthwise tension. Subsequently, the lengthwise tension is desirably slackened after the caustic has been applied but while it is permitted to continue its penetrating action on the cloth. The cloth desirably remains in a slackened condition while the shrinking agent is removed.

Summing up then, this invention proposes a method of forming permanent plisse effects in fabrics which includes the steps of running the fabric through a bath comprising essentially an aqueous solution of a pre-finishing stabilizer, for example—polyvinyl alcohol, at least partially drying the wetted fabric, and subsequently subjecting the fabric to widthwise tension, relaxing the widthwise tension to which the fabric has been subjected, and subjecting the same to lengthwise tension, penetrating only selected portions of the fabric with a shrinking agent while keeping the fabric still under lengthwise tension, slackening the lengthwise tension on the fabric while allowing the shrinking agent to continue its penetration, and subsequently removing the shrinking agent from the fabric while the fabric remains in a slackened condition.

What is claimed is:

1. Method of forming permanent plisse effects in cellulosic fabrics which includes the steps of applying to the fabric a resin shrinkage stabilizer, and subsequently subjecting the fabric to widthwise tension, relaxing the width-

wise tension to which the fabric has been subjected and subjecting the same to lengthwise tension, penetrating only selected portions of the fabric with a shrinking agent while keeping the fabric still under lengthwise tension, slackening the lengthwise tension on the fabric while allowing the shrinking agent to continue its penetration, and subsequently removing the shrinking agent from the fabric while the fabric remains in a slackened condition, and maintaining the fabric in a state of relaxed widthwise tension without framing.

2. The method of claim 1, wherein the resin shrinkage stabilizer is polyvinyl alcohol.

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UNITED STATES PATENT OFFICE

Certificate of Correction

Patent No. 2,867,892 January 13, 1959

Joseph W. Houth

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 73, for "advantage" read —disadvantage—.

Signed and sealed this 28th day of April 1959.

[SEAL]

Attest:
T. B. MORROW,
Attesting Officer.

ROBERT C. WATSON,
Commissioner of Patents.