

Sept. 29, 1959

M. LIEBESKIND

2,906,441

FABRIC PLEATING

Filed Feb. 17, 1955

Fig. 1

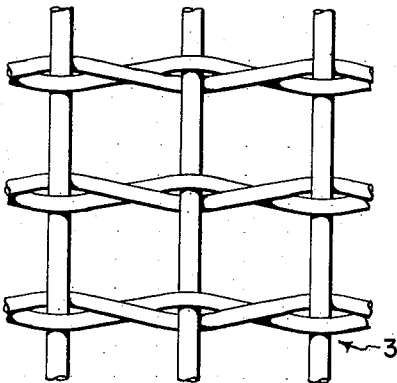
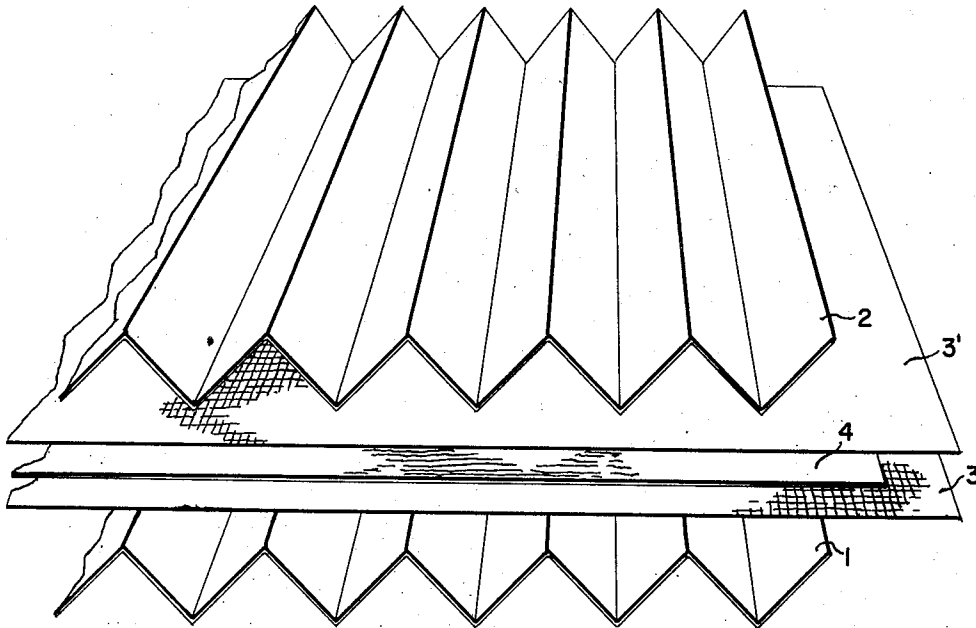


Fig. 2

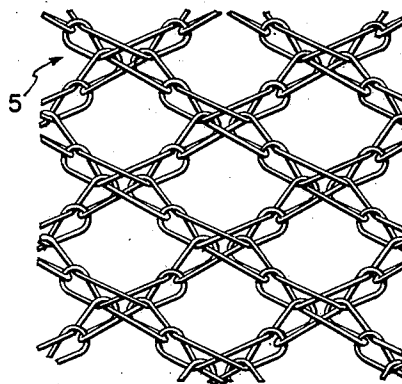


Fig. 3

INVENTOR
MACK LIEBESKIND

BY *Charles A. McClure*

ATTORNEY

1

2,906,441

FABRIC PLEATING

Mack Liebeskind, Lawrence, N.Y., assignor to E. I. du Pont de Nemours and Company, Inc.

Application February 17, 1955, Serial No. 488,862

4 Claims. (Cl. 223—28)

This invention relates to creasing of fabrics, particularly pleating of fabrics containing thermoplastic synthetic fibers, such as those formed from acrylonitrile polymers.

Conventionally, creases usually are imparted to fabrics by application of heat and pressure, often involving a steaming step. Formation of multiple or recurrent folds or pleats commonly is aided by use of mechanical dies or forms to impart a desired pattern to the fabric being treated. Fabrics containing fibers that plasticize or soften upon appreciable increase of temperature are especially well adapted to taking pleats and then retaining them under more moderate conditions, but they have a related characteristic of assuming a glaze, gloss, or shine that is undesirable in many textile uses. This disadvantage, which is attributable at least in part to paralleling of the constituent fibers, is prominent in fabrics having high content of polyvinyl fibers and, as would be expected, is particularly objectionable in the darker shades of apparel. The present invention is directed primarily toward overcoming this handicap, as in the pleating of fabrics formed from acrylonitrile polymers, similar considerations applying generally to the creasing of related materials.

Accordingly, an object of the present invention is improved pleating of fabrics. Another object is glaze-free creasing of fabrics having component polyvinyl fibers. Other objects of this invention, together with methods and means for accompanying the various objects, will be apparent from the following description of the invention and the accompanying diagrams.

Figure 1 is a perspective view of an assembly of elements useful according to this invention. Figure 2 is an enlarged plan view of an element of Figure 1. Figure 3 is an enlarged plan view of another element useful according to this invention.

In general, the objects of this invention are accomplished by use of a dimensionally stable fabric of open construction to space a fabric being creased away from the surface of an adjacent confining element. With fabrics pleatable at or near the normal boiling temperature of water, such as fabrics having high content of polyacrylonitrile fibers or fibers composed of copolymers of acrylonitrile or other vinyl monomers, nylon in a sufficiently open fabric construction is eminently satisfactory as the spacing material. During conventional manufacture nylon customarily undergoes a setting treatment effective to stabilize it dimensionally with respect to such creasing conditions. The practice of this invention otherwise utilizes conventional pleating means and methods.

In Figure 1, forms 1 and 2 constructed to mate with one another appear separated by more than enough space to accommodate spacing fabrics 3 and 3' and intervening subject fabric 4, which is to be pleated. The open construction of the spacing fabric shows clearly in Figure 2. Practical operating conditions using this assembly of elements are exemplified below.

Example I

One-half of a simple accordion-pleating form like that

2

just described, made of 13-point rope paper over a yard wide, is spread out to a length of about 2 yards and clamped flat on a table. A layer of curtain-grade marquisette fabric of 36 x 44 count made of 70-denier, 34-filament nylon is spread over the form, completely covering it. A slightly smaller piece of the fabric to be pleated, a plain woven navy blue lightweight suiting of polyacrylonitrile staple yarn, is laid flat on the nylon. Then a piece of like nylon marquisette is added on top of the second fabric, and the other hand of the form is superimposed in mating position with the first half. The operator unclamps the assembly, gathers the form into the pleating configuration with the fabrics confined therebetween, fastens it securely, and then exposes the entire assembly for 15 minutes to steam superheated to temperature equivalent to 10 pounds gage pressure. Upon subsequent disassembly of the form, the acrylic fabric is found to exhibit sharp pleats in a pattern like that of the form with no shine or other nonuniformity in surface appearance at the faces of the pleats. The nylon spacing fabric is unchanged in appearance. Upon repeating the pleating procedure in the absence of the spacing fabrics, the operator observed an extremely objectionable glazed appearance along the face of each pleat. Attempts to replace the spacing fabric of the example by papers or fabrics of close construction were unsuccessful in eliminating such objectionable shine.

Example II

The male half of a pleating pattern made of a 13-point rope paper and consisting of a repeating 1½ inch box pleat (½ inch underlay) with two ¾ inch knife pleats (½ inch underlay) at each side is opened flat on a table and clamped open. A single layer of skirting fabric to be pleated is spread out, face or right side up on the pattern. The yarn of which the fabric is composed is staple of 1½7 worsted count made of a stock blend of 20% wool with 80% synthetic fiber prepared in conventional manner by copolymerization of acrylonitrile and methyl acrylate (94/6) subsequently extruded through 0.005" spinneret orifices, drawn to 4 times the extended length, and cut into 3½" staple fibers. This fabric, which weighs 6 ounces per yard, is of knit construction, formed on an 18-gauge circular machine at 30 courses per inch, and piece-dyed in a union black shade. A layer of knit netting¹ like fabric 5 of Figure 3 made of 15-denier nylon monofilament (i.e., polyhexamethylene adipamide) previously heat-set at 200° C. for 30 seconds is smoothed out flat against the fabric face; this second fabric is of such size as to completely cover the fabric to be pleated. The other half of the pattern is superimposed on this assembly in mating position. Four flat, weighted "sticks" are then placed lengthwise on the pattern to hold it in position. Next the pleats are folded by hand into their compressed, interlocking position. The pattern is then rolled up lengthwise as is customary for ease of handling and subsequent treatment, the sticks being pushed off it as the roll progresses. Then the pattern is tied with a string to hold it in the rolled position. The roll is placed on end in a box supplied with saturated steam at atmospheric pressure. After thirty minutes of steam treatment, the roll is removed and allowed to cool. When removed from the pattern, the skirting exhibits sharp pleats with no appreciable glazing visible on the faces of the pleats on the right side of the fabric although the unprotected wrong side of the fabric shows considerable glazing along the backs of the pleats.

The above examples suggest in some measure the broad

¹ Construction of such fabric is described by D. F. Paling at pp. 60-64 of "Warp Knitting Technology" published in 1952 by Harlequin Press Co., Ltd., London and Manchester, England.

applicability of the present invention, which is not restricted to pleating or other creasing of the mentioned constructions and compositions of fabric, extending also to similar treatment of fabrics of whatever construction, weight, or composition having high content, preferably at least half, of thermoplastic polymer in the sum total of the component yarns. The fabric to be treated may consist of yarns containing thermoplastic fibers along with non-thermoplastic fibers, or it may be constructed from yarns some of which are thermoplastic and others of which are not. As the acrylonitrile polymers are commercially important constituents of readily pleatable fibers, they are emphasized herein, comprehending not only the homopolymer polyacrylonitrile but also, for example, copolymers of acrylonitrile with monomers such as acrylates and methacrylates, vinylacetate, vinylchloride, styrene, isobutylene, and other ethylenically unsaturated hydrocarbons. Wool fabrics, including notoriously shining serges, also can be pleated successfully according to this invention.

Optimum time and temperature of treatment and use of steam or other optional vapors to accomplish the desired creasing depend upon the subject material, of course, and are ascertainable easily by routine investigation without expenditure of inventive effort. Temperatures above 100° C., conveniently obtainable with steam at superatmospheric pressure, may be employed to facilitate the process, as may be desirable for wholly polyacrylonitrile fabrics, for example, or when several layers of fabric are being treated at once. Conditions conducive to repeated use of paper pleating patterns usually are selected for economy of operations, a characteristic of the present invention. When two or more fabrics are superimposed for simultaneous treatment according to this invention, as is done most easily with relatively simple patterns, the face of each should be protected by suitable spacing fabric as here described to prevent shine.

The spacing fabric should be open in construction (i.e., having interstices larger than, preferably at least several times as great in width as, the surrounding filaments or groups thereof); it may be formed as a leno, for example, instead of the weave mentioned above, or of various knits, including tricot. A knit fabric is desirable for complex or fancy pleating configurations because of its customarily greater "give," which permits it to accommodate itself readily to the pattern, thus preventing excessive localized pressure against the subject fabric during treatment and consequent marking thereof. No other known constituent appears to be so suitable for this fabric as fine filament nylon, which conforms temporarily to the pleating configuration without undesirable distortion or displacement of the individual filaments or permanent change in shape of the spacing fabric itself. Other polyamides sharing the essential characteristics of polyhexamethylene adipamide are similarly satisfactory. The fabric components should resist cracking or splitting

off of individual fibers or pieces thereof and breaking or degradation of entire yarns under the conditions employed, yarns available only in staple form or with cellulosic content being unsuitable. The thickness of the spacing fabric is not critical, and the weight of fabric may be selected for ease of handling, one to four ounces per yard being customary. Preferably undyed, the spacing fabric should be free from sizing or other substance that might transfer to the fabric being treated. Often use of two or more adjacent layers of spacing fabric is conducive to attainment of the full benefits of the present invention during the breaking-in period of new paper forms or with harder pattern materials.

The mechanical form by which the fabric is confined during treatment may be made of metal, such as aluminum or other light-weight metal, rather than the usual paper. The pattern may be folded or otherwise assembled and fastened by any suitable means, whether primarily manual or mechanical. An inflexible ridged or serrated die may replace the usual folding form. The spacing fabric may be affixed more or less permanently to the pattern form itself if desired, although the inconvenience of attaching the fabric to the form by means that will not affect the treated fabric adversely and the long useful life of the spacing fabric, especially when its position relative to the form varies from one exposure to the next, usually render such combination inadvisable.

The claimed invention:

1. In the pleating of a pressable thermoplastic fabric between mating mechanical forms, the improvement comprising positioning the fabric to be pleated between said forms and spacing the fabric to be pleated from its contiguous form by at least one intervening layer of synthetic fabric of open construction, said intervening layer being dimensionally stable to the setting medium under the setting conditions utilized and having interstices larger than the diameter of the yarns which make up the said intervening layer.

2. The process of claim 1 in which the intervening layer is a nylon fabric.

3. The process of claim 1 in which the setting medium is steam.

4. The process of claim 1 in which the fabric to be pleated is an acrylonitrile fabric.

References Cited in the file of this patent

UNITED STATES PATENTS

1,752,897	Dickman	Apr. 1, 1930
1,789,421	Angelus	Jan. 20, 1931
2,428,071	Goldsmith	Sept. 30, 1947
2,490,981	Reiss et al.	Dec. 13, 1949
2,542,297	Sunbury et al.	Feb. 20, 1951
2,601,770	Goldsmith	July 1, 1952
2,608,079	Slater	Aug. 26, 1952
2,627,644	Foster	Feb. 10, 1953
2,705,583	Hoffman	Apr. 5, 1955