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METHOD FOR PRODUCTION OF FABRICS

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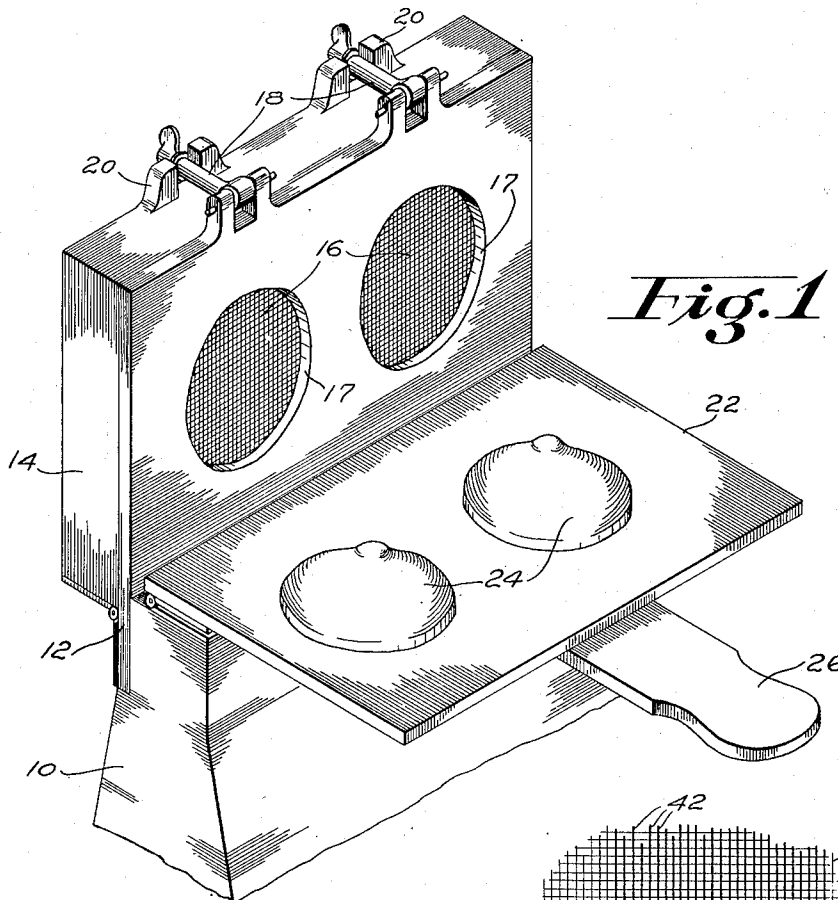


Fig. 1

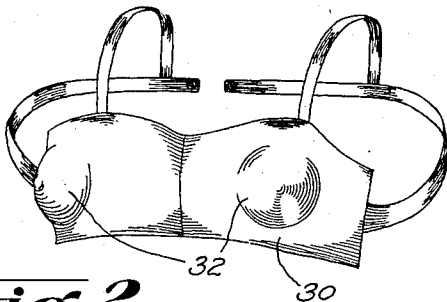


Fig. 2

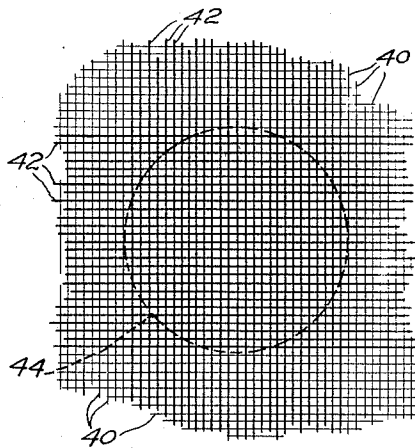


Fig. 3

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2,285,967

METHOD FOR PRODUCTION OF FABRICS

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6 Claims. (Cl. 18—56)

This invention relates to the cold-drawing of flat fabrics woven from synthetic linear polyamide yarns in order to form three-dimensional articles such as brassières and also foundation garments, girdles, and the like.

The standard brassière fabric of the art is woven or knitted from cotton, rayon, or silk yarn. The fabric must be cut to shape, then sewn. Seaming is usually necessary. It is sometimes desirable to laminate these fabrics. These various operations in the production of brassières result in a high cost of fabrication, the production of objectionable seams and ridges, unsatisfactory fit, and distorting and stretching in service.

Attempts have been made to form three-dimensional articles from flat fabrics composed of cellulose derivative yarns. Cellulose derivative fabrics, for example, cellulose acetate fabrics may be shaped and formed into the desired three-dimensional article by incorporating a suitable quantity of a plasticizer or softening agent in the fabric, or by heating the fabric until it is plastic, prior to the shaping operation. Articles formed in this manner from cellulose derivative fabrics are generally unsatisfactory. Such articles often exhibit a loss of fabric identity which results from the pressing together of the highly plasticized yarn and the lack of flexibility in the resultant fabric. Other fabrics produced in this manner often exhibit an objectionable opening of the fabric.

Quite recently yarns have been produced from a new class of materials known as synthetic linear polyamides. The preparation of this material and the formation of yarn therefrom are described in U. S. Patents Nos. 2,071,250; 2,130,523 and 2,130,948. The term "synthetic linear polyamide," as used throughout the specification and claims, is intended to refer specifically to the material disclosed in the above-identified patents.

Synthetic linear polyamide yarns can be "cold-drawn" to greatly increase their tenacity and lower their elongation. Before weaving synthetic linear polyamide yarns, they are customarily cold-drawn 150% to 500% of their original length to impart the requisite physical properties thereto.

It is an object of the present invention to form, by cold-drawing, three-dimensional articles from flat fabrics woven from synthetic linear polyamide yarns, which articles are characterized by their well-shaped form, great strength, and retention of fabric identity.

Other objects of the invention will appear hereinafter.

The objects of the invention may be accomplished by weaving a flat fabric from undrawn, or partially drawn, synthetic linear polyamide

yarn, cutting the fabric into pieces of substantially the outline shape of the article to be produced and forming or shaping the fabric by cold-drawing the same into the three-dimensional form of the desired article. The three-dimensional drawn fabric article may then be substantially permanently set by treatment, with a hot, (i. e., at a temperature of 85° C. to 150° C.), wet, non-solvent swelling agent for the polyamide, as described in U. S. Patents Nos. 2,157,117 or 2,157,118.

The nature of the invention will become more clearly apparent by reference to the following detailed description when taken in connection with the accompanying illustrations, in which:

Figure 1 is a perspective view of a shaping device suitable for use in shaping three-dimensional articles in accordance with this invention.

Figure 2 is a perspective view of a finished brassière produced by shaping in accordance with this invention.

Figure 3 illustrates a section of specially constructed fabric for use in accordance with the present invention.

Referring to Figure 1 of the drawing, reference numeral 10 designates, generally, a base of a cold-drawing apparatus suitable for use in accordance with the present invention. A fabric clamping element 12 is fixed to the base member 10. The fabric clamping element 12 contains a pair of openings 17 which are adapted to cooperate with a pair of cold-drawing dies hereinafter to be referred to. A second clamping member 14 is pivoted to the fixed clamping member 12. The pivoted clamping member 14 is provided with a pair of lugs 20 which are adapted to cooperate with a pivoted thumbscrew 18 attached to the fixed clamping member. The synthetic linear polyamide fabric is clamped between the two clamping members so as to project over the two openings 17 as illustrated. A cold-drawing member 22 is hinged to the supporting base 10 adjacent the side of fixed clamping member 12 opposite to the side on which clamping member 14 is pivoted. The member 22 is provided with a pair of cold-drawn forming dies 24. The forming dies 24, upon swinging the member 22 into contact with the fixed member 12, are adapted to fit within the openings 17, thereby forcing, and cold-drawing, the fabric 16 overlying the openings 17 into a three-dimensional shape. The hinged member 22 may be swung into cold-drawing position by means of handle 26. In the apparatus illustrated in Figure 1, the cold-drawn dies 24 are in the shape of cups to form a brassière of the fabric clamped between clamping members 12 and 14.

Referring to Figure 2 of the drawing, reference numeral 30 designates a piece of fabric having the general outline of a brassière. The fab-

ric has been cold-drawn to form therein two cups 32. The brassière is constructed from the fabric 30 by merely attaching the necessary straps and fastening elements.

Figure 3 of the drawing illustrates a specially woven fabric which is particularly adapted for use in accordance with the present invention.

In this modification of the invention, a fabric is woven primarily of yarns 40 which are incapable of being cold-drawn. These yarns may be previously cold-drawn synthetic linear polyamide yarns or they may consist of yarns composed of other materials. A plurality of undrawn, or partially drawn, synthetic linear polyamide yarns 42 is woven into the fabric as warp threads and a similar plurality of undrawn, or partially drawn, synthetic linear polyamide yarns 42 is woven into the fabric as filling yarns. These undrawn yarns, which are designated by heavier lines in the drawing, are adapted to overlap each other leaving a central overlapping section designated by numeral 44 which is constituted entirely of undrawn, or partially drawn, synthetic linear polyamide yarns. The cold-draw which is to be applied to the fabric will be applied at this section which contains only undrawn yarns.

The following examples are illustrative of specific methods for the production of brassières in accordance with the present invention. The invention is, of course, not to be limited by the specific details of these examples.

Example I

A flat fabric having 50 warp and 60 filling threads per inch and woven from 160-denier, 70-filament, 10-turn per inch, undrawn polyhexamethylene adipamide yarn is made into pieces of the proper outline and dimensions of a brassière. A piece of this fabric is tightly clamped between clamping elements such as members 12 and 14 of Figure 1. The sections of the fabric overlying the openings 17 are then cold-drawn by swinging draw plate 22 into its upward position against the clamping plate 12 so that the cold-drawn dies 24 are moved through the openings 17 against the fabric 16. After the sections of the fabric have been cold-drawn as above outlined the clamping elements are released and the fabric is removed and placed upon a form having the general outline of a completed brassière and is there subjected to a hot, wet setting treatment in a manner similar to that described in U. S. Patent No. 2,157,117. The fabric is then converted into a brassière as shown in Figure 2 by stitching around the edges and attaching the necessary straps and fastening elements thereto. The brassière may then be dyed with dyes usually utilized for the dyeing of cellulose acetate and is given a final boarding treatment on a suitable form in a manner well known in the art. Cutting of the fabric before or after the cold-drawing may be accomplished in various ways, as, for example, with a rotary cutter. A heated cutter or a hot blade may be used to obtain a welded selvage.

Example II

A flat fabric having 50 warp and 50 filling threads per inch and woven from 170-denier, 60-filament, $4\frac{1}{2}$ -turn per inch, undrawn polyhexamethylene adipamide yarn is made into pieces of the same general outline as a brassière. A piece of this fabric is cold-drawn by the apparatus shown in Figure 1 in a method as outlined in Example I. In carrying out the process in ac-

cordance with this example, the clamping elements 12 and 14 are slightly released and saturated steam is passed between the two clamping elements to contact the drawn sections of the fabric for a period of two minutes. The fabric is then removed from the drawing apparatus and is fashioned into a brassière by stitching around the edges of the fabric and attaching straps and fastening elements to the brassière. The brassière is then dyed in a hot dye bath and is given a final boarding treatment on a suitable form.

The brassières prepared in the examples are well-shaped, are very strong, and still possess their fabric identity. They retain their shape over long periods of wearing despite exposure to considerable stresses because the setting treatment so increases the force required to draw the fabric that for all practical purposes the set fabric is non-drawable by the forces to which it is ordinarily exposed in the course of its everyday use.

Although the invention has been discussed with respect to the preparation of a brassière, it is to be understood that other shaped articles may be prepared in accordance with the principles of the invention; e. g., foundation garments, combination brassières and girdles or even hats, gloves and many other three-dimensional articles may be prepared by cold-drawing fabrics prepared from undrawn, or partially drawn, polyamide yarn.

The invention may be carried out with the aid of many different types of cold-drawing devices. For example, an expanding device such as an inflatable rubber form may be used to produce such shaped fabrics as gloves, and the like. Also, polyamide fabrics may be embossed with various designs by subjecting the undrawn fabric to pressure between a pair of suitably cooperating embossing rolls.

Various types of novelty fabrics may be prepared in accordance with this invention. Undrawn polyamide yarn may be plied with viscose rayon, cellulose acetate rayon, cotton, or other yarns; the plied yarn may then be converted into a fabric and the fabric may be cold-drawn to such an extent as to break the latter yarn or yarns to produce a novel fabric.

Various types of mixed fabrics may be made in accordance with this invention with an undrawn polyamide yarn only in the warp and some other yarn in the filling; or similarly, the polyamide yarn may be present only in the filling while some other yarn constitutes the warp. Thus a fabric may be produced which is drawable in one direction only. Also, it is possible to use polyamide yarns which have been coated with an essentially non-drawable material in the production of novel fabrics; upon drawing the fabric, the coating is broken producing novel effects.

The invention has been discussed with respect to fabrics woven from undrawn yarns or partially drawn yarns. Polyamide yarns, as customarily used in the weaving of fabrics, are cold-drawn from about 150% (1.5:1 ratio of drawn to undrawn yarn) to about 500% (5:1 ratio of drawn to undrawn yarn) before the yarn is fabricated. In accordance with the present invention very good results may be obtained by cold-drawing sections of fabrics which are woven from partially drawn synthetic linear polyamide yarns, for example, yarn which has been drawn from 100% to 150%. Novelty fabrics may be prepared by fabricating yarns which have been partially

drawn to different extents in the various sections of the yarn, then cold-drawing the fabric in accordance with the present invention, dyeing and finishing. Furthermore, novel effects may be obtained by spinning a low viscosity polyamide, weaving it into fabrics and drawing the finished fabrics so that the threads will crimp. Since the principle of this invention may be applied to fabrics made from yarns which have been partially drawn, it is to be understood that the invention covers the cold-drawing of any fabric prepared from a yarn which is capable of being cold-drawn.

Various types of setting treatments may be applied to the shaped fabrics of this invention; e. g., steam setting, setting with alkali sulfite solution, etc.; or the fabric may be left unset, if desired.

Yarns prepared from other filament-forming synthetic linear polymers which are capable of being cold-drawn may be used in accordance with the present invention; for example, synthetic linear interpolymers, synthetic linear vinyl polymers and vinyl interpolymers, synthetic linear polyesters, polyesters, polyacetals, and interpolymers of two or more specific polymers of the same type or of different types of the above-named polymers may be used to advantage.

These yarns may contain or may be treated with various modifying agents, such as luster-modifying agents, plasticizers, wetting agents, swelling agents, pigments and dyes, anti-oxidants, resins, sizing agents, finishing agents, etc.

This invention makes possible new, improved shaped articles characterized by great durability, desirable elastic properties, and good appearance. Brassieres and other shaped articles can be produced which conform more closely to the shape desired than similar articles heretofore available. A much more comfortable article of clothing is produced by reason of the elimination of most of the seams which are necessarily present in a brassiere made by sewing together several pieces of fabric. Much labor is saved in the production of brassieres by eliminating the steps of cutting numerous pieces of fabric, fitting these pieces together, and sewing them. Moreover, the process of this invention is more economical than the prior art processes of molding thermoplastic materials by reason of the elimination of the requirements for heat, swelling agents, and plasticizing agents. Cold-drawing requires none of these; but it is to be understood that it may be desirable at times to use plasticizing agents or swelling agents or heat and such modifications lie within the scope of the present invention. Preference for the cold-drawing procedure has been expressed because of the simplicity and low cost of such a procedure as compared with a hot-drawing procedure. However, since numerous synthetic linear polyamides are capable of being drawn at elevated temperatures, it will be obvious that the invention is not to be limited to cold-drawing. In certain cases drawing in a hot, wet atmosphere may be highly advantageous because lower forces are required to draw polyamides in such an atmosphere.

The discovery that dyes usually utilized for dyeing cellulose acetate are particularly suitable for dyeing polyamide yarns and fabrics helps to make these yarns more useful in the practice of this invention; for these dyes very effectively cover up differences in denier and extent of draw-

ing. However, it is to be understood that the yarns or fabrics used in accordance with the invention may be dyed prior to the cold-drawing operation.

An important advantage and an unexpected result of the invention is the increase in wrinkle resistance that accompanies the cold-drawing of the synthetic linear polyamide fabrics in accordance with this invention.

As it is evident that many changes and modifications can be made in the above-described details without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited to the above-described details except as set forth in the appended claims.

I claim:

1. The process which comprises cold-drawing, into a three-dimensional article, a flat fabric woven from synthetic linear polyamide yarn which is capable of being cold-drawn.

2. The process which comprises cold-drawing, into a three-dimensional article, a flat fabric woven from synthetic linear polyamide yarn which is capable of being cold-drawn, and imparting a substantially permanent set to said cold-drawn article by subjecting the same at a temperature of 85° C. to 150° C., to a non-solvent swelling agent for the polyamide.

3. The process which comprises tautly clamping a flat fabric having at least one section containing synthetic linear polyamide yarn which is capable of being cold-drawn and at least one section in which the yarn is incapable of being cold-drawn, and cold-drawing, into a three-dimensional form, that section of the fabric containing the cold-drawable yarn.

4. The process which comprises tautly clamping a flat fabric having at least one section containing synthetic linear polyamide yarn which is capable of being cold-drawn and at least one section in which the yarn is incapable of being cold-drawn, cold-drawing, into a three-dimensional form, that section of the fabric containing the cold-drawable yarn, and imparting a substantially permanent set to said cold-drawn section by subjecting the same, at a temperature of 85° C. to 150° C., to a non-solvent swelling agent for the polyamide.

5. The process which comprises tautly clamping a flat fabric having at least one section in which both the warp and filling are composed of synthetic linear polyamide yarn which is capable of being cold-drawn and at least one section in which the yarn is incapable of being cold-drawn, and cold-drawing, into a three-dimensional form, that section of the fabric in which both the warp and filling is composed of the cold-drawable yarn.

6. The process which comprises tautly clamping a flat fabric having at least one section in which both the warp and filling are composed of synthetic linear polyamide yarn which is capable of being cold-drawn and at least one section in which the yarn is incapable of being cold-drawn, cold-drawing into a three-dimensional form, that section of the fabric in which the warp and filling is composed of cold-drawable yarn, and imparting a substantially permanent set to said cold-drawn section by subjecting the same, at a temperature of 85° C. to 150° C., to a non-solvent swelling agent for the polyamide.

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CERTIFICATE OF CORRECTION.

Patent No. 2,285,967.

June 9, 1942.

VERNAL R. HARDY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 9, for "sweling" read --swelling--; lines 46 and 54, for "cold-drawn" read --cold-draw--; page 3, first column, line 25, for "polyesters" second occurrence, read --polyethers--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of July, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.