

June 16, 1959

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2,890,515

APPARATUS FOR ORNAMENTATION OF FABRICS

Filed April 27, 1953

3 Sheets-Sheet 1

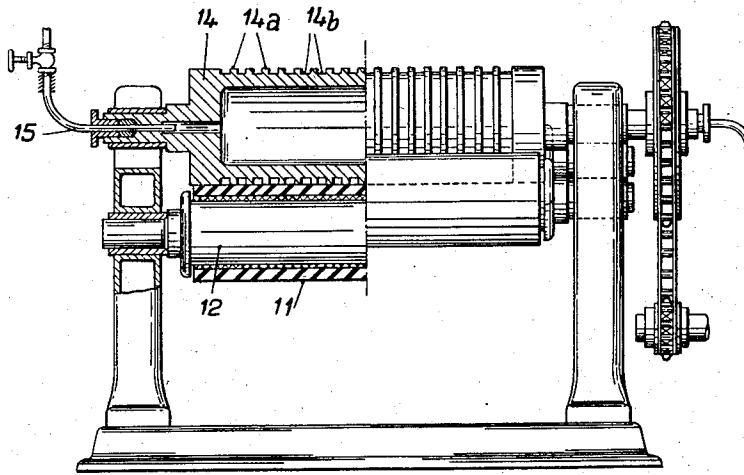


Fig. 2.

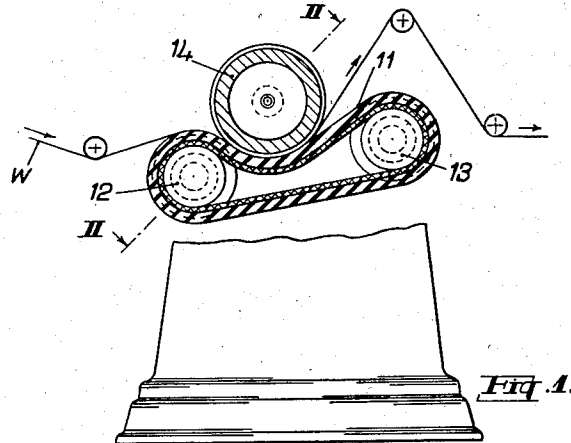


Fig. 1.

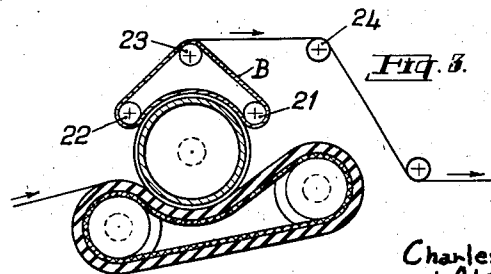


Fig. 3.

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3 Sheets-Sheet 2

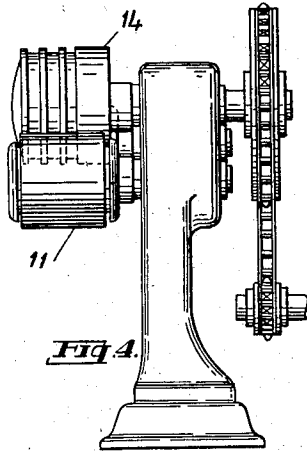


Fig. 4.

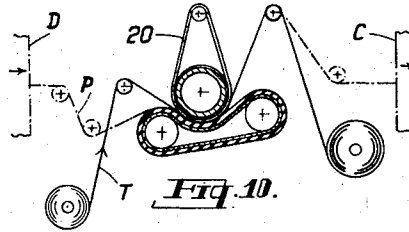


Fig. 10.

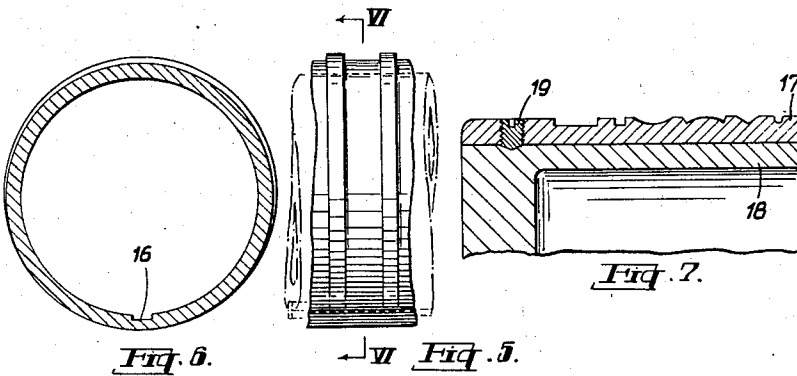


Fig. 6.

Fig. 5.

Fig. 7.

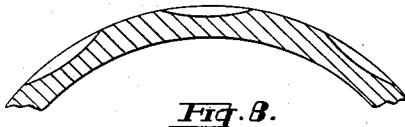


Fig. 8.

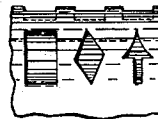


Fig. 9.

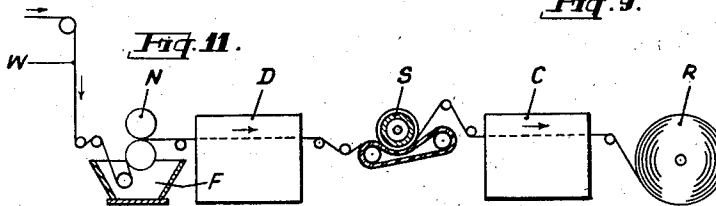


Fig. 11.

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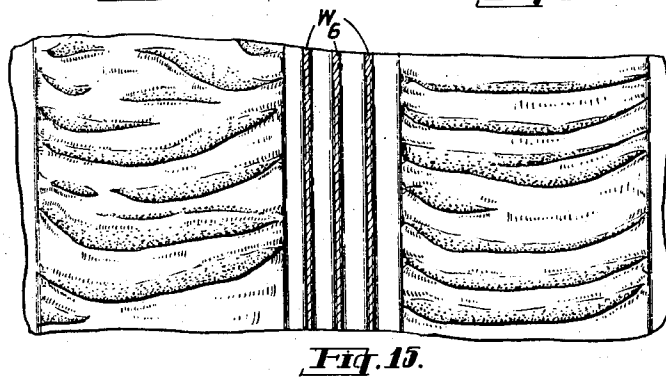
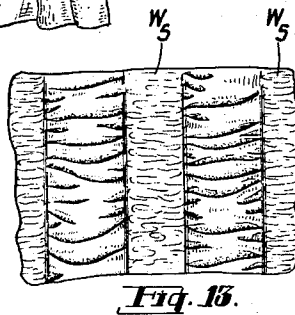
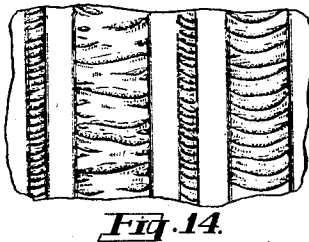
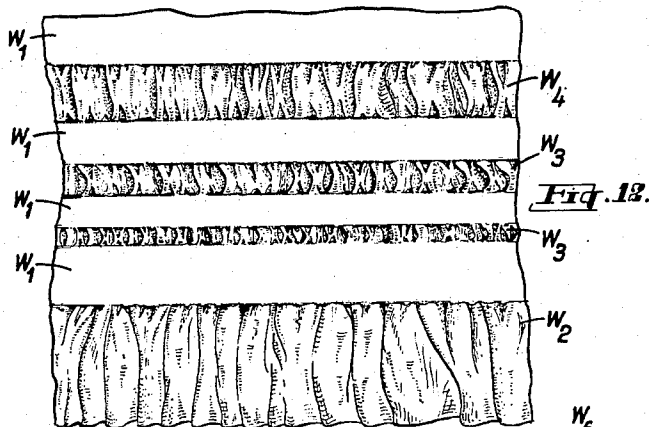
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APPARATUS FOR ORNAMENTATION
OF FABRICS

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Application April 27, 1953, Serial No. 351,076

Claims priority, application Great Britain
July 2, 1952

7 Claims. (Cl. 26—69)

This invention concerns sheet materials, such as textile fabrics, paper, leather and those composed wholly or partly of fibrous or plastic materials which may be shrunk by any process which includes the application of mechanical pressure (hereinafter and in the claiming clauses hereof called "fabrics") and also concerns methods of and apparatus for ornamenting the same. By the term "ornamenting" we mean herein and in the claiming clauses hereof "changing the configuration of the fabric by the formation of ruffles, ribs, frills or the like variations of shape."

The textile fabrics may be woven or knitted and composed of natural fibres such as cotton, silk, wool, linen or synthetic fibres such as rayon, linear superpolyamides such as are known by the name nylon, certain linear superpolyesters such as are sold under the registered trademark "Terylene," glass, or the like or mixtures of two or more of these materials. Textile fabrics treated in accordance with the present invention are particularly useful as wearing apparel, curtains and other interior furnishing fabrics.

An object of the invention is to provide ornamented fabrics and methods of and apparatus for producing ornamentation of fabric without having to rely in the case of textile fabrics, upon special weaving and chemical methods, such as for example, those used in producing the seersucker type of fabrics.

The method of ornamenting fabric according to the present invention comprises shrinking the fabric in at least one region by lengthwise compression and superficial restraint, while allowing relative freedom of lengthwise and superficial movement to the fabric in a region or regions adjoining the contracting edge or edges of said region or regions being shrunk, the fabric being treated to retain shrinkage and, thereby, maintain ornamentation.

The thus produced ornamentation, which is characterised by a substantial absence of surface pressure markings in the ornamented regions and by the irregularity of the ruffles or frills is not such as is obtained by a press or the normal pressure of engraved rolls. The ribbing produced in accordance with the present invention is likewise different from the ribbing obtained by embossing, in as much as the surface of the ribbing produced by our invention, particularly in the case of textile fabrics, shows an absence of the pressure markings and fibre crushing which is a feature of the ribs produced by the known methods of embossing.

The ribbed textile fabric produced by the present invention also differs from those fabrics in which the indentation between ribs has been produced by the crushing effect of a roller, inasmuch as in the present invention, the fabric in the shrunk regions is consolidated by lengthwise compression and superficial restraint and not by superficial compression.

The shrinkage, which may, for instance, be about 5-15% depending upon the degree of ornamentation desired, may be conveniently effected in a continuously act-

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ing compressive shrinking arrangement, by holding a region or regions of the fabric in contact with a contracting surface of an endless travelling belt of rubber, felt or other deformable material by means of a non-resilient pressure element or elements, which allows relative freedom of lengthwise and superficial movement of the fabric in the region or regions adjoining the contracting edge or edges of the region or regions held against the contracting surface of the travelling belt. The pressure element which is preferably heated, may include or consist of a roller, plate or shoe having depressions which may consist of a plurality of recesses or grooves in its operating surface to correspond with the regions of fabric which are to be allowed the said relative freedom of movement for forming ornamental effects. Other known mechanical shrinking arrangements may be adapted to be used, such as that in which the fabric is fed into a constraining or confining passage at a speed greater than that at which it is removed or omitted, the fabric being allowed freedom to move over both surfaces of the passage which is provided with a pressure element adapted for regional shrinking; or that in which two rollers rotating at different speeds are used under variable pressure as in a calender, the roller with the slower surface speed of the two being faced with rubber or other resilient material.

The ornamental effects so produced by regional compressive shrinking of fabrics having thermo-plastic properties such as linear superpolyamides which are known by the name nylon, certain linear superpolyesters such as are sold under the registered trademark "Terylene," silk or wool, are capable of being fixed by a treatment comprising simultaneous application of heat and pressure followed by cooling, this treatment serving to retain shrinkage and, thereby, maintain ornamentation.

With other fabrics fixation may be effected by synthetic thermoplastic materials or thermo-setting resins which are already known for the purpose of fixing effects on fabrics. The fabric may be impregnated with a thermosetting resin in aqueous solution and then preferably dried to a suitable moisture content, such as a moisture content of about 10 percent and preferably cooled. It is then treated by the regional shrinking process and baked at a temperature to suit the type of resin used finally to fix the shrinkage which secures the ornamentation. Preferably, the pressure element is heated to a temperature sufficient to set the resin. Even fabrics having thermoplastic properties may also be subjected to the resin treatment and/or final baking treatment if desired.

In the case of textile fabrics wholly or partly composed of cellulose acetate rayon, the ornamentation may be rendered permanent by the use of thermo-setting resins, as in the case of cotton, but where cloths are wholly constructed from cellulose acetate or contain a high proportion of cellulose acetate in their structure, it is preferred to treat the material with aqueous solutions of water-soluble substances which are taken up selectively by the cellulose acetate yarns, and exert a swelling or plasticising effect, thus reducing the softening point of the cellulose acetate and making it more susceptible to permanent deformation and setting when it comes into contact with the heated element of the machine under conditions of pressure. In carrying out this treatment, the cloth is first impregnated with a solution of the swelling agent or plasticiser of suitable strength, the excess being squeezed away by means of a nip. It is then dried and submitted to the ornamenting process according to the method of the present invention at a suitable temperature, and is then washed to remove the water-soluble swelling agent or plasticiser previously applied.

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If conditions are properly adjusted, the handle of the acetate rayon remains unimpaired after processing and the ornamentation imparted is permanent. The following example will illustrate the procedure.

Example

A textile fabric, wholly or mainly composed of cellulose acetate rayon is padded with a solution of ethyl lactate in cold water, containing 20% by volume. It is subsequently squeezed to leave within it 40% to 75% of its weight of additive. It is then dried at a comparatively low temperature such as 212° F. The dried fabric may or may not be conditioned to the required moisture content. It is then passed through a regional compressive shrinking apparatus, such as is hereinafter described, which includes a pressure element heated to a temperature of between 250° F. and 300° F. The fabric is then washed with warm water and finally dried with the minimum of tension. The mechanical effect imparted to the fabric is then capable of surviving the type of domestic washing usually applied to this class of fabric.

A shrinking apparatus adapted to produce the desired shrinking and ornamentation comprises an endless belt of rubber, felt or other deformable material capable of continuously expanding and contracting along its surface, and a non-resilient pressure element, such as a roller, plate or shoe, preferably heated to a temperature above 250° F., adapted to press one or more regions of a fabric against a contracting surface of the belt and to allow relative freedom of lengthwise and superficial movement of the fabric in the region or regions adjoining the contracting edge or edges of the region or regions held against the contracting surface of the belt and means for causing the said belt to travel.

The working surface of the pressure element may be provided with depressions according to the design of ornamentation required on the fabric. If, for example, the ornamental effect is required in continuous strips running parallel to the length of the fabric, the surface of the pressure element is grooved according to the width and the distance required between the strips of ornamentation. If, for instance, ruffles of 1" width are required with ¼" of plain flat cloth between them, then the operative surface of the pressure element will have depressions in the form of grooves 1" wide with plain portions or bands each ¼" wide between the adjacent grooves. The grooves are formed deep enough to allow the fabric the requisite freedom of lengthwise and superficial movement in the regions to be ornamented. This depth depends on the nature of the fabric and of the desired ornamentation but for a medium textile fabric, grooves of from ⅜" to ⅞" may be used.

Whilst the depth of the depressions is intended to allow clearance and freedom for the ornamentation to form some degree of control of the form and fullness of ornamentation created can be provided by finely adjusting the depth of the depressions. The fabric may be steamed or damped and conditioned prior to treatment in accordance with the present invention to facilitate the shrinking operation.

The amount of regional shrinking, which determines the form of the ornamentation may be controlled inter alia by varying any one or more of the following factors,

(a) The amount of superficial pressure exerted by the pressure element,

(b) The temperature of the pressure element,

(c) The moisture content of the fabric.

The degree of shrinkage imparted to the plain region or regions of the fabric adjacent to the ornamentation may, if desired, exceed the normal potential shrinkage of any given fabric, for the purpose of accentuating the ornamental effect, and obviously the degree of shrinkage imparted to the selected regions is a measure of the amount of fabric converted into loose ruffles or other similar ornamental effects.

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When treating fabrics which are to be subjected in use to a constant tension such as, for example, that resulting from their own weight as in very heavy curtaining, it may be desirable to reinforce the shrunken regions in order to maintain the shrinkage therein and the ornamentation in the other regions. This may be done, for example by reinforcing stitching, or reinforcing tape, or adhesive tape, or by a combination of one or more of these means.

Whilst ornamentation taking the form of continuous strips of ruffles, frills and other effects of varying width has been described, many forms and designs, continuous or intermittent, can be obtained, by changing the form of the depressions in the surface of the pressure element.

Additional heating elements, such as a band in contact with the upper part of the pressure element or co-acting nip rolls, may be used; and if a pair of separate nip rolls are used one or both of these may be designed with grooves or recesses similar to the grooves or recesses in the pressure element and may be maintained at a temperature of, for example, 250° F. to 400° F. A simple arrangement for cooling the fabric, such as a cold cylinder, may be used after the fabric has been dried to a suitable moisture content following resinating and also after the regional shrinking and final baking processes. After fixation by baking, the fabric is preferably washed and dried in its newly formed ornamental state.

A variation of the process as applied to some fabrics may be obtained by first stretching the fabric throughout its entire surface beyond its normal length by say 10 percent or more, and then subjecting the fabric to regional shrinking in accordance with the invention. This variation which is, of course, only applicable to those fabrics capable of being stretched, results in a saving in the net length of the fabric. Alternatively the fabric may be shrunk throughout its entire surface beyond its normal state prior to ornamentation according to the invention.

Certain textile fabrics may be subjected to an acid treatment, such as is used to give an organdie finish or stiff finish, either before or after regional shrinking.

The fabric may be printed or dyed before or after treatment, or even at an intermediate stage of the ornamenting process.

A convenient and economical way of providing differently designed pressure elements, is obtained by adopting the printing machine principle of using removable shells or sleeves (of metal or other suitable material) which may be interchangeably mounted on a cylinder, or differently designed loose liners which may be interchangeably mounted on a base plate or shoe.

Alternatively, a pressure element of the roller type may conveniently be built up from a series of loose rings of varying diameters and widths. These rings are slipped over a central core which may be of cylindrical shape and are keyed or clamped together thereon. Alternate rings forming depressions are smaller in outside diameter than the adjacent rings forming the operating surface of the pressure element to the extent of ⅛ to ¼ inch or more according to the nature of the fabric and the ornamentation desired; and these intermediate rings may vary in width say from ¼" to 1" or more. The larger diameter rings may also vary in width from ¼" to 1" or more to suit the required width of plain flat shrunken portions of fabric. By this simple arrangement a pressure element can rapidly be built up from a stock of rings of varying widths and diameters without the necessity of stocking a large number of different roller type pressure elements.

The operative surface portions of the pressure element, whether in the form of a plurality of rings or a full width sleeve, may be formed of metal or of any other suitable material. The pressure element surfaces may be formed with grooves and plain surface portions which may be either continuous or discontinuous. Moreover

the surface of the rubber belt or band used for shrinking may be grooved, or other elements such as are used in a confining passage form of shrinking machine or in a two roll differential type of shrinking machine, may be grooved, instead of or additionally to the grooving of the pressure element.

When a pressure element of the roller type is employed, the element and the moving belt may be geared together, instead of relying on a friction drive, so that their peripheral speeds are the same, or bear a definite relation one to another. This is particularly useful, when wet fabrics are being ornamented, as without such gearing, the moisture might cause slipping to occur between the belt and the element.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a fragmentary diagrammatic end elevation partly in section showing a form of compressive shrinking machine incorporating a roller type pressure element, capable of being used to provide ornamentation in accordance with the invention;

Fig. 2 is a front elevation partly in section, on the line II—II of Fig. 1;

Fig. 3 is a diagrammatic section similar to part of Fig. 1, but showing a modification;

Fig. 4 is a front elevation showing a modified form of machine to permit side access for ornamenting the edge portions of a fabric;

Fig. 5 is a detail in front elevation showing part of a roller including a shell mounted thereon to form a pressure element, such as is used in machines of the preceding figures;

Fig. 6 is a detail section of the shell on the roller taken on the line VI—VI of Fig. 5;

Fig. 7 is a fragmentary longitudinal section showing various groove profiles which may be applied to the roller type pressure element;

Fig. 8 is a fragmentary detail showing the profile of other depressions, which may be formed on the pressure roller;

Fig. 9 is a fragmentary elevation corresponding to Fig. 8;

Fig. 10 is a diagram illustrating a machine according to the invention being used for ornamenting fabrics having thermoplastic properties (in full lines) and part of the apparatus for ornamenting fabrics requiring prior resin impregnating drying and baking treatments (in chain dotted lines);

Fig. 11 is a diagram illustrating a complete ornamentation and fixing process in accordance with the invention;

Fig. 12 is a view showing part of a fabric which has been ornamented with various ruffles and a frill;

Fig. 13 is a view of part of a fabric ornamented with ruffles, which has in addition had a fine crepe effect produced on the regionally shrunken portions by the use of a cover cloth;

Fig. 14 shows the effects produced by ornamenting according to the invention to produce ruffles of varying widths; and

Fig. 15 is a view of a fabric which has been ornamented to produce ruffles and rib-like effects side by side.

In one preferred form of compressive shrinking machine (Figs. 1 and 2) suitable for producing ornamentation according to the invention, the fabric web W moves in contact with the outer surface of a band 11 of rubber, felt or other suitable material, which passes around two rollers 12 and 13. A pressure element 14 is adapted to be heated, for instance from a source of steam 15, and is adjusted in a vertical direction so as to cause the outer surface of the band 11 to present a concave shape and in so doing to press the web W of fabric between it and the pressure element 14. This element 14, in the em-

bodiment shown, presents a plurality of bands 14a interposed by depressions in the form of grooves 14b. All the bands 14a have in this case the same external diameter and likewise all the grooves 14b have the same root or base diameter. The pressure element 14, which is of non-resilient material, may be formed either of a homogeneous roller, or it may be formed as a detachable shell which is fitted over a cylindrical support and keyed thereon. Such a shell is shown in Figs. 5 and 6, the keyway 16 being obvious from the latter figure. Alternatively the pressure element may be built up of a plurality of narrow rings having two or more different external diameters alternately arranged and fitted as before over a cylindrical support.

Where it is desired to treat an edge region of a piece of fabric only, for example an edge portion of a quilt, it is necessary to use a machine such as is shown in Fig. 4, offering open access to the fabric at one end thereof.

The depressions in the surface of the pressure element may extend continuously, or discontinuously, or some continuously and some discontinuously. The depressions may be of varying depth, i.e. be constituted by grooves in the pressure element, such grooves being eccentric relative to the axis of the pressure element (Figs. 5 and 6). In this case the grooves have a zero depth for part of the circumference of the pressure element, and this progressively increases to a maximum depth and then decreases again, thus producing a further variation of the ornamentation.

Various alternative groove profiles may be used separately or in combination as may be seen from Fig. 7, in which a shell 17 fitted on to a cylindrical support 18 forms the pressure element. Thus for example, a groove may be provided with radial shoulders and a flat root section, or it may be provided with a concave section including the shoulders and root, or it may have inclined shoulders and a convex root, or it may be of V-section with no separate root, or it may have radially extending shoulders with a concave or radiused root portion. Fig. 7, which as stated shows a portion of a shell having a composite profile, also illustrates a form of attachment of the shell 17 to the cylindrical support 18 by means of securing screws such as 19.

Figs. 8 and 9 show alternative forms of discontinuous depressions of the pressure element, which will produce various ornamental effects.

By the introduction of a cover cloth or thin endless band of flexible material, between the pressure element and the fabric, a crepe effect may be produced on the flat shrunken regions of the fabric, as will be seen by reference to Fig. 10.

Fig. 12 illustrates some of the effects produced by treating fabric in accordance with the invention. Lengthwise portions of the shrunken regions W¹ of the fabric web remain substantially flat or plain. An adjacent unconstrained region W², which extends to the edge of the fabric, produces a frill, as one edge only of this region is subjected to the action of the contraction in the region W¹. In the regions W³, between two adjacent shrunken regions W¹, ruffles are produced. The number per inch and size of these ruffles depends not only on the amount of regional shrinkage and the depth of the depression in the pressure element but also upon the resistance of the fabric to the compressive shrinking action in relation to the distance between adjacent shrunken regions. Thus, if the shrunken regions bounding the unconstrained region are further apart, larger and fewer ruffles, such as in the region W⁴, are produced as compared with the ruffles in the regions W³.

The crepe effect produced by interposing an endless band of suitable material between the fabric and the pressure element as has been described with reference to Fig. 10 of the drawings, can be seen from Fig. 13, which

shows part of a fabric which has had ornamentation produced thereon by such a means. The surface of the flat restricted portions W^5 have been given a crepe effect during shrinking, whilst the unrestricted portions have formed ruffles as previously described.

Fig. 14 illustrates the effects of making the unrestricted portions comparatively narrow, so that the ruffles formed are more numerous per inch than those obtained by allowing a wide portion to be unrestricted.

With certain kinds of textile material, depending on their resistance to warpwise compression when a pressure element which provides unconstrained regions of relatively narrow width is used, raised rib-like effects W^6 (Fig. 15) are produced instead of ruffles. These rib-like effects may for example be produced by using grooves about $\frac{1}{16}$ " to $\frac{1}{8}$ " wide with a medium weight fabric.

The fixing time may be increased by additional treatment with heated pressure elements. In one arrangement the fabric may be maintained in contact with the surface of a heated roller form of pressure element (Fig. 3) by the use of a belt or band B, for instance of metal, travelling round three small guide rolls 21, 22 and 23, so that the fabric entering from the left and beneath the roller type pressure element 14 is led around the upper surface region of this roller and is thereafter carried forward by a guide roll 24. One or more nip rolls (not shown) which may be heated, may be used instead of or in addition to the belt B round the top portion of the pressure roller.

Fig. 10 shows diagrammatically the preferred form of shrinking apparatus as used for the ornamentation of different fabrics. A fabric T (shown in full lines) having thermoplastic properties and therefore not requiring additional treatment, is led straight off a roll, ornamented on a machine according to the invention, and then wound on to a further roll. Alternatively, a fabric P (shown in chain-dotted lines) requiring prior resin impregnating treatment, drying and baking after ornamentation is shown passing from a drying machine D to the regional shrinking machine and then to a baking oven C, from whence the roll of fabric may be removed for washing in a suitable washing machine and final drying.

Fig. 11 illustrates diagrammatically a complete process embodying the method of ornamenting in accordance with the invention. In this process the fabric web coming from the left passes through a bath F containing a suitable fixing agent such as a resin and then passes between a pair of nip rolls N and thereafter is dried to an appropriate moisture content in a drying machine D. It then passes through the regional shrinking machine S, and then to the baking oven C and is finally collected in a roll R.

We have discovered a process for the manufacture of elastic textile fabric which comprises subjecting over the whole of its surface, a textile material consisting of or containing thermo-plastic fibres such as, for example, polyamides, polyaminolactams, polyesters, polyacrylonitrile, polyvinyl or polyvinylidene esters, or co-polymers thereof, to compressive shrinkage controlled so that the material is shrunk beyond its normal fully shrunk length and so that the thermo-plastic fibres of the fabric are set in their altered form by heating and cooling. Fabric treated according to such a process may subsequently be ornamented according to the process of the present invention. Preferably, however, the two effects are produced simultaneously.

We claim:

1. In a fabric shrinking apparatus, a surface of deformable material capable of continuously expanding and contracting, means for causing said surface to travel, and a grooved roller of non-resilient material forming a pressure element, said pressure element being arranged so that its surface will press a region of the fabric being shrunk against said deformable surface whilst said deformable surface is contracting, and at the same time

allow relative freedom of movement of said fabric between said surface and said element in regions between said surface and the grooves of said roller.

2. In a fabric shrinking apparatus, a moving surface of deformable material capable of continuously expanding and contracting, and a roller having a detachable sleeve which is grooved on its surface, said roller and sleeve constituting a pressure element which is so arranged that said grooved surface will press a region of the fabric being shrunk against said deformable surface, whilst said deformable surface is contracting, and at the same time allow relative freedom of movement of said fabric in regions between said deformable surface and the grooves of said roller surface.

3. In a fabric shrinking apparatus, a moving surface of deformable material capable of continuously expanding and contracting, a pressure element in the form of a roller of non-resilient material, and gearing between said surface and said element, said pressure element having a discontinuous surface arranged to press a region of the fabric being shrunk against said deformable surface whilst said deformable surface is contracting and at the same time allow relative freedom of movement of said fabric between said surface and said element in regions not so pressed against said deformable surface, and said gearing being such as to ensure that the peripheral speeds of said deformable surface and said element bear a definite relationship one to another.

4. In a fabric shrinking apparatus, a surface of deformable material capable of continuously expanding and contracting, means for moving said surface, a grooved roller of non-resilient material forming a pressure element arranged so that its surface will press a region of the fabric being shrunk against said deformable surface while said deformable surface is contracting and at the same time allow relative freedom of movement of said fabric between said surface and said element in regions between said surface and the grooves of said roller, and means for heating the fabric between said surface and said roller.

5. In a fabric shrinking apparatus, a moving surface of deformable material capable of continuously expanding and contracting, a roller having a detachable sleeve which is grooved on its surface, said roller and sleeve constituting a pressure element which is so arranged that the grooved surface will press a region of the fabric being shrunk against said deformable surface while said deformable surface is contracting and at the same time allow relative freedom of movement of said fabric in regions between said deformable surface and the grooves of the pressure element, and means for heating said roller to heat the fabric between said pressure element and said surface.

6. In a fabric shrinking apparatus, a surface of deformable material capable of continuously expanding and contracting, means for moving said surface, and a rotary pressure element having a discontinuous surface arranged to press a region of the fabric against said deformable surface while said deformable surface is contracting and at the same time to allow relative freedom of movement of said fabric between said contacting surface and said discontinuous surface in regions adjoining said pressed region.

7. In a fabric shrinking apparatus, a surface of deformable material capable of continuously expanding and contracting, means for supporting and moving said surface and a rotary pressure element having a discontinuous surface arranged to press a region of the fabric against said deformable surface while said deformable surface is contracting and at the same time to allow relative freedom of movement of said fabric between said contracting surface and said discontinuous surface in regions adjoining said pressed region, said means for supporting said surface of deformable material and the rotary pressure element being both supported in cantilever fashion from

one side thereof to provide open access to permit the fabric to be introduced between said surface and said pressure element from the opposite side thereof.

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