

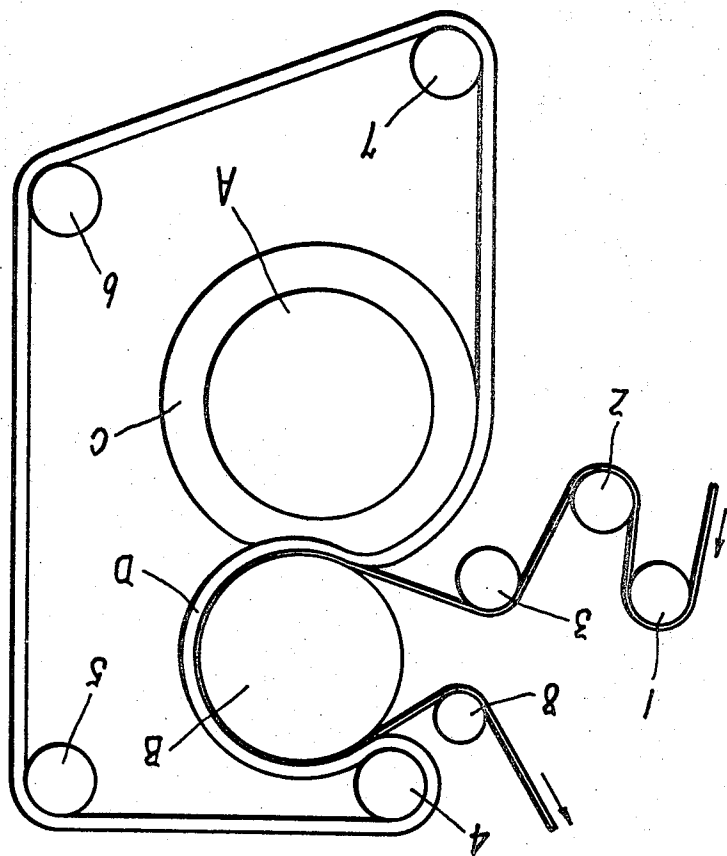
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APPARATUS FOR IMPARTING ELASTICITY TO WOVEN TEXTILE FABRICS

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APPARATUS FOR IMPARTING ELASTICITY TO WOVEN TEXTILE FABRICS

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3 Claims

ABSTRACT OF THE DISCLOSURE

The present invention relates to an apparatus and a process for treating woven textile fabrics. In one aspect, the present invention relates to a process for imparting elasticity to a woven textile fabric in its warp direction, in which a woven textile fabric is compressed in its warp direction by means of a rubber roller and an elastic flexible belt, and is then fixed in its altered state.

SUMMARY OF INVENTION

The invention provides apparatus for treating a woven textile fabric, which apparatus comprises (1) a rotatable heating drum and a rotatable deformable elastic roller, the drum and the roller having parallel axes, (2) a flexible elastic belt which passes through the nip between the drum and the roller, with deformation of both the elastic roller and the belt in the nip, and which belt also contacts the heating drum around a substantial portion of its periphery beyond the nip, and (3) means for feeding a woven textile fabric in its warp direction into the nip between the heating drum and the flexible belt.

The invention also provides a process for treating a woven textile fabric, which process comprises providing a rotating heating drum and a rotating deformable elastic roller, the drum and the roller having parallel axes, and a flexible elastic belt which belt passes through the nip between the drum and the roller and contacts the heating drum around a substantial proportion of its periphery beyond the nip, and feeding a woven textile fabric in its warp direction into the nip between the heating drum and the flexible belt so as to shrink the fabric in its warp direction and temporarily heat-set it by contact with the heating drum. Elasticity may be imparted to the fabric in its warp direction by permanently fixing, e.g. by heat-setting the shrunk fabric in a relaxed state.

The woven textile fabric, which may be used for the purpose of the present invention, can be made of thermoplastic textile yarns. Examples of thermoplastic yarns include poly-ether-esters, rayon, nylon. Suitable yarns comprise thermoplastic textile yarns and textile yarns blended with thermoplastic yarns, the fabric having a low initial web density in its weft direction, which is increased by 5–60%, preferably 5–35%, by the process of the invention.

Pre-treatments of the woven textile fabric (such as desizing, scouring or dyeing) can be carried out at conditions wherein the fabric is treated at such a low temperature that the fabric is not completely heat-set, in order that the fabric may only be completely heat-set after being subjected to compressive shrinkage according to the invention. A complete heat-setting in these pretreatment steps can give rise to subsequent difficulties.

In order to further the subsequent heat-setting, the fabric is then preferably padded with a resin for textile use or a setting agent. Resins of the following types can pref-

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erably be used for this purpose: dimethylol urea, glyoxal monoureine, dimethylol ethylene urea, dimethylol triazone, propylene urea, modified triazine, acetal, carbamate, carbamide, polyacrylamide and acrylic acid ester.

Preferred setting agents include, for example, water, alcohols, phenols and caustic soda. Various setting agents may be used, for example, ammonium salts of thioglycolic acid, monoethanolamine sulphite, ethylene diamine, sodium hypophosphate, sodium hydrogen sulphite, hydro-sulphate. Other setting agents of the known types may also be used for this purpose.

The fabric is padded with a setting agent and is adjusted to a suitable water content. The fabric is then compressed in its warp direction by the use of a compactor, and is temporarily heat-set by means of heating rollers in accordance with the present invention. The compactor is capable of compressing the fabric in its warp direction and is fully described below with reference to the accompanying drawing.

DRAWING

The accompanying drawing is a cross sectional view showing schematically the essential elements of a compactor designed for carrying out the process according to the present invention.

SPECIFIC EMBODIMENTS

A natural or synthetic rubber layer C having a thickness of 60–120 mm. is provided around the surface of a rotatable iron roller A. The surface temperature of a rotatable heating drum B, which is provided adjacent to the roller A, C, is adjustable to 120–180° C. A flexible elastic belt D having a similar width to that of the heating drum B and composed of an elastic material such as rubber is passed through the nip between the heating drum B and the rubber roller A, C, with deformation of the elastic roller A, C, and the belt D in the nip, in such a manner that broad surfaces of the flexible elastic belt D closely contact the rubber roller A, C, and heating drum B before and after the nip. The elastic flexible belt D also contacts the drum B round a substantial portion of its periphery beyond the nip and is arranged to rotate in accordance with the rotation of the rubber roller A, C.

In one embodiment of the compactor according to the present invention, rubber of the rubber roller A, C has a hardness of 20–60° measured by JIS (Japanese Industrial Standard)—K 6301—and the elasticity of the flexible elastic belt D is more than that of the rubber roller A, C. The materials for the flexible elastic belt D, which contacts directly with the heating roller B, preferably are highly elastic materials having good heat stability, such as certain natural rubbers having good heat stability or synthetic rubbers. Rubber materials for the rubber roller A, C are preferably substances having good elasticity such as e.g. natural rubbers and synthetic rubbers.

At the time of compressing a fabric which is fed into the compactor by means of tension bars 1, 2 and a guide bar 3, the rubber roller A, C is pressed against the heating drum B, so that the rubber surface of the elastic roller A, C is deformed, and this deformation gives rise to large degree of compression on the fabric. Additional compression of the fabric is caused by the flexible elastic belt D. Not only is the belt similarly deformed in the same way as the elastic roller A, C but the flexible elastic belt D is also bent sharply, and its surface is expanded or shrunk correspondingly.

The fabric is first closely contacted with the expanded portion of the elastic belt D and is compressed according to the shrinkage of the elastic belt D so that warp yarns of the fabric are bent strongly. The fabric is temporarily fixed in its altered state by means of the heating drum B. The amount of compression of the fabric depends partly

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upon the degree of deformation of the rubber layer structure C of the elastic roller A, C and of the belt D, and partly upon the degree of bending of the belt D. The flexible elastic belt D is guided by rollers 4, 5 and 6 and a guide roller 7, and the fabric is fed out by a roller 8.

The fabric, which was compressed in its warp direction by means of the aforesaid compactor and has been temporarily fixed in its altered state, may then be heat-treated without tension in its warp direction in the next step, to improve its laundering properties and to completely heat-set the warp yarns in their strongly bent state. Conditions under which the fabric is completely heat-set depend upon the types of the yarns and on the setting agents applied to the fabric before compression. Preferable conventional heat-setting machines useful for thermoplastic yarns can be employed.

The fabric is preferably heat-set for 1-5 minutes at 150-200° C. When a resin is applied in association with the heat-setting agent, the fabric should be heat-set under conditions capable of curing the resin completely.

As described above, woven textile fabrics capable of shrinking or elongating in the warp direction can be obtained by controlling completely each and all steps from the determination of the yarns to be used to the refinishing of the obtained fabric.

The following non-limitative examples illustrate the invention. In the examples the rate of elongation and the elastic recovery rate were determined by the following procedure:

Each sample had a length of 20 cm. in its warp direction and a width of 5 cm. in its weft direction. The elongation was measured by burdening a sample with a load of 2 kg. in its warp direction and comparing the elongation with the initial length of 20 cm. The elastic recovery was determined by burdening a sample with a suitable load so as to give an elongation of 20% in its warp direction, maintaining the fabric in the same state for 3 minutes, removing the load from the fabric and after one minute comparing the obtained shrinkage value with the initial elongation of 20 cm. $\times \frac{20}{100}$.

EXAMPLE 1

A tropical woven textile fabric was prepared from a blended yarn composed of 65% of copolymerized poly-ether ester fibers, which contained 85% by molar unit of ethylene terephthalate and 15% by molar unit of ethylene oxybenzoate, and 35% of rayon under the following weaving conditions:

	Cotton count	Density of the fabric, threads/inch
Warp.....	30/2	50
Weft.....	30/2	47

After singeing, the fabric was desized and scoured with a pad steamer. The fabric was washed with water in an open soaper, dried at 100° C. for 3 minutes with a roller drier, padded with dyes, dried at 100° C. for 3 minutes, and was treated at 120° C. for 4 minutes to fix the dyes with saturated steam. After being treated with a soaper, the fabric was padded with a resin solution having the following composition: The fabric adsorbed 65% of its weight of the resin solution.

Resin solution:	Percent
Sumitex Resin NS-1 (Commercial product of glyoxal monourein resin available from Sumitomo Kagaku Kogyo K.K., Japan) ..	15
Noran Silicon Softener (Commercial product of silicon softener available from Nippon Reichhold K.K., Japan) ..	2
Saibinol P.N.-3500 (Commercial product or polyethylene softener available from Saki-den Kagaku K.K., Japan) ..	2
Zinc nitrate ..	0.75
Water ..	80.25

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The fabric was shrunk by 25% in its warp direction using the compactor shown in the drawing by the method described relative thereto, and at the same time was temporarily heat-set at 130° C. by the heating drum. After this, the fabric was fixed in its altered state by baking at 150° C. for 7 minutes with a short loop type baking machine. The resulting fabric had a good elasticity in its warp direction as shown in the following table and had finished densities of 55 threads/inch and 57 threads/inch in its warp and weft directions, respectively.

	Finished fabric, percent	After laundering 5 times, percent
Elongation.....	17.5	17.0
Elastic recovery.....	67.5	87.7

EXAMPLE 2

A blended yarn composed of 65% nylon and 35% rayon was used to give a tropical fabric under the following weaving conditions:

	Cotton count	Finished density of the fabric, threads/inch
Warp.....	20/2	45
Weft.....	20/2	40

The fabric was desized and scoured with a pad steamer, washed with an open soaper, and dried at 100° C. for 3 minutes with a roller drier. The fabric was dyed by using a jigger at 100° C. for 90 minutes, soaped, dried and singed. Then the fabric was padded with a resin solution having the following composition, and was afterwards dried at 100° C. for 2 minutes. The fabric adsorbed 65% of its weight of the resin solution.

Resin solution:	Percent
Sumitex Resin NS-4 (Commercial product of glyoxal monourein resin available from Sumitomo Kagaku Kogyo K.K., Japan) ..	15
Saibinol P.N.-3500 (Commercial product of polyethylene softener available from Sainen Kagaku K.K., Japan) ..	2
Noran Silicon Softener (Commercial product of silicon softener available from Nippon Reichhold K.K., Japan) ..	2
Zinc nitrate ..	0.75
Water ..	80.25

Upon passing through the apparatus shown in the drawing, the fabric was shrunk by 30% in its warp direction, and at the same time was temporarily heat-set at 125° C. by the heating drum. After this, the fabric was fixed in its altered state by baking at 150° C. for 7 minutes with a short loop baking machine. The resulting fabric had a good elasticity in its warp direction as shown in the following table, and finished densities of 49 threads/inch and 54 threads/inch in its warp and weft directions, respectively.

	Finished fabric, percent	After laundering 5 times, percent
Elongation.....	19.5	19.4
Elastic Recovery.....	89.7	90.0

EXAMPLE 3

A blended yarn composed of 50% of copolymerized poly-ether-ester fiber, of which each repetitive unit consists of 85 wt. percent of ethylene terephthalate and 15 wt. percent of ethylene oxybenzoate, and 50% of woolen fiber was woven under the following conditions to give a tropical fabric:

	Cotton count	Density of the finished fabric, threads/inch
Warp.....	30/2	50
Weft.....	30/2	42

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The woven fabric was scoured at 80° C. for 30 minutes by the use of a beam dyeing machine, dyed at 100° C. for 90 minutes, and was dried at 100° C. for 3 minutes with a drier. After being dried and singed, the fabric was padded with a 0.4% thioglycolic acid solution, shrunk by 26% in its warp direction using a compactor as shown in the drawing, temporarily fixed, wound on a semidecatizer, steamed for 10 minutes, dried for 3 minutes, oxidized with a 0.1% peroxide solution, washed with water, dried by using a short loop type drier, and subjected to the conventional paper press finishing. The resulting fabric had a good elasticity in its warp direction as shown in the following table. The finished densities of the resulting fabric were 56 threads/inch and 53 threads/inch in its warp and weft directions, respectively.

	Finished fabric, percent	After laundering 5 times, percent
Elongation.....	19.3	20.0
Elastic recovery.....	89.8	89.2

Having described the invention that which is sought to be protected is set forth in the following claims.

What we claim is:

1. Apparatus for compressively treating a woven textile fabric, which comprises,
(1) a rotatable heating drum,
(2) a rotatable deformable elastic roller, the drum

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- and the roller being in close cooperative relationship and having parallel axes,
(3) a flexible elastic belt adapted to pass through the nip between the drum and the roller, with consequent elastic deformation of both the elastic roller and the belt in the nip, said belt also being adapted to contact the heating drum around a substantial portion of its periphery beyond the nip, and
(4) means for feeding a woven textile fabric in its warp direction into the nip between the heating drum and the flexible belt, the elastic deformation of both the elastic roller and elastic belt permitting increased amounts of fabric compression.
2. Apparatus as claimed in claim 1, wherein the elasticity of the flexible elastic belt is greater than that of the elastic roller.
3. Apparatus as claimed in claim 1 wherein the surface of the elastic roller and the flexible elastic belt are made of a member of the group consisting of natural and synthetic rubber.

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