Feb. 7, 1939. J. H. WRIGLEY ET AL 2,146,694

METHOD OF AND MEANS FOR TREATING WOVEN AND THE LIKE FABRICS AND YARNS

Original Filed Dec. 30, 1932 2 Sheets-Sheet 1

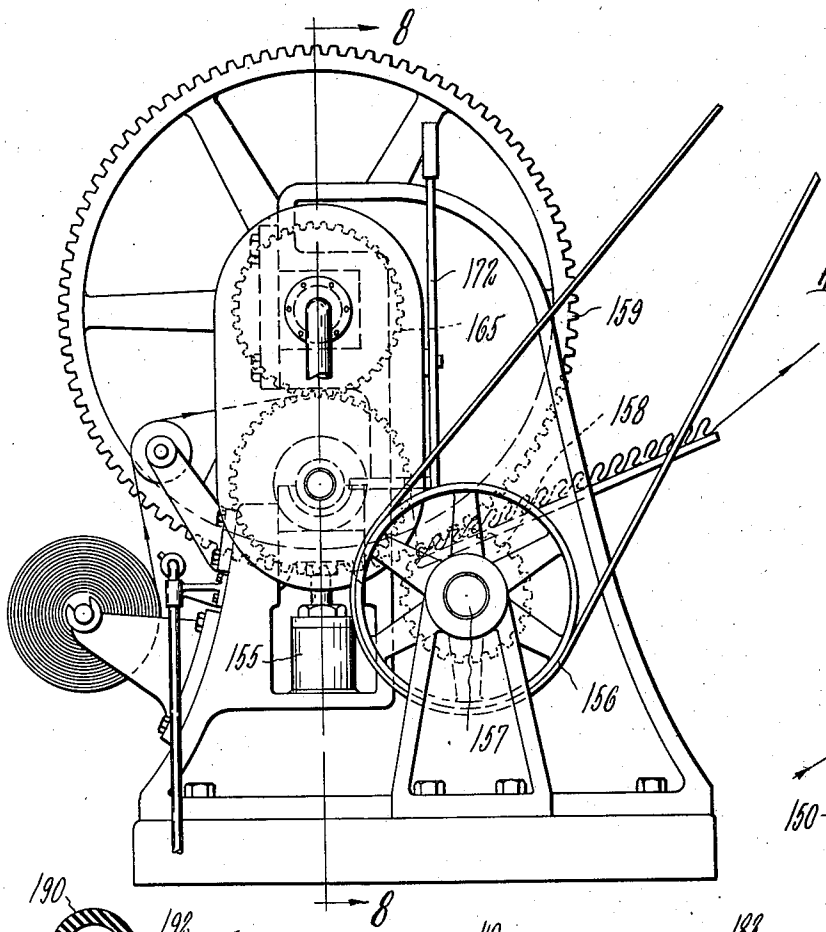


Fig. 1.

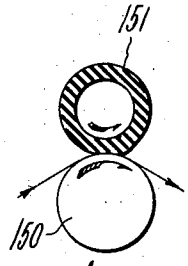


Fig. 2.

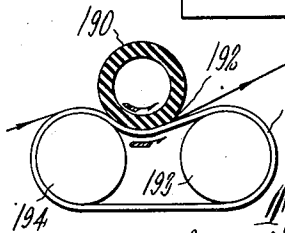


Fig. 4.

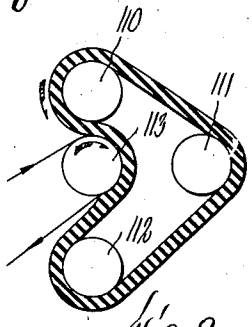


Fig. 7.

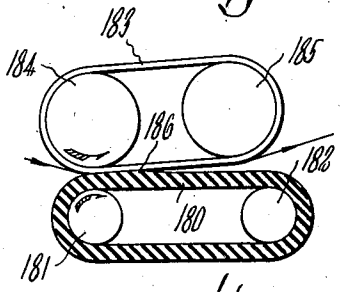


Fig. 3.

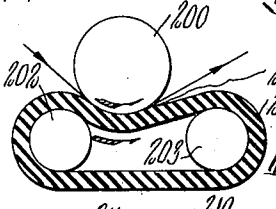


Fig. 5.

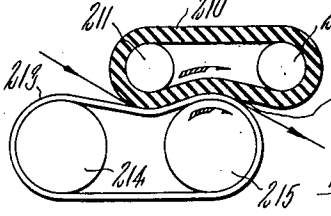


Fig. 6.

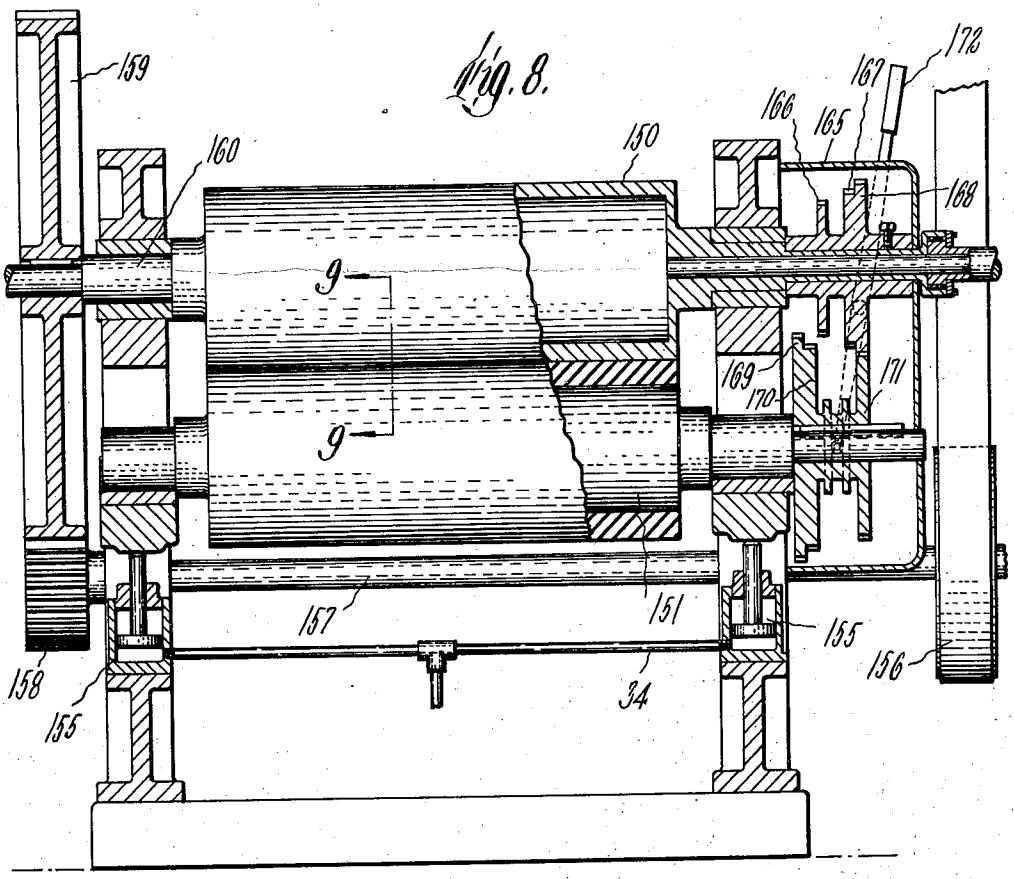
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Fig. 8.



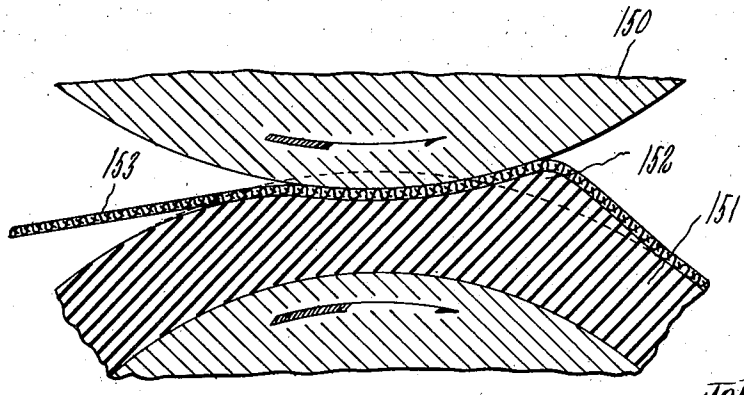


Fig. 9.

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2,146,694

METHOD OF AND MEANS FOR TREATING WOVEN AND THE LIKE FABRICS AND YARNS

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Original application December 30, 1932, Serial No. 649,528. Divided and this application May 28, 1935, Serial No. 23,868. In Great Britain February 2, 1932

14 Claims. (Cl. 26—18.6)

This invention relates to the treatment of woven or the like fabrics and yarns for the purpose of changing dimensional characteristics thereof. For example, in the weaving of cloth the warp strands are ordinarily under a considerable degree of tension so that in the woven cloth they are in a relatively straight condition, while the weft or filling strands are sinuated to a much greater degree as they pass partly around the warp strands. Bleaching, dyeing and finishing operations to which cloth is often subjected may also cause elongation thereof with consequent tensioning of the warp strands. When such cloth is subjected to laundering operations in use, the more highly tensioned warp strands contract and become more sinuous, passing further around the weft or filling strands, and this results in shrinking of the cloth lengthwise. It is therefore desirable that cloth be pre-shrunk to substantially that ultimate condition resulting from several launderings in order that garments made therefrom will retain their original shapes and sizes in service, and without impairing the finish or otherwise injuring the goods, and to do this quickly and cheaply. Various methods of and mechanisms for pre-shrinking have previously been employed many of which, however, have certain disadvantages.

The present invention relates more particularly to the changing of dimensional characteristics by mechanical means, employing for this purpose a surface with which the material treated is engaged during a dimensional change of such surface. More particularly this surface is the surface of a deformable body of material such as rubber, which is alternately deformed and more or less released to produce the desired surface dimensional change. This general method is set forth and claimed generically in our application for patent Serial Number 649,528, filed December 30, 1932, for Method of and means for treating woven and the like fabrics and yarns, which issued as Patent No. 2,021,975 on November 26, 1935, of which this present application is a division.

This invention relates to the method and mechanism in which the dimensional change of the textile material is accomplished by passing it through the nip between a relatively soft deformable body and a harder surfaced body, the mean surface speeds of the confronting faces of the two bodies being different but in the same direction.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which—

Figure 1 is a somewhat diagrammatic side elevation of a machine embodying the invention.

Figures 2 to 7, inclusive, are diagrams showing various arrangements of material treating members which may be used.

Figure 8 is a section on line 8—8 of Figure 1.

Figure 9 is a detail section to a larger scale on line 9—9 of Figure 8.

A simple form of mechanism is shown in Figures 1, 2, 8 and 9 in which a pair of cooperating rolls 150 and 151 are employed. One of these, as the roll 151, is formed or covered with a relatively soft deformable material such as soft rubber, and the other is formed or surfaced with a harder material, and they are pressed together with substantial pressure as by the hydraulic cylinders 155 and are driven in opposite directions but at different mean peripheral speeds. As shown, for example, in Figures 1 and 8, the relatively hard surfaced roll 150 is rotated through a belt drive 156 which rotates a drive shaft 157 geared through the meshing gears 158 and 159 to the shaft 160 of the roll 150. The mating soft surfaced roll is driven at a definitely relatively lower or higher mean peripheral velocity depending on whether shrinkage or stretching of the material is desired. As shown this is accomplished through a change gear arrangement indicated at 165. Any suitable change gear mechanism may be used, but as shown the shaft of the roll 150 has fixed thereon three gears 166, 167 and 168 with which any selected gear 169, 170 and 171 splined to the shaft of the gear 151 may be selectively engaged by shifting the lever 172. This gear mechanism as shown provides for three definite speeds of rotation of the roll 151, each lower than that of the roll 150, thus to provide for shrinkage of material passed therebetween as will be more fully explained.

Referring to Figure 9, it will be noted that the combination of pressure, which must be sufficiently heavy, exerted between the rolls and their relatively different velocities causes the harder surfaced roll 150 to press into the softer surface of the roll 151 and to stretch the material of this softer surface toward the outgoing side of the nip

between these rolls to form a hump 152. The material to be treated shown at 153 engages the surface of the softer roll where it has been distorted by the action of the harder surfaced roll, tending to force the material of the softer roll through the nip faster than the mean peripheral speed of the softer surfaced roll. As soon as the material 153 has passed through the nip it is in contact with the softer deformed material which is pulling back from the hump 152 toward and into the nip, which thus causes the superficial area of the softer material to contract where the textile material is in engagement therewith, thus producing the desired shrinkage of the material. The recoiling rubber surface thus controls the rate of exit of the textile material which is pushed in by the action of the rotating harder surfaced roll acting on the material and through the material on the softer surfaced rubber roll. The amount of this shrinkage may be controlled by adjusting the relative mean peripheral velocities of the two rolls, the greater this difference in velocities the greater being the amount of shrinkage. Another factor which determines the amount of shrinkage imposed in the fabric is the relative or difference in co-efficients of friction of the co-acting surfaces. For instance, the surface which expands and contracts must, during its contraction, retain its grip on the fabric as it passes out of the machine, and the harder surface must have only sufficient frictional hold on the opposite side of the fabric to allow the soft rubber to take charge of the fabric where the continual recoiling action is taking place. If the harder surface is highly polished its effect in stretching the rubber is not as great as if dulled, because greater slip takes place, which is shown by glaze or a calender effect on the fabric; yet it must be understood that the degree of shrinkage produced under these conditions may be sufficient to resist laundering. Dulling the surface of the hard surfaced roll, therefore, gives more stretch to the rubber in front of the nip, and consequently increased shrinkage due to more recoil can be obtained, if desired, but if this dulling is carried too far, say, for instance, to the point of being engraved or milled the shrinkage cannot be effected, and slight extension of the fabric has been obtained under such conditions. From the foregoing it is clear that the hard surface must not interfere with the recoiling action of the soft rubber beyond the nip, and although the hard surfaced material is traveling in the direction of the cloth feed to the machine, its surface must be smooth enough to allow the slipping back of the fabric in the opposite direction to the cloth travel. It will be clear now that while a hard engraved roll will function particularly well in creating the necessary reservoir of the recoiling rubber beyond the nip, this recoiling rubber will not retain its grip on the fabric, but will merely slip over it and distort the fibers, due to the other side of the fabric being firmly embedded in the engraving. It might be noted that the pulling force which stretches the soft rubber is actually transmitted through the fabric before it is shrunk; therefore the hard surfaced material can be credited with having two functions, first, to stretch the softer material, and second, to allow the fabric to be slipped back over its surface after the point of maximum pressure has been passed. The backward movement of the fabric over the harder roll is obviously the measure or theoretical degree of machine shrinkage, and while a large portion of this shrinkage releases itself, there remains in the fabric a sufficient amount of shrinkage to substantially resist standard laundry treatment. It is quite possible to so control the initial shrinkage that, if so desired for any special purpose, the fabrics will extend to a predetermined extent when laundered. Hard and soft rubber have been found in practice to be admirably suited for the surface materials of these two rolls. For example, the relative hardness of the rubber of the two rolls may be 75° to 80° and 95° to 100° registered on the "Shore" type of durometer instrument. The hard rubber presents a surface which does not produce a glazing effect and yet which permits the softer rubber of the softer surfaced roll to have a greater frictional effect on the material and to substantially control the speed with which the textile material emerges from the nip between the rolls. Other materials such as cloth, paper, or even dull finished, but relatively smooth metal, may be found satisfactory for the harder surfaced body. A dull finished steel roll is about equal to the hard rubber roll for general work. For special finishes one or the other may be found preferable. One or both if these rolls may be provided with heating or cooling means as may be found desirable in any particular instance. While the textile material may be preliminarily steamed or otherwise treated to soften the waxes and starches to facilitate the shrinking or stretching operation it has been found that with this method by the use of differential velocities of coacting materials of different hardness better results are usually obtained without added moisture to the material treated. In the case of the stretching operation it is only necessary that the softer surfaced roll be run at a greater peripheral speed than that of the harder surfaced roll, in which case the softer material is forced into a hump at the entering side of the nip and accelerates the feed of the material to be treated into the nip, while the harder surfaced roll may substantially control the rate at which the textile material emerges from the nip. The soft rubber presents a continuous smooth surface to contact with the textile material and which squeezes in between the yarns smoothing down projecting fiber ends so that the desirable trade finish appears thereon as the textile material emerges from contact with the rubber; the rubber surface, being impervious to moisture, preventing the material from being dried out in the process so that the finish is relatively soft. The pressure necessary between the bodies depends on such factors as the softness of the soft body and the permissible amount of slip between the two and is ordinarily substantial.

Figure 2 differs from Figures 1, 7 and 8 only in the fact that the softer surfaced roll is positioned above the harder surfaced roll.

In Figures 3 to 7 modifications of this general method in which also changes of contour of the treating surface may be utilized are illustrated. In Figure 3, for example, instead of forming the softer surface element as a roll, it is formed as a belt 180 passed about a pair of pulleys 181 and 182 and with which cooperates a hard surfaced belt 183 passed over a pair of pulleys 184 and 185. These belts are so related that a pressure is exerted between them adjacent to the pulleys 181 and 184 where the textile material enters therebetween, the pulleys 185 and 182 being somewhat separated so that by driving the belt 180 at a speed less than the belt 183, the softer belt ma-

terial is distorted, forming a hump at 186 which tends to pay back into the nip between the belts and thus produce the shrinkage effect on the textile material.

In Figure 4 a soft surfaced roll 190 is used in conjunction with a hard surfaced belt 191 supported on the pulleys 194 and 193. The soft surfaced roll 190 is rotated at a less peripheral speed than the hard belt 191, which results in a distortion of the soft material and the formation of the hump 192 which pays back into the nip and produces the shrinkage effort on the textile material passed therebetween.

In Figure 5 a relatively hard surfaced roll 200 is used in conjunction with a relatively soft and deformable belt 201 supported on pulleys 202, 203. The belt is run at less surface velocity than the roll 200, thus distorting the material of the belt and forming a hump at 204 of the soft material which tends to pay back into the nip and exerts the shrinkage effort.

In Figure 6 a relatively soft and deformable belt 210 supported on pulleys 211 and 212 is used in conjunction with a relatively hard belt 213 supported on pulleys 214 and 215, which is driven at a greater peripheral velocity than the soft belt and forms a hump 216 which exerts a shrinking effort on the textile material passed between the belts. In this form also advantage may be taken of a surface contraction of the soft belt as it is concaved in passing over the pulley 215.

A similar effect also occurs in the constructions of Figures 3, 5 and 7, Figure 7 showing an arrangement of four rolls 110, 111, 112 and 113 engaging the belt instead of three rolls as shown in Figure 5.

By causing the softer surface material to be moved at a greater velocity than the cooperating harder surface material in any of the constructions illustrated in Figures 2 to 7, stretching instead of shrinking may be produced as described in connection with Figures 1 and 8.

In all the instances described where differential speed of confronting relatively hard and soft bodies is employed, it will be noted that there is a local distortion of the softer elastic distortable body beyond that which is occasioned by the passage of successive portions of the body through the various parts of the closed path in which they travel. By causing this local distortion to occur in proximity to distortion caused by a variable curvature of the path through which the rubber surface is passing, these two causes of distortion can both be utilized in effecting a dimensional change of the textile material. Thus the rubber surface may be distorted by causing the harder surfaced body to travel at a greater surface speed than the normal speed of the rubber surface, in proximity to a location where the rubber is also being distorted by passing from a more to a less convexed path, both of which actions cause shrinkage of the textile material held against the rubber surface by the harder surfaced body. Distortion of the rubber by varying the curvature of its path of motion and utilizing this distortion to effect dimensional change of the textile material is more fully described in the parent application Serial No. 649,528 hereinbefore mentioned.

From the foregoing descriptions of certain embodiments of this invention, which are given merely by way of illustration, it should be evident to those skilled in the art that many changes and modifications might be made without departing from the spirit or scope of this invention as defined by the appended claims.

We claim:

1. In combination in a machine for changing the superficial area of textile material, a body of deformable rubber, a body of material harder than said rubber body, means for pressing said bodies together under substantial pressure, and means for imparting motion to the confronting faces of said bodies of different velocities whereby to deform said rubber body to produce on one side of the nip between said bodies a hump of rubber tending by its elastic recoil to move toward said nip.

2. The method which comprises progressively moving at different surface speeds a relatively soft elastically distortable body and a relatively hard body pressed together under substantial pressure, said hard body presenting a surface of a sufficiently high coefficient of friction to distort said relatively soft body in its direction of motion by such differential speed and pressure, thereby increasing the superficial area of successive portions thereof and forming a hump of such soft material tending by its elastic recoil to return into the nip between said bodies and contract its superficial area, and passing textile material through said nip and in contact with the surface of said hump where the superficial area is contracting.

3. Apparatus for use in the treatment of textile fabric or the like, comprising a body of smooth surfaced elastically distortable rubber, means for moving said body to present successive surface portions thereof into one position, means for pressing textile material against a portion of the surface of said body, and means for moving said pressing means at a mean surface speed different from the mean surface speed of said body to thereby progressively distort said body and change the superficial areas of successive portions of said body and to then cause through the inherent elasticity of the rubber said superficial areas to resume their former extents and while in sufficient contact with said material to effect a dimensional change therein and a smoothing of the constituent yarns thereof.

4. Apparatus which comprises a relatively soft elastically distortable body, a relatively hard body, means pressing said bodies together under substantial pressure with textile material therebetween, and means for moving said bodies with their confronting surfaces traveling in the same direction but at different mean velocities, said hard body presenting a surface having sufficient coefficient of friction to grip the textile material and through it the surface of the relatively soft body to cause said relatively soft body to be distorted in the direction of movement and produce a hump of the material thereof pulling back into the nip between said bodies and in contact with said textile material at one side of said nip.

5. Apparatus which comprises a relatively soft elastically distortable body, a relatively hard body, means pressing said bodies together under substantial pressure with textile material therebetween, and means for moving said bodies with their confronting surfaces traveling in the same direction but at different mean velocities, said hard body having a sufficient coefficient of friction to grip the textile material and through it the surface of the relatively soft body whereby said relatively soft body is distorted and a hump of the material thereof pulling back into the nip between said bodies and in contact with said textile material is formed at one side of said nip, said relatively hard body presenting a sur-

face having less frictional engagement with the textile material than said relatively soft body.

6. Apparatus which comprises a relatively soft elastically distortable body, a relatively hard body, means pressing said bodies together under substantial pressure with textile material therebetween, and means for moving said bodies with their confronting faces traveling in the same direction but with that of the harder body at a faster mean rate, said hard body having a sufficient coefficient of friction to grip the textile material and through it the surface of the relatively soft body whereby the relatively soft body is distorted and a hump of its material continuously pulling back into the nip is formed beyond said nip in the direction of travel of said surfaces.

7. Apparatus which comprises a relatively soft elastically distortable body, a relatively hard body, means pressing said bodies together under substantial pressure with textile material therebetween, and means for moving said bodies with their confronting faces traveling in the same direction but with that of the harder body at a faster mean rate, said hard body having a sufficient coefficient of friction to grip the textile material and through it the surface of the relatively soft body whereby the relatively soft body is distorted and a hump of its material continuously pulling back into the nip is formed beyond said nip in the direction of travel of said surfaces, said softer body material having a greater frictional engagement with the textile than the hard body material whereby the material flowing back from said hump effects mechanical shrinkage of said textile material.

8. The method of treating textile material, which comprises placing the material in frictional contact with a surface of an elastically deformable support, moving the support and contacting material in a predetermined path of variable curvature, and during such movement subjecting said material to pressure from a surface harder than that of said support and moving in the same direction as but at a different speed from that which the confronting surface of the support would take if unaffected by the speed of said harder surface, said harder surface presenting such a frictional grip on the textile material as to cause its speed to predominate in feeding the textile material at one side of the nip between said harder support surface and the speed of said support surface adjacent to said nip to predominate in feeding the textile material at the other side of said nip locally varying the speed of said surface from the speed otherwise determined by conveyance of the support through said path.

9. A machine of the class described, comprising a body of distortable rubber, means for moving said body in a predetermined closed path of variable curvature, means for producing alternate distortion and relative relief of successive portions of said body in such movement in proximity to where such curvature is changing, said machine including means for holding textile material in facial contact with said body where the surface velocity of said body is decreasing by reason of such variable curvature and such distortion and release to effect shrinkage in the material and a desirable finish on the rubber engaged surface of said material.

10. A machine of the class described comprising a body of distortable rubber, means for moving said body in a predetermined closed path of variable curvature, means for producing alternate distortion and relative relief of successive portions of said body in such movement beyond that attributable to the varying curvature of said path, said machine including means for holding textile material in facial contact with said body where the surface velocity of said body is varying by reason of such distortion and release from both causes, said holding means engaging the textile material and having less frictional hold on said material than has said rubber.

11. A machine of the class described, comprising a body of distortable rubber, means for moving said body in a predetermined closed path of variable curvature, means for producing alternate distortion and relative release of successive portions of said body in such movement in proximity to where such curvature is varying, said machine including means for holding textile material in facial contact with said body where the surface velocity of said body is increasing by reason of such variable curvature and such distortion and release to effect stretching of the material and a desirable finish on the rubber-engaged surface of said material.

12. The method which comprises progressively moving at different mean surface speeds a relatively soft elastically deformable body and a relatively hard body pressed together under sufficient pressure to cause said hard body to deform said soft body, and through its speed differential to vary the surface velocity of said soft body adjacent to the nip between said bodies above and below the mean surface speed of said soft body, and passing textile material through the nip between said bodies, the surfaces of said bodies having such relative gripping characteristics on the material that the described deformation and velocity changes of said soft body surface are produced by said hard body acting through said material and the speed of travel of said material through said nip and its superficial area are changed in a manner corresponding to the speed variations of said soft surface in contact therewith.

13. The method which comprises progressively moving at different mean surface speeds a relatively soft elastically deformable body and a relatively hard body pressed together under sufficient pressure to cause said hard body to deform said soft body, and through its speed differential to vary the surface velocity of said soft body adjacent to the nip between said bodies above and below the mean surface speed of said soft body, and passing textile material through the nip between said bodies, the surfaces of said bodies having such relative gripping characteristics on the material that the described deformation and velocity changes of said soft body surface are produced by said hard body acting through said material, and the speed of travel of said material through said nip and its superficial area are changed in a manner corresponding to the speed variations of said soft surface in contact therewith, said material first engaging said soft surface where its velocity is relatively high and leaving said surface where its velocity is relatively low, to thereby shrink the material.

14. The method which comprises progressively moving at different mean surface speeds a relatively soft elastically deformable body and a relatively hard body pressed together under sufficient pressure to cause said hard body to deform said soft body and through its speed differential to vary the surface velocity of said soft body adjacent to the nip between said bodies above

and below the mean surface speed of said soft body, and passing textile material through the nip between said bodies, the surfaces of said bodies having such relative gripping characteristics on the material that the described deformation and velocity changes of said soft body surface are produced by said hard body acting through said material, and the speed of travel of said material through said nip and its superficial area are changed in a manner corresponding to the speed variations of said soft surface and contact therewith, the material first engaging said soft surface where its velocity is relatively low and leaving said surface where its velocity is relatively high to thereby stretch the material.

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