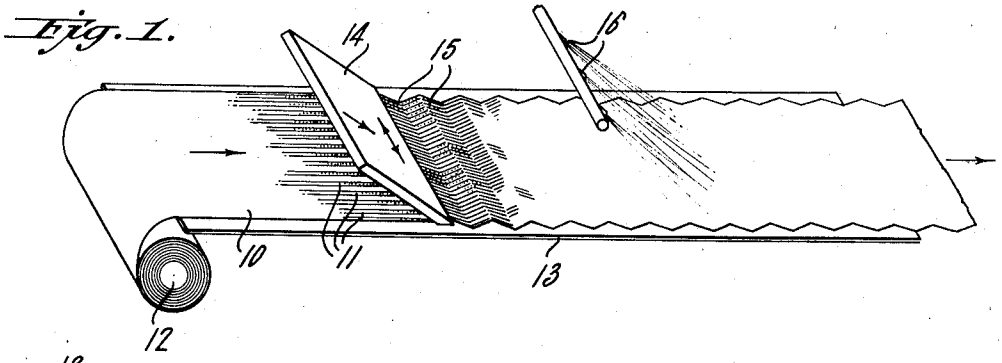
June 13, 1939. T. G. HAWLEY, JR. 2,162,551

METHOD OF MAKING ELASTIC FABRIC

Filed Oct. 30, 1935

Fig. 1.



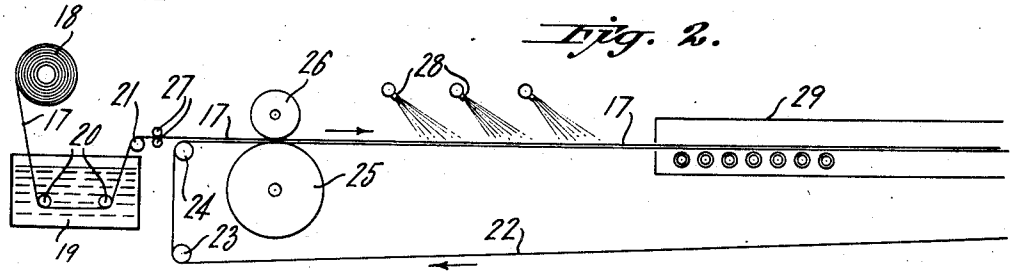


Fig. 2.

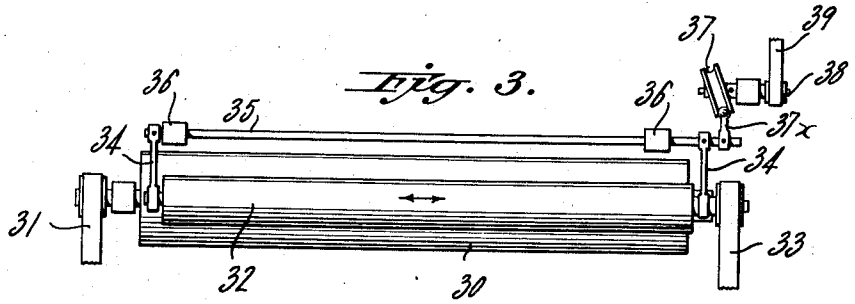


Fig. 3.

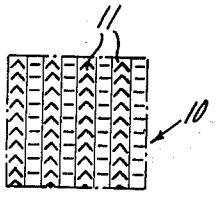


Fig. 4.

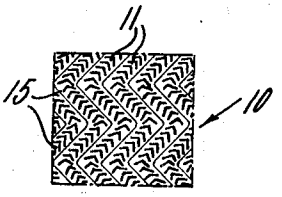


Fig. 5.

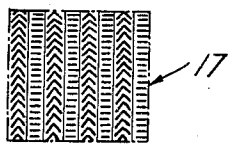


Fig. 6.

INVENTOR.
THOMAS G. HAWLEY, JR.

BY Walter L. Tyler

ATTORNEY.

Patented June 13, 1939 2,162,551

UNITED STATES PATENT OFFICE

2,162,551

METHOD OF MAKING ELASTIC FABRIC

Thomas G. Hawley, Jr., Naugatuck, Conn., assignor, by mesne assignments, to United States Rubber Company, New York, N. Y., a corporation of New Jersey

Application October 30, 1935, Serial No. 47,361

6 Claims. (Cl. 154—2)

This invention relates to elastic fabrics and to a method of imparting elastic properties and an ornamental design to textile fabrics.

It has been proposed heretofore to form elastic fabrics from stretchable textile fabrics by calendering sheet rubber onto a surface of knitted or other stretchable fabric, or by treating the fabric surface with a rubber-containing fluid such as solvent rubber cement of an aqueous rubber dispersion such as latex spread or sprayed on the fabric, and when desired the rubber has been sandwiched between plies of fabric. The rubber imparts to the fabric the desired quick recovery from stretched condition and a capacity to retract to its original condition after being stretched.

It has also been proposed heretofore to act upon knitted goods to stretch it in the direction of the courses and while thus stretched apply a rubber-containing fluid to the fabric to yieldingly retain it in the stretched condition to thereby increase the property of the fabric to stretch in the direction of the wales so as to produce a two-way stretch fabric.

The effect of these prior treatments has been to make elastic fabrics, and to increase the property of the fabric to elongate in one direction with a loss of such property in a direction at right angles thereto, but such treatments have not served to increase on the whole the property of a fabric to elongate over that which the textile fabric originally possessed before the rubber treatment.

The present invention relates to a method of treating a fabric by condensing or otherwise distorting the fabric and then securing the fabric normally in this condensed or distorted condition by a deposit or coating of rubber which permits the fabric to stretch and causes it to contract. In this manner the fabric may be given a much greater range of stretch than the range of elongation it possessed before the treatment.

One important feature of the present invention resides in the method of condensing or distorting the fabric, which consists in placing the fabric to be treated on a supporting surface and then exerting a sliding pressure upon the fabric to slide or shift portions thereof so as to modify the distance between the adjacent rows of threads of the fabric to bring these rows closer together or otherwise change their position with respect to that which they previously occupied.

The present method may be employed to condense the fabric in the direction of its length or at various angles thereto. In the first case the appearance of the fabric will not be greatly changed except that it will appear more closely formed, but in the second case various designs may be imparted to the fabric while it is being condensed. For example, if one transverse portion of the fabric is condensed in a direction inclined to the right of the length of the fabric and the next portion in a direction inclined to the left, the finished fabric will have a distinct striped appearance which will be retained when the fabric is set by the rubber treatment. Various other design effects may be imparted to the fabric by varying the operation of the fabric condensing means.

A further important feature of the present method resides in wetting the fabric before it is condensed so as to increase its flexibility and render it sufficiently plastic to remain in its condensed condition until it can be set in this condition by the rubber treatment. In this case the moisture in the fabric serves as an adhesive to temporarily hold it in the condensed condition. However, if desired other adhesives may be used to retain the fabric condensed until it has been set by spraying or otherwise applying a rubber-containing fluid thereto.

The rubber-binding material may be so applied that it will only slightly diminish the porosity of the original fabric, or if desired it may serve to impart waterproof properties to the fabric.

A fabric when treated in accordance with the present invention will have the original stretch of the fabric plus the amount it was condensed. The present invention may be employed to greatly increase the stretch of a knitted fabric either longitudinally or transversely and may also be employed to impart a substantial stretch either longitudinally or transversely to woven and other fabrics which normally have only a very slight stretch. It may also be used to impart various pattern or design effects to these fabrics, and these properties may be imparted to the entire fabric or only selected portions thereof as desired.

Fabric constructed in accordance with the present invention and mechanism adapted for use in carrying out the present method are illustrated in the accompanying drawing wherein:

Fig. 1 is a perspective, diagrammatic view of one form of mechanism for treating the fabric in accordance with the present invention;

Fig. 2 is a diagrammatic side elevation of another form of mechanism for treating the fabric;

Fig. 3 is a top plan view of a modified construction associated with the rolls shown in Fig. 2;

Fig. 4 is a conventional showing of a piece of

knitted fabric before it has been treated in accordance with the present invention;

Fig. 5 is a similar view of the fabric after it has been treated in accordance with the present invention with either the mechanism shown in Fig. 1 or Fig. 3; and

Fig. 6 is a face view of the fabric of Fig. 4 after it has been treated upon the mechanisms of Fig. 2.

The method of the present invention may be employed in treating knitted, woven, lace or other fabrics to render them elastic. If a woven fabric is used, it preferably should have an open weave so that the fabric may be condensed to a large degree by crowding the strands thereof closely together. However, even closely woven fabric may have some elasticity imparted thereto by the present method.

If a knitted fabric is used it may be condensed in the general direction of either the courses or the wales and this will result in materially increasing the stretch of the fabric. Thus fabrics can be produced with different amounts of stretch in the two directions, varying from approximately equal stretch in each direction to a great deal of stretch in one direction and practically none in the other.

In the drawing, the fabric **10** is shown conventionally as a knitted fabric having the wales **11** running lengthwise of the fabric as usual. This fabric is shown in Fig. 1 as extending from a supply roll **12** to a supporting table **13** having any suitable form of smooth upper surface upon which the fabric **10** may slide. The upper surface of the table **13** may constitute a steel plate, a Bakelite surface, or the table may be formed of wood or other hard material covered with oilcloth or other material having a glazed face.

The fabric **10** in accordance with one feature of the present invention is thoroughly wetted either before it is delivered to the table **13** or while resting thereupon so that it will be softer and more flexible than when dry. The wetting liquid, which may be water, or a diluted aqueous solution, acts as a plasticizer and makes the fabric better conditioned for the condensing operation. It also serves as an adhesive to retain the fabric upon the table **10** temporarily in its condensed or molded condition so that it may be treated with a rubber substance while in this condition and yieldingly held by the rubber in the condensed condition. When the water supplied to the fabric **10** is relied upon to adhesively hold the fabric upon the table in the molded or condensed condition, it is important that the proper amount of water be provided as either too much or too little water makes the process difficult to carry out. The desired amount of water varies to some extent with the fabric and should be sufficient to render the fabric thoroughly wet without tending to cause the fabric to float upon the table. If desired, paste, glue or other forms of adhesives may be used in place of water to temporarily hold the fabric in its condensed condition.

The simple form of mechanism shown in Fig. 1 for condensing or otherwise distorting the fabric may be operated by hand, and in accordance with this aspect of the invention the wet fabric **10** while resting upon the table **13** is acted upon by the inclined board or pusher **14** which is engaged with successive narrow transverse portions of the fabric to slide or crowd these portions forward. The fabric may be condensed by the board **14** in a straight forward direction or the board may be moved forward at different angles to the length of the fabric to produce pattern effects. The fabric is shown in Fig. 1 as having been condensed by moving the board forward first to the right and then to the left in a direction diagonally to the length of the fabric to impart the wavy effect to the fabric best shown in Fig. 5. This treatment of the fabric gives it a distinct striped appearance as indicated at **15**. Other desired ornamental effects may, however, be imparted to the fabric by varying the type of movement that is imparted to the board **14** while condensing successive portions of the fabric. This condensing operation may be carried out throughout the entire length of the table by starting at its right hand end and working back step by step towards the roll **12**.

If the fabric **10** has been rendered sufficiently flexible and plastic by the water treatment, then when the transverse portions of the fabric are successively slid forward upon the table **13** and crowded together by the action of the presser board **14**, they will be held in this condensed or molded condition by the adhesive action of the water long enough to enable them to be secured in this condition by a rubber binder, to be hereinafter more fully described. However, as above stated, other adhesives than water may be used, but water has the advantage that it is readily removed by drying the fabric, whereas if other adhesives are used they may be more difficult to remove.

The effect of the action of the board **14** upon the fabric is to displace small, transverse sections thereof in first one direction and then the other, which imparts to the fabric the saw-tooth appearance at each selvage edge, as shown. At the same time that these strips or transverse sections of the fabric are being displaced laterally, they are being slid forward to a considerably greater degree to thereby condense the fabric in the direction of the wales.

After the wet fabric **10** has been condensed or molded, as shown at the right hand side of the board **14**, it may have sprayed or otherwise deposited thereupon a rubber-containing fluid which, when the rubber becomes set or vulcanized, will serve to maintain the fabric in a condensed condition, and will permit the fabric to stretch. Nozzles **16** may serve to spray the rubber-containing fluid upon the fabric so that it will form either a porous or non-porous coating as desired, whereupon a vulcanization of the rubber may be effected by heating the treated fabric while it rests upon the table **13**. The rubber-containing fluid may be an aqueous dispersion of rubber such as latex with or without compounding and/or vulcanizing ingredients and in either a vulcanized or unvulcanized condition of any degree, or a solvent rubber may be used, and the fluid may be applied to the fabric either before or after the latter is condensed provided the rubber binding material remains in a liquid condition until after the fabric is condensed. Preferably the rubber-containing fluid takes the form of a vulcanizable latex composition, and where the fabric is to be utilized without doubling or plying, substantially complete vulcanization may be effected by the time the treated fabric leaves the table **13** or the dryer (not shown) to which the fabric may be delivered from this table.

In Figure 2 is shown another type of apparatus for carrying out one aspect of the method of the present invention. The construction of Fig. 2 however. is adapted to act upon the fabric con-

tinuously, whereas the construction of Fig. 1 is capable of acting upon the fabric only intermittently or step-by-step. In Figure 2 the fabric 17 to be treated is supplied by the cloth roll 18 from which it may pass into a water tank 19 and around the rollers 20 therein, and then out of the tank and over a roller 21 whereupon it may be delivered to the endless conveyor or apron 22. This apron passes around the spaced rollers 23 and 24 in the direction indicated by the arrows and the upper run of the apron passes between the cooperating rollers 25 and 26 which serve to condense the fabric 17. As the wet fabric is delivered to the upper run of the apron 22 or to the nip of the rollers 25 and 26 the excess water may be removed from the fabric by the cooperating rolls 27.

The lower supporting roller 25 has the same surface speed as the apron 22 but the upper roller 26 is driven at a higher surface speed so that it will act to slip or crowd the fabric 17 forward to condense the fabric. The condensed fabric rests upon the traveling apron 20 and may be temporarily held in the condensed condition by the adhesive action of the water as above described. The fabric 17 may be conveyed by the apron 22 beneath the nozzles 28 that spray a rubber-containing liquid thereupon which will serve as it coagulates or solidifies to yieldingly retain the fabric in the condensed conditions. The nozzles 28 are preferably arranged at an inclination to the fabric as shown so as to coat the upper face of the fabric without causing an excessive penetration of the liquid into the fabric. The coated fabric may then be conducted by the apron 22 through the drying and vulcanizing chamber 29.

If the upper or fabric-condensing roller 26 is not moved in the direction of its length while rotating it will condense the fabric in a lengthwise direction as shown in Fig. 6 but will not produce striped effects. If, however, the roller 26 is moved axially back and forth as it rotates the fabric will be condensed in a zigzag or diagonal direction alternately to the right and left as shown in Fig. 5. It will therefore be seen that the machine of Fig. 2 may be employed to produce the striped effect of Fig. 5 if the upper roll is provided with means for shifting it back and forth in the direction of its length as it rotates.

Means for accomplishing this is shown in Fig. 3 wherein the lower roller 30 is provided with a driving belt 31 and the upper roller 32 is provided with the driving belt 33 that drives it at a faster surface speed than the roller 30. The upper roller 32 is shown as supported by a sliding frame consisting of the arms 34 in which the roller is journaled and these arms are secured to the bar 35 which is slidably supported by the brackets 36. Reciprocatory movement is imparted to the bar 35 and roller 32 by a grooved cam wheel 37 secured to the shaft 38 that is rotated by the belt 39. An arm 37x secured to the bar 35 and projecting into the groove of the wheel 37 serves to reciprocate the bar 35 as the grooved wheel rotates. By varying the relative speed of the rollers 30 and 32 and the grooved wheel 37 the fabric 10 or 17 may be condensed at various inclinations to its length and the distance between the strips thus formed may be varied as desired by increasing or decreasing the speed of the grooved wheel 37.

Other pattern effects may be imparted to the fabric as it is condensed by the roller 32 by embossing or otherwise varying the surface of the roller so that it will condense part but not all of the fabric passed thereunder.

It will be seen from the foregoing that by employing the construction of Fig. 2 fabric may be easily and quickly condensed in the direction of its length, and that by employing the construction of Fig. 3 a distinct striped effect may be imparted to the fabric as it is condensed, and that by yieldingly securing the condensed fabric is the condensed condition by the use of a rubber binder, a woven, knitted or other textile fabric may be converted into an elastic fabric having a substantial degree of stretch.

While the method of the present invention has been herein described as adapted to impart stretch to a fabric in the direction of its length, the fabric may be condensed in accordance with the present invention either longitudinally or transversely or both longitudinally and transversely and then retained in this condition by the rubber treatment.

Fabric treated by the present method may have imparted thereto a capacity to stretch which is two or more times that of the untreated textile fabric, and if the rubber binding material is applied only to one face of the fabric the other face will be free from rubber and will retain its textile appearance and feel. In some cases it may be desirable to ply two sheets of this treated fabric with the two coated faces together so that no rubber will be noticed on the outside of the finished fabric.

The present fabric is well adapted for use in corsets, girdles and other elastic garments, and for various other purposes where a stretchable textile fabric is desired.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

1. The method of making an elastic fabric, comprising the steps of wetting a textile fabric composed of interconnected threads to render it more flexible, placing the fabric on a supporting surface, exerting a sliding pressure upon the fabric in a direction to condense it by decreasing the distance between adjacent rows of threads, holding the fabric in the condensed condition on the supporting surface by virtue of it being wet, and treating the fabric with a rubber-containing fluid to yieldingly retain it in this condition.

2. The method of making an elastic fabric, comprising the steps of adhering a textile fabric composed of interconnected threads to a supporting surface with a liquid, exerting a sliding pressure upon successive portions of the fabric to thereby slide some portions relative to others upon the surface in opposition to the resistance of such adherence so as to condense the fabric by reducing the distance between adjacent rows of the threads, and treating the fabric with a rubber-containing material to retain the fabric yieldingly in the condensed condition.

3. The method of making an elastic fabric comprising the steps of temporarily adhering a textile fabric composed of interconnected threads to a supporting surface with a liquid, exerting a sliding pressure on the fabric to slide the fabric upon the surface in opposition to the adherence and thereby condense the fabric by decreasing the distance between adjacent rows thereof and also to shift portions thereof in different directions to produce a pattern effect, and yieldingly binding the parts of the fabric in this shifted position with a rubber-containing material.

4. The method of making patterned elastic fabric comprising the steps of securing a textile

fabric to a supporting surface with a film of liquid interposed between the fabric and the supporting surface, applying pressure progressively to selected areas of the fabric and not to other areas, said pressure having components acting perpendicular to the surface of the fabric and in the direction of the supporting surface and other components acting parallel to the surface of the fabric so as to slide the fabric along the supporting surface against the resistance of the liquid film and thereby condense the fabric by crowding the threads extending transversely to the direction of the latter components closer together and relax the threads extending in the direction of such components, holding the textile fabric in its condensed condition on the supporting surface by the liquid film, applying a rubber containing fluid to the surface of the fabric opposite to the side on which is the liquid film, treating said rubber containing fluid to deposit the rubber therefrom and convert it into an elastic medium which is capable of yieldingly retaining said fabric in its condensed condition by the adherence of the rubber thereto, and removing the fabric with the rubber adhered thereto from the supporting surface.

5. The method of making an elastic fabric comprising the steps of securing a textile fabric to a supporting surface with a film of liquid interposed between the fabric and the supporting surface, moving said supporting surface underneath a roll, running the roll in contact with the textile fabric in the direction of the movement of the supporting surface along the lines of contact and at a greater surface speed than the movement of the supporting surface and thereby moving the textile fabric along the surface against the resistance of the liquid film and condensing it by crowding the threads thereof extending transversely to the direction of rotation of the roll closer together and relaxing the threads extending in the direction of such rotation; holding the textile fabric in its condensed condition on the supporting surface by the liquid film, applying a rubber containing fluid to the surface of the fabric opposite to the side on which is the liquid film, treating said rubber containing fluid to deposit the rubber therefrom and convert it into an elastic medium which is capable of yieldingly retaining said fabric in its condensed condition by the adherence of the rubber thereto, and removing the fabric with the rubber adhered thereto from the supporting surface.

6. The method of making an elastic fabric comprising the steps of securing a textile fabric to a supporting surface with a film of liquid interposed between the fabric and the supporting surface, applying pressure to the fabric having components acting perpendicular to the surface of the fabric in the direction of the supporting surface and other components acting parallel to the surface of the fabric, said pressure being applied so that the latter components are progressively applied over some areas in a given direction and over areas at an angle thereto in the same general direction to shift the areas of the fabric in respect to one another, holding the textile fabric in its shifted positions on the supporting surface by the liquid film, applying a rubber-containing fluid to the surface of the fabric opposite to the side on which is the liquid film, treating said rubber containing fluid to deposit the rubber therefrom and convert it into an elastic medium which is capable of yieldingly retaining said fabric in its shifted condition by the adherence of the rubber thereto, and removing the fabric with the rubber adhered thereto from the supporting surface.

THOMAS G. HAWLEY, JR.