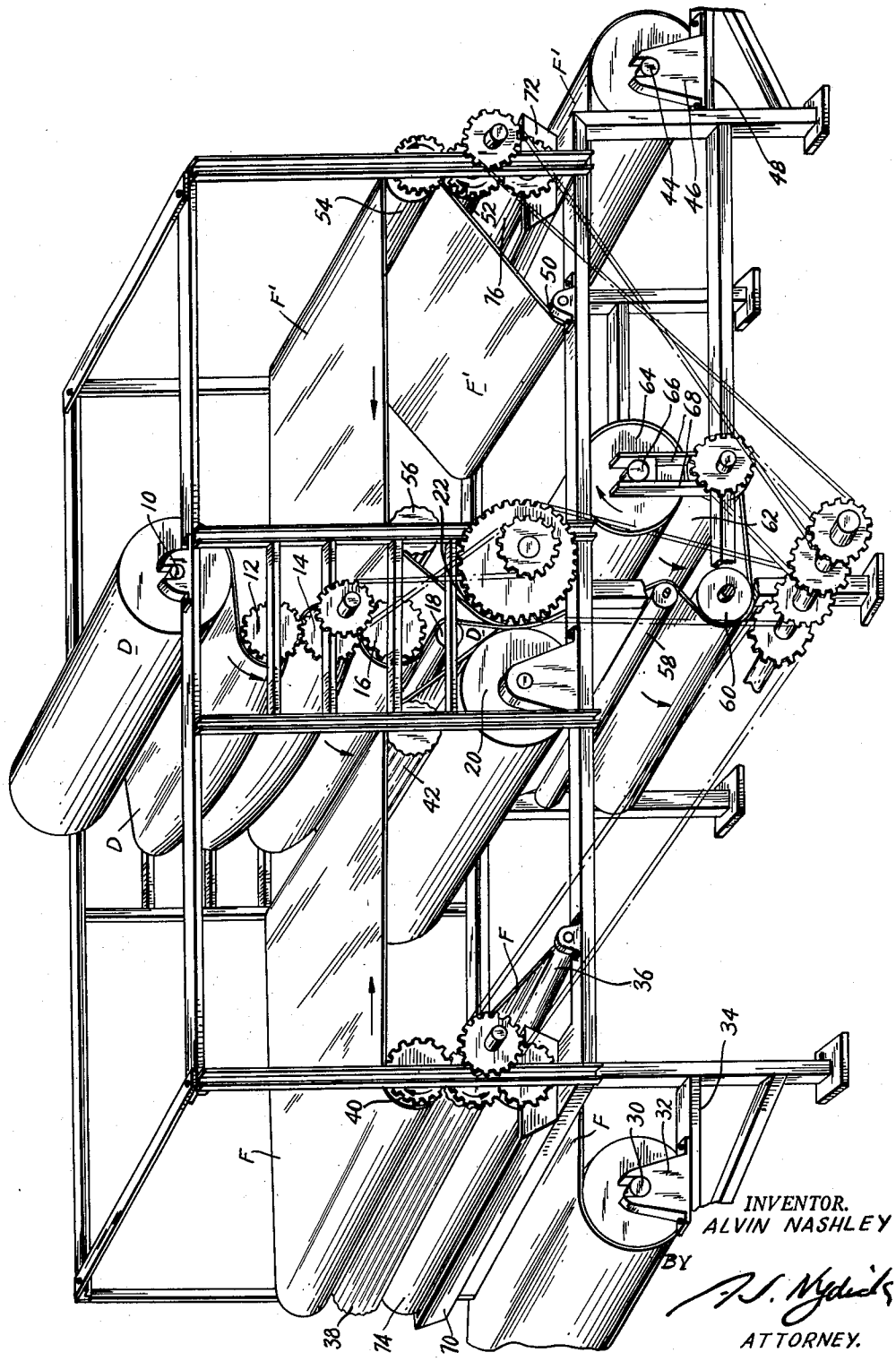
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METHOD OF PRODUCING STRETCHABLE CLOTH HAVING AN ELASTOMERIC DAM

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METHOD OF PRODUCING STRETCHABLE CLOTH HAVING AN ELASTOMERIC DAM

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This invention relates to a stretchable cloth or fabric of the class wherein an elastomeric dam is combined with a layer of stretchable textile fabric. In particular this invention is directed to an improved process for the continuous production of such a stretchable cloth or fabric; and a novel apparatus for carrying such continuous process into effect.

Many attempts have been made in the past to provide the art with a process for the continuous production of a stretchable cloth or fabric having greater stretchability either in the length or width or both than the textile fabrics from which they are made. Such stretchable fabrics are used for foundation garments, panties, shoes, bathing suits, surgical supplies, slip covers, table covers, and other purposes. Fabrics of this class are frequently referred to as "two-way stretch" materials when they are stretchable in both directions, or "one-way stretch" materials when they are stretchable in but one direction. However, all of the processes heretofore proposed for the continuous production of such stretchable fabrics have failed to yield products of constant uniformity of hand and stretch. Such prior continuous processes have also entailed the use of expensive and cumbersome machinery which occupy a great amount of mill space and involve substantial capital investment and large operating overhead.

I have conceived of a novel method of achieving the continuous production of stretchable fabrics of the foregoing class, possessing uniformity of hand and stretchability of the product, such stretchability being readily controlled so as to achieve predetermined degree, ease, and direction of the stretch. I have also conceived of a novel apparatus which may be used in carrying my novel process into effect, said novel apparatus being relatively inexpensive to install, of marked improvement of simplicity in design, and one that may readily be operated with great economy.

Accordingly, it is among the objects of this invention to provide a process for the continuous production of stretchable cloth or fabric of the class wherein an elastomeric dam is combined on one side or both with a layer of stretchable textile fabric, such stretchable cloth or fabric possessing constant uniformity of hand and stretch.

Another object of this invention is to provide a continuous process for the production of a stretchable cloth or fabric of the class wherein an elastomeric dam is combined on one side or both with a layer of stretchable textile fabric, such product having constant uniformity of hand and

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stretchability, with the stretchability thereof being readily controlled so as to achieve predetermined degree, ease, and direction of the stretch.

A further object of this invention is the provision of a novel apparatus for the production of a stretchable cloth or fabric of the class wherein an elastomeric dam is combined with a layer of textile fabric, the apparatus being relatively inexpensive to install, of markedly improved simplicity in design, and one that may be readily operated with great ease and at low cost.

In its fundamental aspect, my novel process for the production of stretchable cloth or fabric of the class wherein an elastomeric dam is combined on one side or both with a layer of stretchable textile fabric comprises, subjecting a sheet of an appropriate elastomer to tension while the said sheet is constantly maintained at its initial width; elongating, and reducing the width of the textile fabric to the width of the dam; coating the stretched textile fabric with an appropriate adhesive; and combining the aforesaid tensed elastomeric sheet with the stretched textile fabric.

In its fundamental aspect, my novel combining apparatus comprises a combination of bowbars whereby they subject the sheet of the elastomeric dam to tension while its width is maintained constantly at its initial dimensions; means for elongating and reducing the width of the textile material to the width of the tensed dam; and means, such as a pair of cooperating combining cylinders or rolls, whereby the tensed elastomeric sheet is combined with the stretched textile fabric. Preferably, the bowbar unit is positioned so that the sheet delivered therefrom emerges as close as possible to the position where it is combined with the layer of stretched textile fabric so as to minimize the danger of foreign air-borne particles falling on the expanded dam and becoming entrapped between the dam and the fabric.

An important feature of my novel process is that the elastomeric dam, while under tension, is fed vertically into the combining cylinders and that the layers of the textile fabric to be affixed to each side of the dam are fed into the combining cylinders under equivalent states of stress.

The advantage of this feature is that the final product is one in which the layer on each side of the dam is affixed under equivalent states of stress, and the finished product possesses extraordinary uniformity of stress in both of the textile layers so that the final cloth is devoid of tendency to buckle or curl.

The important feature of my apparatus is that the bowbars of the bowbar unit are positioned

vertically and the tensed dam is thereby delivered to the combining cylinders in a vertical plane while the means which feed the webs of textile fabric to the combining cylinders are substantially symmetrically arranged and disposed with respect to the combining cylinders so that both webs of fabric are fed thereto under equivalent states of stress.

One of the advantages of such arrangement is that the operator is able more easily to observe the combining operation and make certain, for example, that the selvages of all the components coincide at the combining station.

Other objects, purposes, features, characteristics and advantages of the present invention will be in part apparent or obvious, and in part pointed out as the description progresses. In describing the invention in detail, reference will be made in part to the accompanying drawing in which the figure is:

A perspective view of an embodiment of an apparatus for carrying my continuous process into effect.

As shown in the drawing, a roll of an appropriate elastomeric material D, e. g. rubber sheet, is mounted, so as freely to rotate on shaft **10**. The sheet D is passed over a unit of plurality of cooperatively rotating bowbars **12**, **14**, and **16**, each covered with a sheath of rubber or other suitable material which grips the dam, so that the sheet D is subjected to tension while the width thereof is maintained at its initial dimension. As the sheet D emerges from the last bowbar **16**, it passes over the guide roller **18**, positioned close to the combining cylinders or rolls **20** and **22**. The distance between (A) let off roll D and bowbar **12**, (B) between each of the bowbars **12**, **14** and **16**, (C) between bowbar **16** and guide roller **18**, and (D) between guide roller **18** and the combining station where the combining rolls **20** and **22** meet with each other, is so small that any slight decrease transversely of the dam is corrected by the bowbars **12**, **14** and **16**. Such distances should not exceed from six to eight inches. A roll of textile fabric F on a textile shell carried by a suitable shaft **30** mounted on a bracket **32** carried by the support **34** passes over the guide roller **36** and thence between roller **38** and roller **40** from which point the web passes over an expander **42** and thence between the combining rolls **20** and **22**. A second web of fabric F′ is similarly fed to the combining rolls, said web F′ being suitably rolled on a textile shell carried on a suitable shaft **44** mounted on the bracket **46** affixed to the support **48**. The web of the fabric F′ passes over the guide roller **50** and thence between rollers **52** and **54** and then over the expander **56**. Sufficient pressure is exerted between the rollers **20** and **22** so as to effectuate the adhesion of the webs textile fabric to the dam, as they pass between the rollers **20** and **22**. The inside surfaces of the webs of textile fabric are coated with a thin film of adhesive as hereinafter described. The combined stretchable cloth or fabric thus produced, as it emerges from the combining rollers **20** and **22** passes under guide roller **58** and under expander **60**. It then passes under driven roller **62** from which it is reeled up on the contact take up roller **64**, the shaft **66** of which rides within the legs of the U-bracket **68**.

Pans **70** and **72** containing an appropriate adhesive are so positioned that the rollers **74** and **76** rotate therein and thereby transfer to the rollers **38** and **52** respectively, with which they

are respectively in contact, some of the adhesive. The rollers **38** and **52** in turn, deposit the adhesive to the stretched web of textile fabric. It will be observed that the applicator rollers **38** and **52** are slightly fluted or striated longitudinally thereof so that the adhesive is deposited continuously in a series of relatively thin transverse lines or ridges which finally merge into a single evenly distributed film of adhesive as the fluid ridges spread out.

It will also be observed that the various rollers hereinabove described are so mounted and provided with appropriate gearing so that they operate in directions whereby the stretched webs of textile fabric and the expanded dam are brought into position for the combining operation, and after being combined, the finished product is rolled up on the contact-take up roller. It will also be observed that the surface speed of the bowbars may be adjusted so as to achieve the desired degree of tensing of the elastomeric dam. With respect to the degree of stretch of the textile fabric, such degree may be controlled by regulating the speed of the let-off rolls F and F′ by placing conventional brakes (not shown) on shafts **30** and **44**, respectively. The finished product may be produced or finished in any suitable fashion.

If both sides of the finished product are made, for example, of knitted fabric, such finished product will be stretchable in both directions. Such two-way stretch materials may be used for foundation garments, bathing suits, panties, or other articles in which the two-way stretch characteristic is desired. If the finished product is made of the combination of a knitted fabric on one side, the dam, and a woven fabric on the other side, such finished product will generally be stretchable in but one direction. This product may be used in the manufacture of ski wear, snow suits, rain coats, or other articles where but one-way stretch is desired. If the textile fabric on both sides of the dam is woven, the finished product will also be a one-way stretch product; and may be used where the one-way stretch material is desired. If the product is the combination only of the stretched dam and a textile fabric on one side, a two-way stretch or a one-way stretch may be attained by using either a knitted fabric or a woven fabric respectively. A one-way or two-way stretch material having the fabric on one side may be used in the manufacture of slip covers, upholstery covers, automobile seat covers or the like in accordance with the desires of the manufacturer or user. It is to be noted that if porosity of the stretchable fabric is desired, the same may be achieved by perforating the elastomeric dam, the perforations beings of relatively small magnitude so that when the dam is in the unstretched condition, the holes will be closed, and will open when the stretchable fabric is actually stretched. Such porosity is advantageous in the case of garments which are worn close to the skin as for example, bathing suits, foundation garments, etc.

It will be observed that my process involves the expansion or stretching of the elastomeric dam so that it is under uniform tension both longitudinally and transversely at the time it is combined with the textile fabric which likewise is under uniform tension both in respect of the longitudinal stretch and the transverse direction respectively. The deposition of the adhesive on the textile fabric in its stretched state, also is an important feature of this invention in that it

obviates the disadvantages inherent in the prior processes when the stretching of the fabric was carried out after the adhesive had been applied thereto. In the latter case, the stretching caused some of the adhesive to impregnate the yarn and ooze through the fabric and thereby seriously marring the finished cloth. By my process, the application of the adhesive to the fabric in the stretched state, obviates the danger of such damage or spoilage. The application of the adhesive is controlled with greatly enhanced sensitivity by the flutings or striations of the applicator rollers **38** and **52**. In carrying out the combining operation of this invention, a markedly improved finished product is obtained, since the elastomeric dam is delivered to the combining station with the longitudinal tension maintained at a constant degree and the transverse tension likewise maintained at its constant degree, and the textile fabrics are likewise delivered to the combining station with their longitudinal tensions at constant degree while their transverse tensions are likewise maintained at their constant degrees. The combined product therefore emerges as a finished stretchable fabric in which the longitudinal tension is constant, at the requisite degree throughout the length of the finished web; and the transverse tension is likewise kept constant at its predetermined degree. On release of the tension, the finished product reverts to the normal dimensions of the dam in the unstretched condition.

The ease of the stretch of the finished product may be controlled by the character of the elastomeric material used for the dam; as for example, the degree of cure of the rubber or the like and/or the thickness of the rubber and the degree of cure thereof.

The differential in speed between the speeds of the combining cylinders and the bowbars regulate the percentage of stretch of the finished product. The bowbars are geared with each other and although they are not in contact with each other, operate as a unit. If the surface speed of the bowbars is slower than the surface speed of the combining cylinders, less of the elastomeric dam passes through the combining cylinders than the stretched textile fabric which is being released at the same surface speed as the combining cylinders. Thus, if one yard of the tensed dam is allowed to pass through the combining cylinders in a given unit of time while the combining cylinders are rotating at a surface speed of two yards in such given unit of time, then two yards of the stretched fabric will be combined with one yard of the dam. Upon relaxation, the finished product will revert to the original longitudinal dimension of the dam which is one yard thereby giving a product in which two yards of fabric are affixed to a side of one yard of the dam. Such a product can therefore be stretched 100 per cent.

I may start with a 48'' wide web of knitted fabric and by appropriate tension, reduce its width to 36'' and affix it to the dam under tension having a width of 36''. The finished cloth on relaxation will have a width of 36''. This 36'' material will stretch the same distance as the original 48'' fabric. Thus I can increase or decrease the stretch of the finished material in its width by increasing or decreasing the width of the knitted fabric used in the combining operation. Such finished stretchable fabrics will thus have a greater percentage of stretch than the textile fabric used in making the same.

The two-way stretch material thus produced, will have a smooth even surface, free from ridges or corrugations in the relaxed state and in its stretched state, and will closely reflect the characteristics of the textile fabric used in manufacturing the stretchable fabric.

It will be manifest that the feeding and combining of the dam and the stretched textile fabric to the combining station vertically possess marked advantages. Such advantages are to be found in the ease of carrying out the combining operation, preservation of cleanliness; accuracy of the combining; and great simplicity of operation.

Among the stretchable fabrics which are used in the manufacture of the two-way stretchable cloth hereinabove described are: milanese, tricot, jersey, and other stretchable fabrics made of silk, nylon, cotton, rayon, and other yarns or mixture of yarns. The elastomeric dam may be a sheet of rubber, or other suitable elastomeric material, having a thickness of from 0.004'' to 0.018'', or even thicker, provided such thicker sheet of elastomeric material possesses full snap back. The adhesive used may be an aqueous latex adhesive containing accelerators, non-flammable solvents, with or without additional ingredients, which will provide the desired adherence of the stretched textile fabric to the elastomeric dam.

It will be understood that the foregoing description of the invention, both as to the process and the apparatus for carrying the process into effect, is merely illustrative of the principles thereof, and accordingly, that the appended claims are to be construed as defining the invention within the full spirit and scope thereof.

I claim:

1. A continuous process for the production of a stretchable fabric of the class wherein an elastomeric dam is combined with a layer of a web of stretchable fabric which comprises: continuously subjecting a moving sheet of an elastomeric dam to tension while maintaining the width thereof at its initial dimension, said tensioning being effectuated by maintaining the elastomeric dam initially in free running status and moving the same so as to stretch it uniformly from the center to the sides thereof; elongating and reducing the width of a moving web of stretchable fabric whereby a moving web of stretched textile fabric is produced; coating the inner side of said moving stretched fabric with an adhesive; and while the moving elastomeric dam is under the aforesaid tension, stretching it while maintaining its original width and simultaneously combining it at a combining station with the moving stretched web of textile fabric.

2. A continuous process for the production of a stretchable fabric of the class wherein an elastomeric dam is combined with a layer of a web of stretchable fabric which comprises: continuously subjecting a moving sheet of an elastomeric dam to tension while maintaining the width thereof at its initial dimension, said tensioning being effectuated by maintaining the elastomeric dam initially in free running status and moving the same so as to stretch it uniformly from the center to the sides thereof; elongating and reducing the width of a moving web of stretchable fabric whereby a moving web of stretched textile fabric is produced; coating the inner side of said moving stretched fabric with an adhesive; and while the moving elastomeric dam is under the aforesaid tension, stretching it while maintaining its original width and simultaneously com-

bining it at a combining station with the moving stretched web of textile fabric, the percentage of stretch of the combined fabric being controlled by regulating the differential between the surface speeds of the dam while being stretched and the surface speed of the moving stretched fabric at the station where the said elastomeric dam and the stretched fabric are combined.

3. A continuous process for the production of a stretchable fabric of the class wherein an elastomeric dam is combined with a layer of a web of stretchable fabric which comprises: continuously subjecting a moving sheet of an elastomeric dam to tension while maintaining the width thereof at its initial dimension, said tensioning being effectuated by maintaining the elastomeric dam initially in free running status and moving the same so as to stretch it uniformly from the center to the sides thereof; elongating and reducing the width of a moving web of stretchable fabric whereby a moving web of stretchable fabric is produced; coating the inner side of said moving stretched fabric with a film of adhesive; and while the moving elastomeric dam is under the aforesaid tension, stretching it while maintaining its original width and simultaneously combining it with the moving web of stretched textile fabric by passing said stretched web and the dam through combining cylinders, the percentage of stretch of the combined fabric being controlled by regulating the differential between the surface speed of the dam while being stretched and the surface speed of the combining cylinders.

4. A process in accordance with claim 1 wherein the sheet of elastomeric dam subjected to tension is moved vertically to the position where it is combined with the moving stretched web of textile fabric.

5. A process in accordance with claim 1 wherein the sheet of elastomeric dam subjected to tension is moved vertically to the position where it is combined with the moving stretched web of textile fabric, and the distance between the position where said dam is subjected to tension and the position where it is combined with the moving stretched web of textile fabric is of small dimension.

6. A process in accordance with claim 2 wherein the sheet of elastomeric dam subjected to tension is moved vertically to the position where it is combined with the moving stretched web of textile fabric.

7. A process in accordance with claim 2 wherein the sheet of elastomeric dam subjected to tension is moved vertically to the position where it is combined with the moving stretched web of textile fabric, and the distance between the position where said dam is subjected to tension and the position where it is combined with the moving stretched web of textile fabric is of small dimension.

8. A process in accordance with claim 3 wherein the sheet of elastomeric dam subjected to tension is moved vertically to the position where it is combined with the moving stretched web of textile fabric.

9. A process in accordance with claim 3 wherein the sheet of elastomeric dam subjected to tension is moved vertically to the position where it is combined with the moving stretched web of textile fabric, and the distance between the position where said dam is subjected to tension and the position where it is combined with the moving stretched web of textile fabric is of small dimension.

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