

July 24, 1962

D. W. KERN
PROCESS FOR THE PRODUCTION OF PUFFED
SURFACES ON TEXTILE FABRICS

3,045,318

Filed June 29, 1959

3 Sheets-Sheet 1

Fig. 1

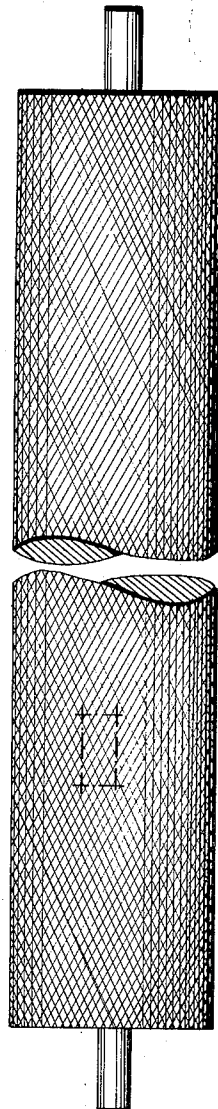
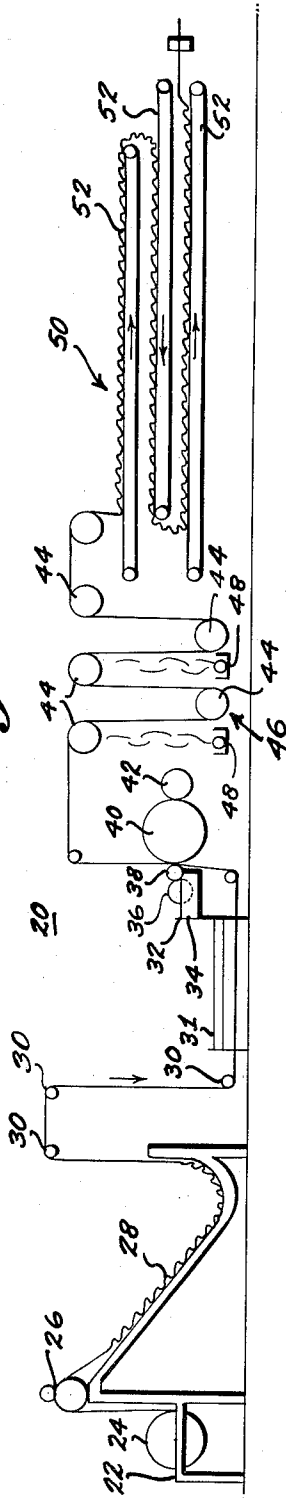


Fig. 2

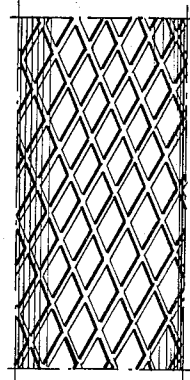


Fig. 3

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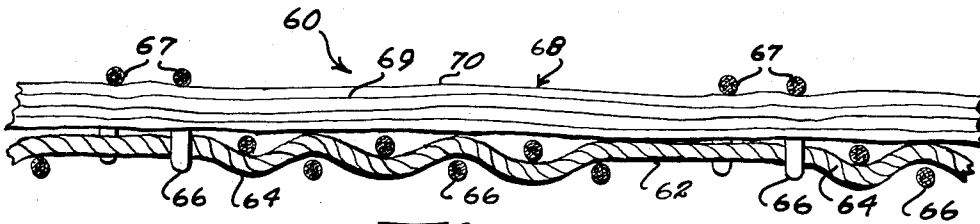


Fig. 4

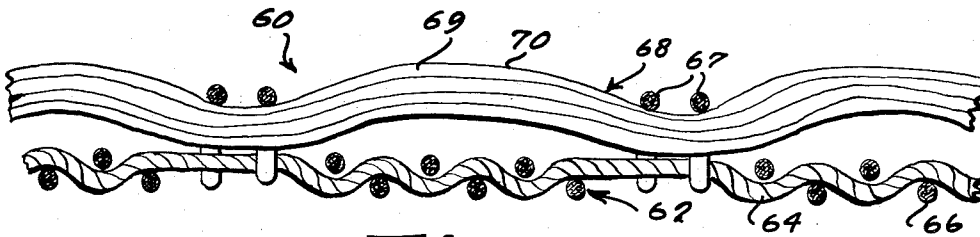


Fig. 5

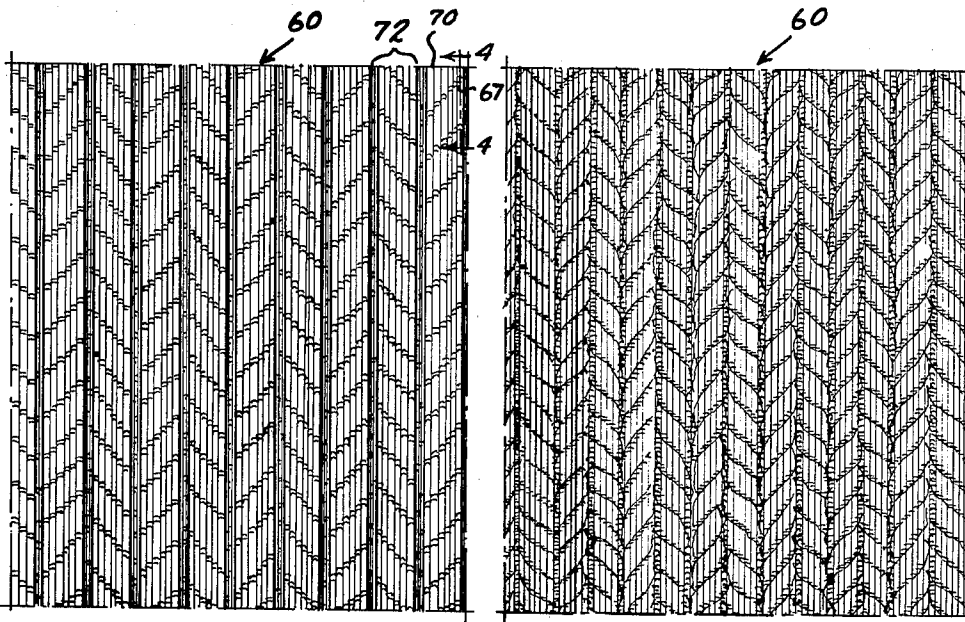


Fig. 6

Fig. 7

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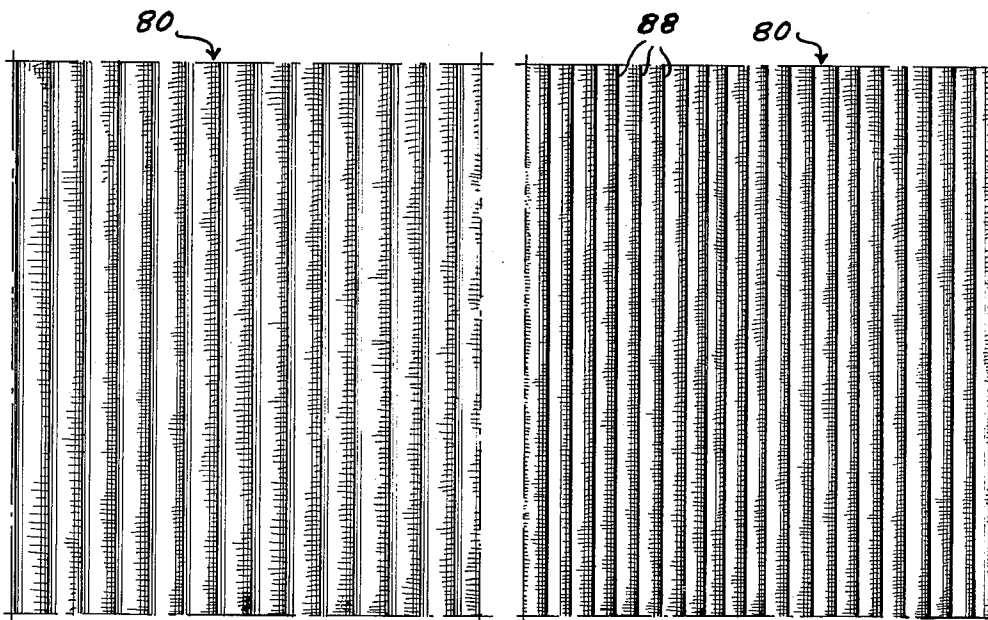
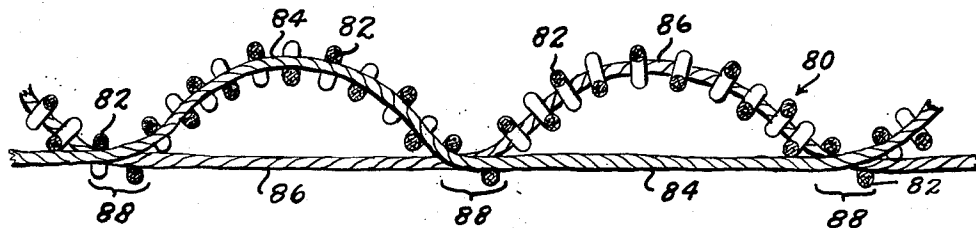
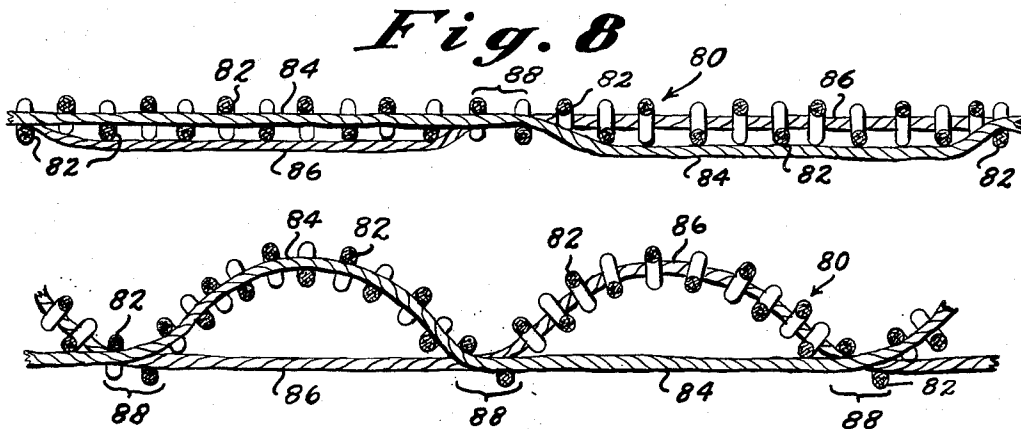


Fig. 10

Fig. 11

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PROCESS FOR THE PRODUCTION OF PUFFED SURFACES ON TEXTILE FABRICS

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6 Claims. (Cl. 28—76)

The present invention relates to the production of novel surface effects on textile fabrics and more particularly to the production of textile fabrics having yarns puffed out on the surface thereof.

Many textile fabrics are presently produced with textured surface effects to be used in making garments, upholstery, draperies, etc. These textured effects have become increasingly popular with the buying public and considerable effort has been directed to the development of new and novel textured effects.

One of the most appealing textured effects is provided by yarns puffed out on the surface of the fabric, providing not only a novel appearance, but also a novel contour. A number of methods have been used to produce puffed surfaces on textile fabrics, such as combining yarns of different shrinkage characteristics so that when the fabric is wetted and subsequently dried the yarns of higher shrinkage will contract and cause the less shrinkable yarns to puff out on the surface of the fabric. Another process of producing puffed surfaces involves the tensioning of some of the yarns during weaving so that, upon relaxation, the tensioned yarns pull-in the other yarns, causing them to puff. Still another process involves the use of thermoplastic yarns or filaments in a fabric which is subjected to heating on one side only or to differential heating of the surfaces, causing contraction of the yarns on the hotter surface with resulting puffing out of the yarns on the other side. All of these processes provide some degree of puffing on the surface of the fabric, but do not provide as pronounced puffing as is often desired. Further, these processes are relatively expensive because of special yarns and equipment necessary to accomplish satisfactory results.

The present invention provides a process which produces pronounced puffing on fabric surfaces using conventional yarns in an inexpensive and simple process. Basically, the invention comprises forming a textile fabric structure with the back face having cotton yarns therein, applying a caustic soda solution to all or selected portions of the back of the fabric structure, and then drying the fabric in a relaxed state. As a result of this processing the portions of the cotton yarns to which the caustic soda has been applied will shrink and draw-in the other yarns, causing a pronounced puffing of the yarns on the top surface of the fabric structure. Various designs and various degrees of puffing can be provided by varying the fabric structure, the concentration and application of the caustic soda solution, and the subsequent treating of the fabric. In one modification of the present invention a fabric structure has been produced from woven goods which, after treatment by the present process, produces a puffing of the surface yarns such that the woven goods has the appearance of knit goods and is actually used as a substitute for knit goods.

An important feature of the present invention is the versatility of designs and degrees of puffing possible. The prior processes are limited to designs extending across the fabric and are limited in the variation of the amount of puffing. However, in the present invention the design can be varied by varying the fabric structure and varying the engraved design on the applying roller. The degree of puffing may be varied by varying the fabric structure, the pretreating of the fabric, the speed of the fabric dur-

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ing processing, the amount of penetrant in the solution, the amount of thickening agent in the solution, the depth and shape of the engraving on the applicator roller, the steaming after the solution is applied, the washing after the solution is applied, and other subsequent processing and finishing operations.

Other and further features and advantages of the present invention will be apparent from the following description and drawings in which:

FIG. 1 is a diagrammatic view of apparatus for continuously processing fabric using the process of the present invention;

FIG. 2 is a plan view, partially cut away, of the applying roller of the apparatus of FIG. 1;

FIG. 3 is an enlarged plan view of the portion of the surface of the roller of FIG. 2 enclosed in dot-dash lines in FIG. 2;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 6, illustrating one type of fabric construction prior to processing according to the present invention;

FIG. 5 is a view similar to FIG. 4 showing the fabric after treatment by the process of the present invention;

FIG. 6 is a top plan view of the fabric construction of FIG. 4 prior to processing according to the present invention;

FIG. 7 is a view similar to FIG. 6 showing the fabric after processing;

FIG. 8 is a sectional view illustrating another type of fabric structure prior to processing according to the present invention;

FIG. 9 is a view similar to FIG. 8 showing the same fabric after processing;

FIG. 10 is a plan view of the fabric construction illustrated in FIG. 8 prior to processing according to the present invention; and

FIG. 11 is a view similar to FIG. 10 showing the fabric after processing.

The details of the apparatus illustrated in FIG. 1 for carrying out the process of the present invention are not shown. It is to be understood that the elements of the apparatus are well known and the process of the present invention can be accomplished by using various other types of equipment and apparatus and the scope of the present invention is not intended to be limited in any way to the particular apparatus illustrated.

Also, the present invention is not limited to any particular treatment of the goods before processing, although variations in the textured effect may be obtained by varying the particular pretreating. A preferred pretreatment of gray goods presently in commercial production consists of the sequential steps of desizing, Kier boiling, chlorine bleaching, mercerizing at 40 degrees Tw. and drying on a loop dryer. The goods are then wound on rollers and are ready for processing according to the present invention. If desired, the pretreating may include any conventional resin treatment to control shrinkage of the finished goods.

The apparatus 20 illustrated generally in FIG. 1 includes a support 22 on which a roll 24 of gray goods, to be treated by the process of the present invention, is rotatably supported. The goods are wound from the roll 24 by a pair of rollers 26, one of which is driven, and are overfed into a J-box 28. The web is drawn from the J-box 28 over a system of idler rollers 30, under an operator's platform 31, and through an applying apparatus 32.

The applying apparatus 32 consists of a pan 34 containing a quantity of caustic soda solution that is picked up by a rotating roller 36 partially submerged in the solution. The partially submerged roller 36 rotates in contact with an applicator roller 38 and transfers the so-

lution thereto. The goods pass between the applicator roller 38 and a large diameter roller 40 which is driven by a small drive roller 42, in turn driven by a power source (not shown). The goods are pressed against the applicator roller 38 so that the caustic soda solution will be deposited on the side of the goods in contact with the applicator roller 38.

After the application of the caustic soda solution, the goods pass over a system of rollers 44 in a steamer 46 in which steam from a source (not shown) is introduced through perforated pipes 48 arranged adjacent the traveling web of fabric to heat and activate the caustic soda solution and increase the penetration into the goods. When treating light goods steaming may be omitted completely to avoid penetration of the caustic soda onto the yarns on the opposite face, which would cause shrinkage of the other face and reduce the puffing effect obtained.

After leaving the steamer 46, the fabric is overfed onto a loop dryer 50, which consists of a number of horizontal conveyor belts 52 vertically arranged with respect to each other and with alternate belts traveling in opposite directions so that the fabric progresses in the directions indicated by the arrows. The belts 52 travel at a surface speed less than the speed at which the fabric is delivered to the belts so that the fabric is deposited in relaxed loops and is free to shrink naturally. The goods are then removed for further processing including washing in a sulfur dioxide bath to neutralize the caustic soda.

In the preferred embodiment of the process and apparatus of the present invention the fabric is run over the applicator roller 38 at from 40 to 50 yards per minute for heavy goods and from 80 to 90 yards per minute for lighter goods. These speeds are not critical but can be varied as desired. The roller 38 is a standard blotch roller of the type normally used for printing fabrics. It has an engraved surface consisting of a multitude of closely spaced diagonal lines extending in opposite directions to provide a finely crosshatched surface which is capable of picking up the caustic soda solution from the partially submerged roller 36 and transferring it to the traveling web of fabric. The particular roller configuration may be varied as desired to increase or decrease the amount of caustic soda applied, and to vary the amount of solution applied at different locations in the fabric, thereby varying the degree and location of the puffing effect in the finished fabric.

The caustic soda solution consists of caustic soda (NaOH), a penetrant, a gum compatible with caustic soda, and water. The caustic soda is the ingredient that produces the desired shrinking and resulting puffing. The other ingredients merely facilitate the application of the caustic soda to the fabric. It has been found that excellent results are obtained by applying at room temperature a solution of 40% caustic soda, 0-2% penetrant and 60-58% water and gum. If the amount of caustic soda is reduced considerably below 40% the solution loses its shrinking effect. On the other hand concentration of the caustic soda above 40% does not appear to increase the shrinking effect.

The penetrant is used to provide desired penetration of the caustic soda into the fabric. When treating relatively thick fabrics it is necessary to use a considerable amount of penetrant to insure proper contact and treating of the back face yarns. However, when treating thin fabrics it may be desirable to eliminate the penetrant entirely so that the caustic soda solution will not contact the top face yarns and cause undesirable shrinkage of the top face as well as the back face. Satisfactory results have been obtained using a cresylic acid base penetrant of a type well known in fabric finishing, such as that sold by Laurel Soap Manufacturing Co., Inc., of Philadelphia, Pa., under the tradename "Penetrator 20X."

The gum is used as a thickening agent so that the solution will remain on the back face of the fabric and

will not flow through the fabric onto the front face yarns. Thus, the penetrant and the gum complement each other and can be finely balanced to produce a solution having any desired penetration characteristic. Any gum which is compatible with caustic soda may be used such as any well known dextrine compound normally used in roller printing of fabrics. Satisfactory results have been obtained with "610 Dextrine," a produce sold commercially by Clinton Corn Processing Co. of Clinton, Iowa.

It is contemplated that numerous penetrants and gums may be substituted for those set out above with satisfactory results and the present invention is not intended to be limited to the specific compounds set out above.

A typical puffed surface effect, which can be produced by the process of the present invention, is illustrated in the fabric of FIGS. 4-7. This fabric 60 is a woven double beam, single ply construction with a backing face 62 consisting of interwoven warp and filling ends 64 and 66, respectively, and a top face 68 consisting of warp ends 69 arranged in groups 70 of four ends per group which substantially conceal the backing face 62. Each group 70 is tied to the backing 62 by interweaving with every sixth pair 67 of backing filling ends 66 and floating over the other backing filling ends 66. The groups 70 of top warp ends 69 are arranged in repeating series 72 of six groups 70 per series. The adjacent series 72 are spaced apart a distance equivalent to two bottom filling ends 66. Each pair of back filling ends 66 ties down one top filling group 70 in each series 72 with the tie down ends forming a diagonal line on the top ply and the diagonal lines extending in opposite directions in adjacent series.

FIGS. 4 and 6 illustrate this fabric structure prior to processing according to the present invention and FIGS. 5 and 7 illustrate the fabric after processing, in which the backing 62 has been treated with caustic soda and allowed to shrink, thereby causing the top yarns 68, which were not treated and have not shrunk, to puff out between the tie-down ends of the backing face 62. This puffing in the above described fabric construction closely resembles the appearance of knit goods with the result that this woven fabric gives the same appearance as knit goods and has been used as a substitute therefor.

Another typical puffed surface effect is provided by the fabric illustrated in FIGS. 8 through 11 wherein a woven single beam fabric 80 consists of warp ends 82 and pairs of filling ends 84 and 86. The warp ends 82 are arranged in groups of ten with a pair of warp ends 88 separating each group. Each pair of filling ends 84 and 86 float under alternate groups of warp ends, and both pairs are woven with the separating pairs of warp ends 88. FIG. 8 illustrates the grey goods before treating, and clearly shows portions of the filling ends 84 and 86 floating on the back face of the fabric. FIG. 9 illustrates the fabric after treating, with the floating portions of the filling ends 84 and 86 shrunken so as to puff out the front face. FIG. 10 is a plan view of the untreated fabric and FIG. 11 is a plan view of the treated fabric, showing the pronounced raised cord effect obtained by the process of the present invention.

The above described fabrics of FIGS. 4-11 are included for purposes of illustration only. Obviously the weave pattern of the fabric may be varied as desired to produce various puffed designs. Also, although the above description and the claims set out the treatment of cotton yarn with a caustic soda solution it is not intended that the scope of the present invention is limited to cotton yarn and caustic soda as equivalent results may be obtained by practicing the process of the present invention using other types of yarn and/or other solutions. In particular, synthetic cellulosic yarns are presently being developed which, when treated according to the process of the present invention with caustic soda or some other shrinking agent, may produce results similar to those described above.

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Further, the process of the present invention has been described above for purposes of illustration only, and is not intended to be limited by this description or otherwise, except as defined in the appended claims.

I claim:

1. A process for the production of a textile fabric having a puffed surface, said process comprising forming a fabric structure with a top face and a back face, with portions of cotton yarn arranged on the back face of the fabric structure and with other portions of yarn arranged on the top face, applying a solution of caustic soda to the back face of said fabric structure to concentrate the caustic soda on the portions of cotton yarn on the back face, relaxing said fabric structure to allow shrinkage of said portions of cotton yarn to which the caustic soda solution has been applied, thereby causing the other portions of yarn in the area of the portions of cotton yarn to which the caustic soda solution has been applied to puff out on the top face of the fabric structure.

2. A process for the production of a textile fabric having a puffed surface, said process comprising forming a fabric structure with a top face and a back face, with portions of cotton yarn arranged on the back face of the fabric structure and other portions of yarn arranged on the top face, applying a solution of caustic soda to the back face of said fabric structure so as to penetrate less than the entire thickness of said fabric structure and thereby concentrate the caustic soda on the portions of cotton yarn on the back face, relaxing said fabric structure to allow shrinkage of the cotton yarn to which the caustic soda solution has been applied, thereby causing the other portions of yarn which are in the area of the portions of cotton yarn to which the caustic soda solution has been applied, but which were not penetrated by the caustic soda solution, to puff out on the top face of the fabric structure.

3. A process for the production of a textile fabric having a puffed surface, said process comprising forming a fabric structure with a top face and a back face, with portions of cotton yarn arranged predominantly on the back face of said fabric structure and with other portions arranged on the top face, applying a solution of caustic soda to the portions of cotton yarn on the back face of said fabric structure to concentrate the caustic soda on the cotton yarn on the back face, relaxing said fabric structure to allow shrinkage of said cotton yarn portions, thereby causing the other yarn portions in the area of the portions of cotton yarn to which the caustic soda solution has been applied to puff out on the top face of the fabric structure.

4. A process for the production of a textile fabric having a puffed surface, said process comprising forming a fabric structure with a back face having cotton yarns therein and a front face having yarns tied down by said

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cotton yarns in the back face, applying a solution of caustic soda to said back face to concentrate the caustic soda on the cotton yarns in the back face, relaxing said fabric structure to allow shrinkage of the cotton yarns in the back face, thereby causing said yarns in the front face in the area of the portions of cotton yarn to which the caustic soda solution has been applied to puff out on the top face of said fabric structure.

5. A process for the production of a textile fabric having a puffed surface, said process comprising forming a fabric structure with a top face and a back face with portions of cotton yarn arranged on the back face of the fabric structure and other portions of yarn arranged on the top face, causing the fabric to travel in a continuous web, passing the back face of said continuous web over a roller having caustic soda solution thereon to apply caustic soda to the back face thereof and thereby concentrate the caustic soda on the cotton yarn arranged on the back face, relaxing said fabric structure to allow shrinkage of the cotton yarn to which the caustic soda solution has been applied, thereby causing the other portions of yarn in the area of the portions of cotton yarn to which the caustic soda solution has been applied to puff out on the top face of the fabric structure.

6. A process for the production of a textile fabric having a puffed surface, said process comprising forming a fabric structure with a top face and a back face, with cotton yarn arranged on the back face of the fabric structure and other portions of yarn arranged on the top face, causing said fabric to travel in a continuous web, passing the back face of said traveling web over a roller having a caustic soda solution thereon to apply said solution to the back face thereof and thereby concentrate the caustic soda on the cotton yarn on the back face, applying steam to said traveling fabric web to activate the caustic soda and increase penetration thereof, allowing said fabric web to relax on a conveyor to permit shrinkage of the cotton yarn to which the caustic soda solution has been applied, thereby causing the other portions of yarn in the area of the portions of cotton yarn to which the caustic soda solution has been applied to puff out on the top face of the fabric structure.

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