

June 10, 1969

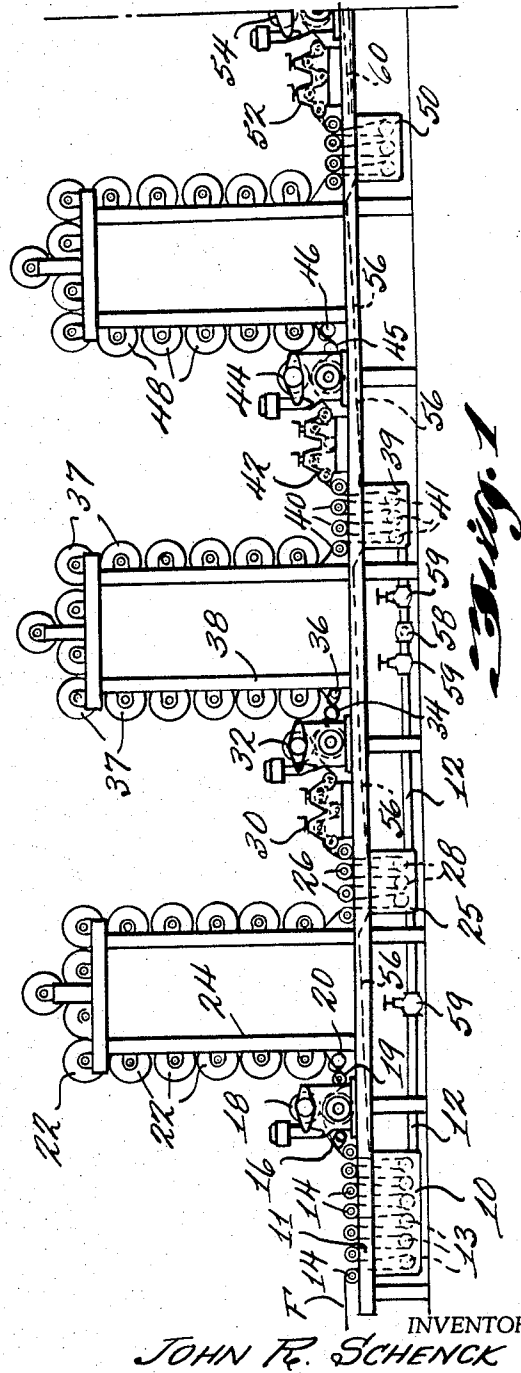
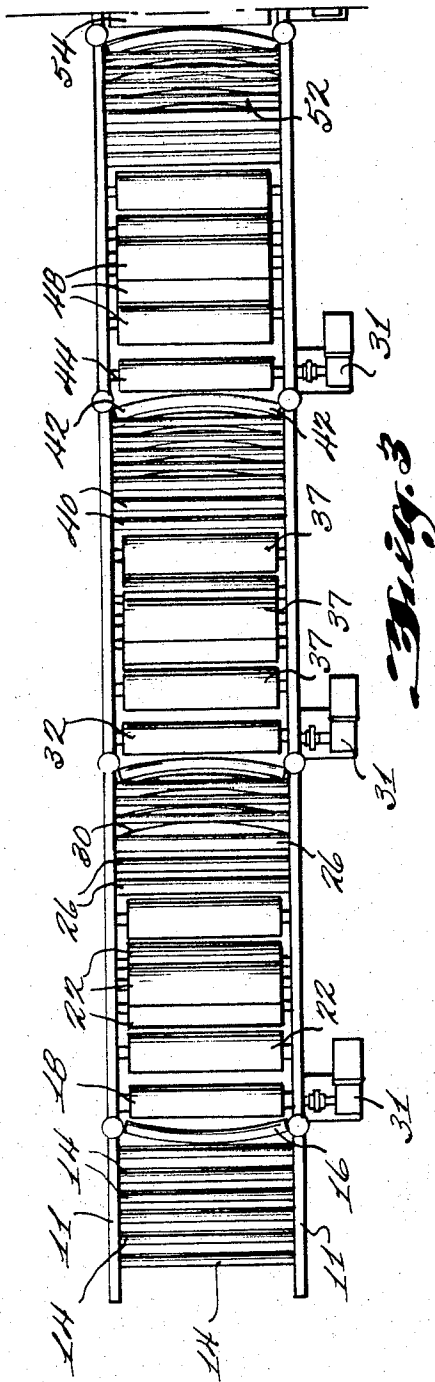
J. R. SCHENCK

3,449,060

TREATMENT OF TEXTILE FABRIC

Filed Nov. 4, 1963

Sheet 1 of 2



INVENTOR
JOHN R. SCHENCK

BY
Cushman, Darby & Cushman
ATTORNEYS

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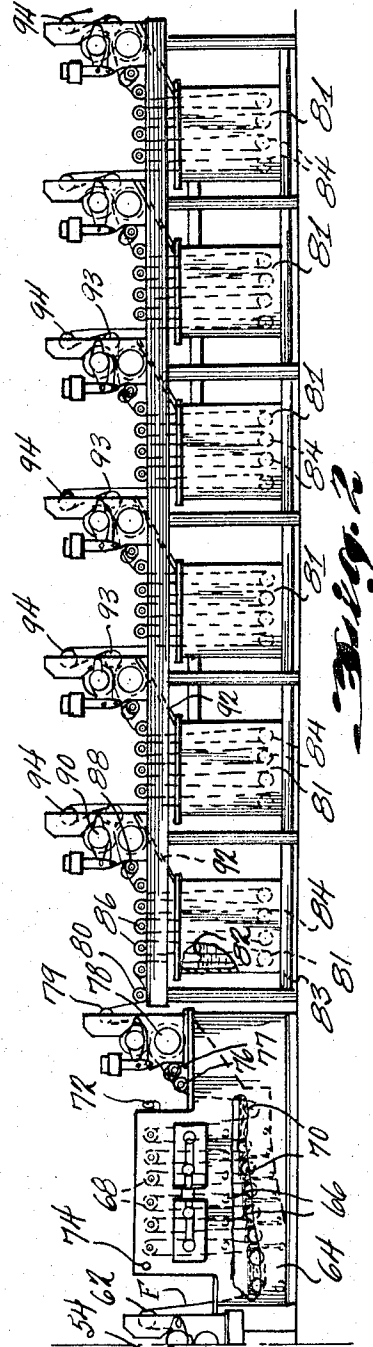
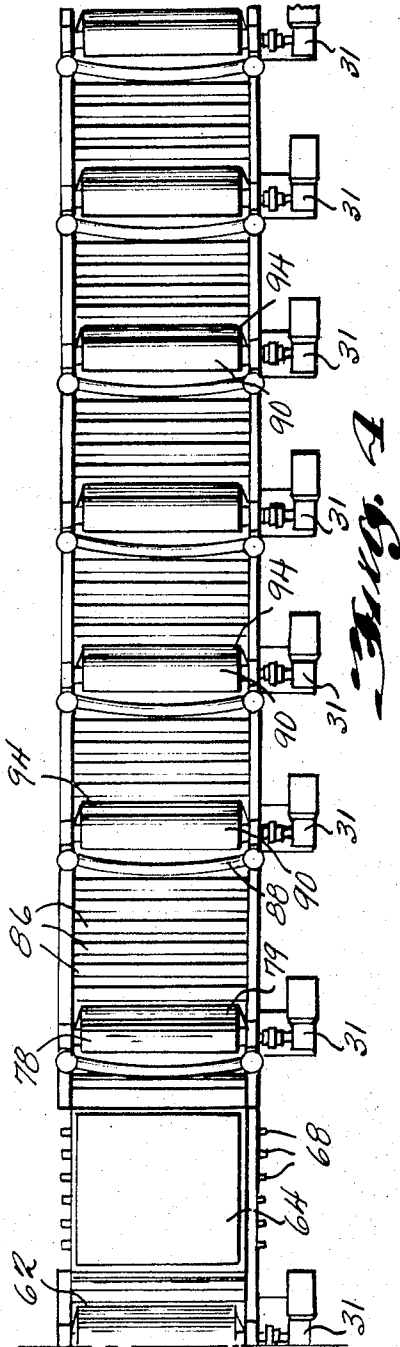
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Sheet 2 of 2



INVENTOR
JOHN R. SCHENCK

BY
Cushman, Darby & Cushman
ATTORNEYS

1

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TREATMENT OF TEXTILE FABRIC

John R. Schenck, Charlotte, N.C., assignor to Klopman Mills, Inc., Asheboro, N.C., a corporation of Delaware
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4 Claims

The present invention relates to a novel process and apparatus for continuously causticizing textile fabric. The invention is of particular significance in the treatment of woven fabric comprising blends of cotton and polyester textile material but other types of fabrics which are normally subjected to causticizing or mercerizing treatment may also be processed in the manner described herein.

Broadly stated, the invention involves successively impregnating the fabric with caustic soda solution and aerating the thus treated fabric after each impregnation, the fabric being held under warp tension throughout the impregnation and aeration. Surprisingly, it has been found that this sequence of operations makes it possible to very effectively causticize the fabric continuously and in a minimum length of time with optimum results.

The exact reasons for the improved results of the invention are not understood. However, it appears that the caustic soda in the fabric loses some of its strength during the subsequent aeration step through being converted to carbonate of soda by means of carbonic acid in the atmosphere. In any event, it is apparent that successive caustic soda treatments followed in each case by aerating, all while the fabric is under a constant amount of warp tension, create highly desirable effects on cotton/polyester blend fabrics and the like. These effects, both chemical and physical, remain on the fabric after neutralizing and subsequent steaming and/or washing.

The treatment of the invention is uniquely different from conventional cotton mercerizing or causticizing operations. In the past, mercerization has generally been carried out using so-called chain or expander mercerizers. With the chain mercerizers, the fabric is held under extreme filling tension (e.g. tensions of the order of 25% of the fabric break strength) by clips or the like attached to chains which are positioned along the edges of the fabric. Numerous problems are associated with the use of these chain mercerizers. For one thing, the caustic soda has an undesirable effect on the chains. Furthermore, the substantial tension in the filling direction is undesirable and it is difficult to insure width uniformity. Expander mercerizers also apply considerable filling tension on the fabric and suffer from lack of width uniformity and other disadvantages. Hence, it will be appreciated that there is considerable room in this highly developed field for improvements which will obviate the disadvantages encountered in prior procedures.

In contrast to the techniques conventionally employed in the past, the present invention eliminates the use of chains and requires only warp (lengthwise) tension during the caustic soda impregnations and aerating steps, with minimal fillingwise tension, sufficient only to keep the fabric free from creases (i.e. tension not in excess of 10-20 pounds outward thrust).

The various features of the present invention are more fully described below in conjunction with the accompanying drawings wherein:

FIGURE 1 is a diagrammatic view of part of the system contemplated herein for successively impregnating the fabric with caustic soda solution followed by aeration;

FIGURE 2 is a diagrammatic view of the balance of the system shown in FIGURE 1; and

FIGURES 3 and 4 are top views of the system shown in FIGURES 1 and 2, respectively.

Referring now more specifically to the system shown

2

in the accompanying drawings, fabric F which has been previously bone dried (i.e. dried to a moisture content below 5%, by means not shown) is fed to a first causticizing pan or tube 10 appropriately mounted on a metal supporting frame 11. Tub 10 may be made of mild steel or the like and is adapted to contain caustic soda solution supplied through an appropriate supply 12. The temperature and concentration of the solution in tub 10 and the other tubs hereinafter referred to can be widely varied but, generally speaking, the temperature of these solutions will be in the range of 100 to 110° F. and the caustic concentration will be about 20-25% by weight. Usually, the same temperature and concentration are used throughout the process although these can be varied as desired.

Within tub 10 there is provided a bottom horizontal row of rolls 13 positioned so that they are normally immersed in the caustic solution. Additionally, there is a top row of rolls 14 mounted on frame 11 so as to be either partially immersed in the liquid in tub 10 or just above the same.

As shown, the fabric F is alternatively passed over a top roll 14 and under a bottom roll 13 through tube 10 and then over a gently curved roller 16 (see especially FIGURE 3) which exerts just sufficient fillingwise tension to keep the fabric flat. From the roller 16, the fabric passes nip rollers 18 which are positioned just beyond roller 16. Liquid tapeup as a result of the caustic treatment in tank 10 will usually amount to from 175 to 185% by weight, based on the weight of dry fabric and the nip rollers 18 reduce the liquid content to 95 to 100% by weight. From these rollers 18, the fabric is passed under a guide roll 19 and then over another gently curved roller 20 which again serves to simply smooth out the fabric in the filling direction.

From the roller 20, the fabric is passed through the first aerating zone which comprises a plurality of rotatable cylinders or cans 22 mounted, as shown, on a vertical frame 24. As shown, this first aerating zone includes two vertical rows of six cans each with two intermediate horizontally disposed cans joining the top of the two rows. However, it will be recognized that more or less than this number of cans can be used, depending on the can size, to provide the necessary aerating time. Advantageously, cans 22 are conventional drying cans although, in the present case, the cans are not heated but simply serve to provide the necessary time for aerating the caustic treated fabric prior to the next immersion step. The aeration time may be varied but, generally speaking, will usually fall in the range of .13 to .23 minute from the exit of one immersion pan to the entrance of the next pan.

The fabric leaving the last can 22 is then fed through a second pan or tub 25 of mild steel or the like containing caustic as in the case of tub 10. The fabric is passed through tub 25 by means of top rolls 26 and bottom rolls 28 in the same manner as the first caustic treating tub 10 although tub 25 is desirably shorter in length than tub 10 so that the caustic treatment in tub 25 is shorter in time (e.g. about half) than the time for the first treatment. This is also preferably the case with respect to the caustic treatment following tub 25.

After the caustic treatment in tub 25, the fabric is passed through a series of curved expanders 30 suitably mounted on frame 11 and arranged as shown in FIGURE 1. These expanders may be driven by appropriate means, e.g. a right angle gear motor 31 as diagrammatically shown in FIGURE 3. Similar means may also be provided for driving the other rolls used herein as may be necessary. The expanders 30 continue to maintain the fabric in the flat condition with minimum fillingwise tension thereon. The warp tension on the fabric is maintained by means of the other rolls, e.g. the various sets of nip

rolls with appropriate compensating means to maintain this tension constant throughout.

Following the expanders 30, the smooth fabric is fed through another pair of adjustable nip rollers 32, under a guide roll 34, over another curved roll 36 and then into the second aerating zone comprising the timing cylinders or cans 37 arranged as shown in FIGURE 1 on a frame 38 and operating in the same manner as cans 22.

From this second series of cans 37, the fabric is again treated with caustic in the tub 39 in the manner previously described. As before, pan 39 includes the top and bottom rolls 40 and 41, respectively, and from the last roll 40, the fabric is fed over the curved expanders 42, through nip rolls 44, under guide roll 45, over the curved roll 46 and then through another series of aerating cans 48 after which the fabric is fed into a washing pan 50 filled with wash water by means not shown. From this initial wash, the fabric is passed through another series of expanders 52 to be sure the fabric is crease-free and then through nip rolls 54, all as in the manner heretofore described. It will be noted that the further caustic treatment in tub 39 and the water wash in tub 50 are again only about one half as long as the treatment in the initial tub 10 so that, in the embodiment shown, the total time of immersion in caustic in tubs 25 and 39 is equal to the time of the caustic treatment in the first tub 10.

As shown in FIGURE 1, angularly disposed trays 56 are provided between tubs 10, 25, 39 and 50 in a position to collect caustic which is removed by the nip rolls or otherwise comes off the fabric at any other time during passage between tubs. These trays are appropriately shaped as shown to direct the collected caustic back into the top of the preceding tub or the following one.

As noted earlier, caustic is fed to the tubs by means of conduit 12, the latter being supplied with caustic solution through an inlet 58. Appropriate valve means 59 are provided in the conduit, as necessary, to control the amount supplied to each tub.

A pan or the like designated at 60, is also provided for returning caustic from nip rolls 54 to the preliminary wash tub 50.

As shown in FIGURE 2, the fabric is passed from nip rolls 54 upwardly to a feed roll 62 and then downwardly into a combination steam and washer unit or caustic recuperator 64, where the fabric is alternately treated with steam and water flowing in a direction opposite to the fabric direction. Steam is sprayed into the unit at points 66 positioned between alternate passes of the fabric intermediate top rolls 68 and bottom rolls 70, the top rolls being driven. Steam at .1 to .2 p.s.i.g. is usually sufficient for this purpose and relief means 72 may be supplied to prevent pressure above a desired limit, e.g. 4 p.s.i.g. A vacuum breaker 74 may also be advantageously included in the system.

To provide the desired countercurrent flow of water, the water is fed into the unit 64 at the fabric outlet end and allowed to cascade downwardly as shown to the fabric entrance end of the unit where the water is withdrawn by appropriate means (not shown). The withdrawn water contains the caustic removed from the fabric and, if desired, may be recycled to one of the caustic tubs.

From the steam and washer unit 64, the fabric is drawn over a guide roll 76, the curved roll 77 to keep the fabric flat and nip rolls 78 and then fed by way of rolls 79 and 80 into the first of a series of wash tanks 81 containing water at an essentially constant level as shown at 82. Wash tank 81 may be suitably mounted on a metal supporting frame 83 and includes the lower set of rolls 84 immersed in the wash water. Upper rolls 86 are mounted on frame 83 and the fabric is passed back and forth between rolls 84 and 86 through tank 81. The thus washed cloth is fed over another curved fabric flattening roll 88 and then through the nip rolls 90, water removed by the rolls 90 being fed back into the vessel 81 by means of an appropriate drip plate 92. Washing of the fabric is then re-

peated several more times as indicated (five additional times being shown) using a wash system as just described. For convenience, the same numerals are used to identify the various elements of the further washing operations.

It is to be noted that the fabric leaving the wash nip rolls 90 passes under a roll 93 and then upwardly around a roll 94 before going into the next washing operation (or other treatment in the case of the last washing operation). Roll 93 may be used as a compensator to appropriately adjust the warp tension on the fabric if this is needed.

The fabric leaving the last pair of nip rolls 90 after the final wash is characterized by highly desirable physical and chemical properties as a result of the successive causticizing and aerating operations described above. If desired, the fabric may be taken from the last series of rolls and fed continuously into appropriate drying means and/or other operations, e.g. scutching and finishing. The present system, by virtue of the sequence of operations described herein lends itself to continuous operations for treating fabric from, for example, bleaching through drying, causticizing as described herein and finishing.

The present process and apparatus are especially useful in the treatment of woven fabric comprising polyester/cotton blends. Such fabric may comprise such blends in both warp and filling or, if desired, the blends may be used only in the filling or warp with 100% polyester or cotton in the other direction. Typical staple blends comprise 35-65% polyester and 65-35% cotton although other proportions may also be used. The polyester component may be conventional polyethylene terephthalate such as the products known as Dacron, Terylene, Fortrel or the like. Other cellulosic materials which may be suitably processed in the manner described herein are the spun rayons of the viscose and cuprammonium types, including the more recent high wet modulus rayons such as Moynel and Avril and the crosslinked rayon Corval.

Warp tension on the fabric processed in the manner described herein will usually fall in the range of 30 to 50 pounds. This tension is obtained by means of the various rolls used with whatever adjustment of the compensator means may be needed as the operation proceeds to keep the tension essentially constant throughout. Of the rolls referred to above, the driven rolls include all of the top rolls 14, 26 and 40 associated with the tubs 10, 25 and 39, respectively; the top rolls for the wash tub 50, steam and washer unit 64 and the several washing tanks 81; the several curved fabric straightening rollers; the top roll for each pair of nip rolls; and the various cans forming the several aerating zones.

The invention is illustrated further by reference to the following operating conditions using the system shown in the drawings for the treatment of a woven fabric comprising, per inch, 80 to 130 warp ends of 65% polyester and 35% cotton blends and 40 to 90 filling ends of 65% polyester and 35% cotton blends:

Caustic concentration

Tub 10	-----percent by weight--	20
Tub 25	-----do-----	20
Tub 39	-----do-----	20

Time of impregnation

Tub 10	-----minutes--	.10 to .17
Tub 25	-----do-----	.06 to .10
Tub 39	-----do-----	.06 to .10

Aerating time

From tub 10 to tub 25	-----minutes--	.13 to .23
From tub 25 to tub 30	-----do-----	.13 to .23
From tub 39 to tub 50	-----do-----	.13 to .23
Total aerating time	-----do-----	.39 to .69
Warp tension, total	-----pounds--	30 to 50
Filling tension (Only sufficient to avoid creases).		
Total treatment time (From entrance to first tub through final wash)	-----minutes--	1.50 to 2.60

5

It will be recognized that various modifications may be made in the invention as described above without deviating from the scopethereof as set forth in the following claims.

I claim:

1. A continuous process for causticizing a textile fabric containing cellulosic-linear polyester blends which comprises impregnating the fabric with aqueous caustic soda solution at a temperature between 100° and 110 °F., a plurality of times, and aerating the thus treated fabric after each said impregnation for .13 to .23 minute, maintaining said fabric under lengthwise tension throughout said impregnating and aerating steps with minimal widthwise tension sufficient only to keep the fabric smooth and wherein said fabric is washed, steamed and dried after said impregnating and aerating steps, all of said operations being carried out continuously.

2. The process of claim 1 wherein the fabric is completely dry prior to the first impregnating step.

6

3. The process of claim 2 wherein said fabric is woven.

4. The process of claim 2 wherein said fabric is a woven cotton/polyester blend.

References Cited

UNITED STATES PATENTS

1,577,393	3/1926	Voegeli	8—125
1,626,438	4/1927	Voegeli	8—125
1,717,870	6/1929	Bosshard	8—125
1,807,762	6/1931	Thies	8—125
1,980,498	1/1934	Nitsche	8—125
2,203,375	7/1940	Weiss	8—125

NORMAN G. TORCHIN, *Primary Examiner.*

J. CANNON, *Assistant Examiner.*

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8—151