Sept. 29, 1970 C. N. RABOLD 3,530,510

DURABLE PRESS PROCESS

Filed May 6, 1968 2 Sheets-Sheet 1

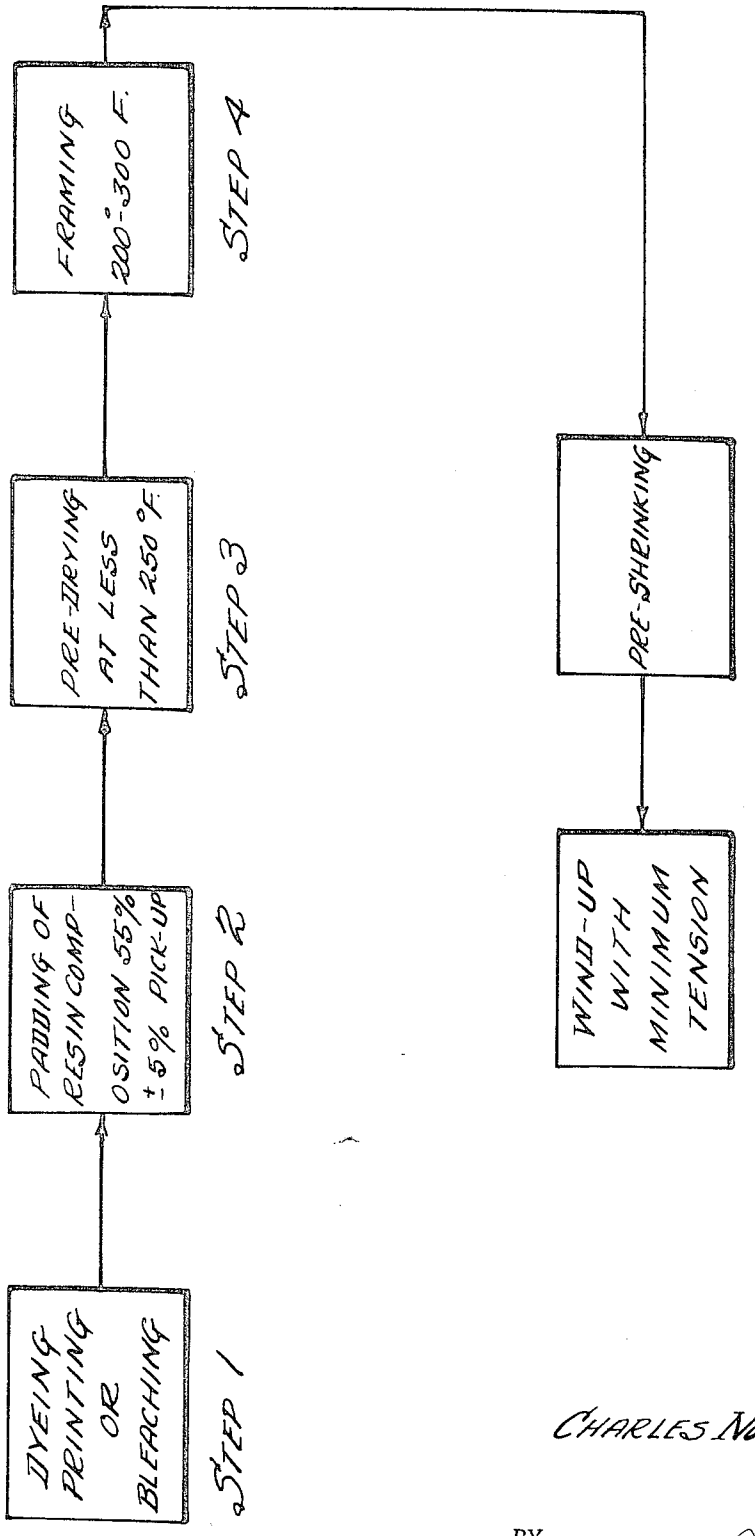


Fig. 1

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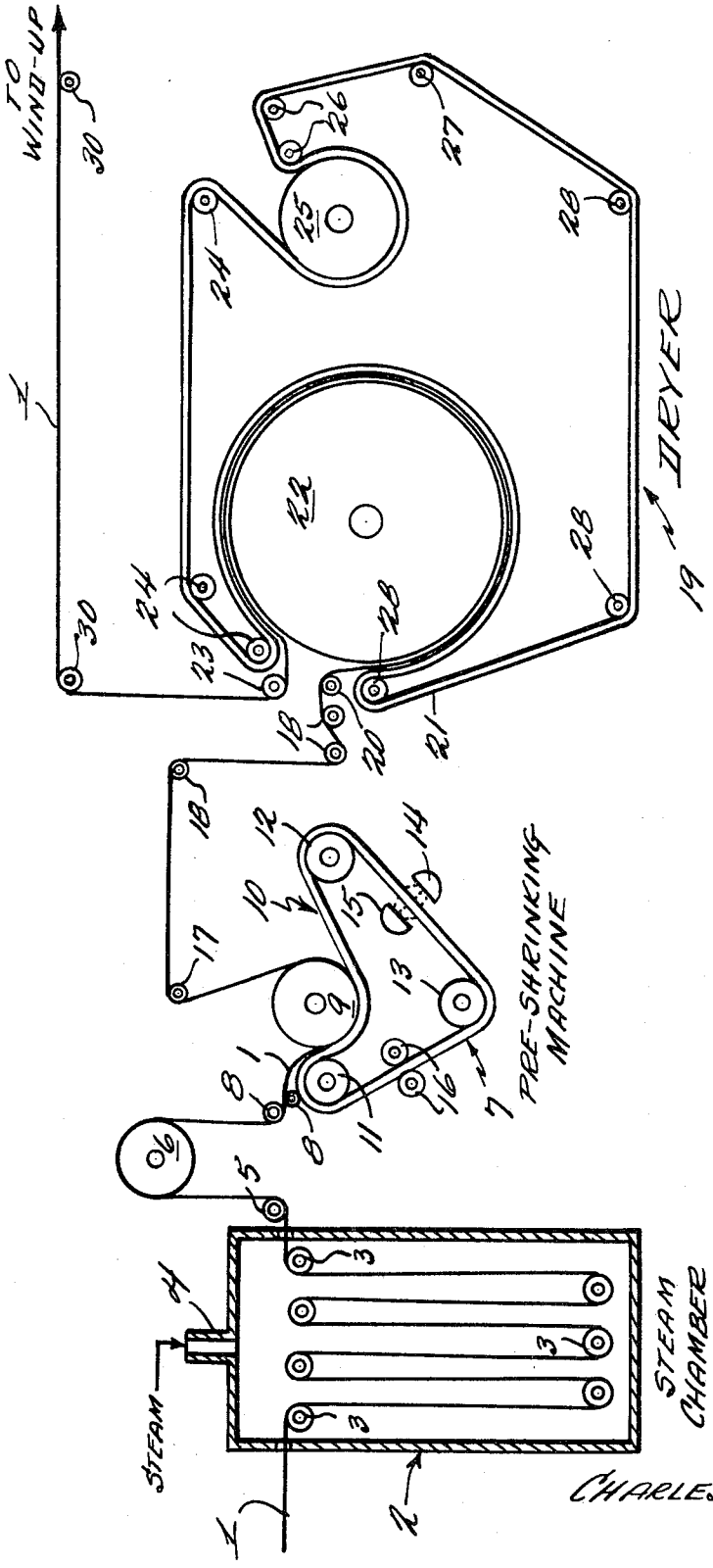


Fig. 2

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DURABLE PRESS PROCESS

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Continuation-in-part of application Ser. No. 400,878, Oct. 1, 1964. This application May 6, 1968, Ser. No. 726,730

Int. Cl. A41d

U.S. Cl. 2—243 7 Claims

ABSTRACT OF THE DISCLOSURE

Durable press cellulosic garments demonstrating controlled shrinkage in curing are obtained by padding the textile with a resin selected from the group consisting of methylated urons, lower alkylated carbamates and hydroxyl carbamates and hydroxy ethylene ureas and a catalyst therefor, drying the fabric by heating to a temperature up to 250° F., compressively shrinking the fabric at a temperature up to 350° F., then drying the fabric at a temperature up to 290° F., pressing and curing.

This application is a continuation-in-part of Ser. No. 400,878, filed Oct. 1, 1964, now abandoned, the subject matter of which is incorporated herein by reference.

The invention relates to a process for preparing cellulosic containing textiles which are characterized by their durable press or crease retention properties and wrinkle-free appearance even after repeated launderings and drycleanings.

The invention is applicable to cellulosic containing fabrics generally but it is of particular importance for use with woven fabric made up of mixtures or blends of cellulosic and man-made fibers, e.g., acetate, acrylic, polyester or polyamide fibers. The cellulosic fibers can be cotton, high modulus rayons, polynosic types or conventional rayon. Examples of fabrics suitable for treatment according to the invention are blends of polyester-cotton, polyester-rayon or tri-blends made up of polyester, cotton and rayon fibers in varying proportions. The fibers may be in either staple or filament form. Typically, a 50–50% blend of staple man-made fiber and cellulosic fiber for warp and filling has been found satisfactory for use in the present invention. However, other proportions may be used and, of course, the fabric may also be 100% cellulosic.

Durable press garments are conventionally made from textiles which have a curable resin finish applied thereto. After the resin treated textiles are formed into garments they are pressed and cured, either simultaneously or in sequence, to produce the desired crease retention garment. A disadvantage of the known procedures is that during the curing operation, considerable shrinkage takes place resulting in nonuniformity of garment sizes. Additionally, unattractive puckering of sewed seams often results from this shrinkage. Further shrinkage occurs when the garment is laundered by the consumer thus causing more additional size changes and accentuating the seam puckering to an unattractive degree.

It has been proposed to eliminate the above problems by pre-shrinking the resin treated fabric before garment formation so that the residual shrinkage in the fabric is less than 1%. However, this prior process suffers from the disadvantage that during the pre-shrinking operation the resin on the textile is cured to such an extent that when garments formed therefrom are subsequently pressed and cured, the crease retention properties produced thereby are considerably inferior to resin treated textiles which have not been pre-shrunk.

The principal object of the invention is to obviate the

prior art problems referred to above by pre-shrinking the resin-treated fabric in such a way that there is little or no curing of the resin until the garment is pressed and cured thus insuring a product of optimum crease retention properties with outstanding shrinkage control. Other objects will also be apparent from the following detailed description of the invention.

Broadly stated, the objects of the invention are realized by a process involving the steps of padding the cellulosic textile with an aqueous composition containing a curable resin selected from the group consisting of methylated urons, lower alkylated carbamates and hydroxyl carbamates and dihydroxy ethylene ureas (e.g. dimethylol ethylene urea), and a catalyst therefor; drying the fabric at a temperature below 250° F., compressively shrinking the fabric at a temperature up to 350° F. to a residual shrinkage of less than 1%, drying at a temperature up to 290° F., making a garment from the dried fabric, pressing and curing to obtain a durable press garment.

The process is illustrated in the accompanying drawings wherein FIG. 1 is a block diagram showing the various steps of the process prior to garment formation while FIG. 2 diagrammatically shows the pre-shrinking operation of the invention. Referring more particularly to the drawings, the fabric processed according to the invention may first be subjected to conventional dyeing, printing, bleaching and/or like operations as illustrated in step **1** (FIG. 1). The fabric is then padded with aqueous resin composition (step **2**) preferably using a pre-saturator and nip, followed by, for example, at least two dips and two nips on the pad. However, the resin composition may be applied on a conventional pad if time in the pad bath is sufficient to insure complete wetting out. The fabric should have a 55.0%±5.0% pick-up of resin composition based on the fabric weight. The fabric is then predried (step **3**) in a conventional manner by any suitable device such as cans, roller pre-dryers or infrared predryers. The temperature during drying should not be above 250° F.

The fabric is thereafter framed (step **4**) to proper width on a tender frame or equivalent device at a temperature from 200–300° F. As the fabric leaves the framing device it is preferably cooled to room temperature. The fabric moisture content at this stage should be within the range of 3.0%–5.0% by weight. The fabric, which may be doffed at this point on rolls for subsequent preshrinking or fed directly to the pre-shrinking stage (step **5**), has a residual shrinkage of from 3.0% to possibly as high as 8.0%, depending upon, for example, the fabric composition and other operating conditions. The preshrinking stage (step **5**) removes this residual shrinkage down to less than 1% after which the fabric is wound up at little or no tension (step **6**).

Referring to FIG. 2, the pre-shrinking (step **5**) comprises a steam chamber **2**, a pre-shrinking machine **7** and a dryer **19**. Since much of the general apparatus useful with the present invention is known in the art, it is shown diagrammatically for illustrative purposes. For a more detailed description of the general apparatus see U.S. Patents 2,082,981, 2,450,022, 2,721,370 and 3,277,552, which disclosures are hereby incorporated by reference.

The fabric **1**, enters steam chamber **2** and passes over idler rolls **3**. Steam enters the chamber at **4** in amounts and at pressures sufficient to plasticize the fabric, which amounts and pressures will depend on the particular fabric and are easily determinable by simple trial. The fabric then leaves the steam chamber **2** by idler roll **5** and passes around steam heated drum **6**. Steam is maintained in drum **6** up to 15 p.s.i. and preferably between 2.5–15 p.s.i. pressure (220–250° F.) in a conventional manner. The fabric thereafter passes between movable tension control rolls **8**

and is engaged between steam heated drum **9** and rubber belt **10**. The rubber belt **10** is pressed against drum **9** by roll **11**. During the travel around drum **9** the rubber belt **10** contracts and causes the fabric **1** to "compressively shrink" due to the frictional engagement of the rubber belt **10** with the fabric and the relatively frictionless engagement of the fabric with polished drum **9**. The fabric becomes disengaged after shrinking and the rubber belt **10** is passed over idler roll **12** and between cooling water sprays **14** and **15** whereby the temperature of the rubber belt is controlled. The wetted rubber belt passes over idler roll **13** and between wringer rolls **16** where the water adhering to the rubber belt is squeezed off before the belt again engages the fabric. After disengagement from the heated drum **9**, the fabric passes over idler rolls **17** through tension rolls **18** to dryer **19**. While any suitable dryer may be used, the preferred dryer is a felt belt or Palmer type dryer which is known in the art. The fabric **1** passes over a support bar **20**. It is very important that this support bar be rigged to support the fabric and deliver it as nearly as possible at a right angle to drum **22**. The fabric is engaged between porous felt belt **21** and steam heated drum **22** and is dried during the travel around drum **22**. The fabric is then disengaged and passed over idler roll **23** while the felt belt is passed over idler rolls **24** and around steam heated drum **25** where the felt belt is dried. The felt belt **21** is then returned via idler rolls **26** and **28** to further engagement with the incoming fabric. The correct tension in the felt belt is maintained by tension roll **27**. The thus pre-shrunken and dried fabric **1** is passed over idler rolls **30** to a conventional windup machine (not shown) at minimum tension (step **6** of FIG. 1).

In regard to the shrinking operation, it is important that the following conditions be strictly observed: the fabric must be fed into the steam chamber **2** with steam only, i.e. no cold water spray is used as in conventional shrinking operations; the drum **6** is heated interally with steam up to 15 p.s.i. and preferably between 2.5–15 p.s.i. pressure (220–250° F.) so that the steam plasticized fabric is further heated; polished drum **9** is heated internally with steam up to 120 p.s.i., preferably between 52 and 120 p.s.i. pressure (300–350° F.), the exact steam pressure employed depending on the fabric and the degree of compressive shrinkage desired; the support bar **20** should deliver the fabric as nearly as possible at a right angle to the drying drum **22**; and the drying drum **22** should have a steam pressure up to 43 p.s.i. and preferably between 8 p.s.i. and 43 p.s.i. steam pressure (235–290° F) therein.

It is important to the success of the invention to use specific types of resin composition, in conjunction with the other conditions outlined above, in order to avoid an undesired degree of pre-curing in the goods and to otherwise obtain the desired crease retention properties in the final product. The essential components of these compositions, which are used in aqueous form, are certain curable resins (or resin precondensates) and catalysts for curing the resin. The preferred resins contemplated for use herein are methylated urons (e.g. those available as "Karaset No. 2"), lower alkylated carbamates having up to four carbon atoms in the alkyl group or hydroxyl carbamates (such as "Karaset 1435") and dihydroxy ethylene ureas, typically dimethylol ethylene urea.

The catalyst employed is dependent on the resin used but any of a variety of catalysts can be used herein. Preferred catalyst/resin combinations are shown below:

Resin:	Catalyst
Methylated urons	Organic-metallic compounds (e.g. zinc or magnesium salt/amine mixtures).
Alkylated and hydroxyl carbamates	Zinc nitrate. Aluminum chloride. Acid metallic salts.
Dihydroxyl ethylene ureas	Zinc chloride.

The resin composition will usually also contain one or more suitable hand modifiers, many of which are known in the art. A preferred modifier is a fatty ester of low density polyethylene, such as "Sewsoft EJ," available from Synthron Inc., Ashton, R.I. Advantageously, the composition also contains a surfactant, such as a non-ionic ethylene oxide derivative. An example of such a surfactant is Dexopal 555 manufactured by the Dexter Chemical Co. However, other well known surfactants such as the "Tergitols" and "Tritons" may be used. Also, the composition may contain an abrasion resistance modifier such as an emulsion of polypropylene or high density polyethylene available as "Abrazade" from the Proctor Chemical Co., Salisbury, N.C. Hand builders may also be advantageously included in the resin composition and may be polyvinyl acetate emulsions, polyvinyl chloride, alkyd resins, polyvinyl alcohols, carboxymethyl-cellulose, starches, gums and acrylics. The acetates and acrylics are the preferred choices. A conventional masking agent may also be included in the composition.

While the proportions of the resins, catalysts, hand modifiers, surfactants, hand builders and abrasion resistant modifiers may be varied with considerable latitude, it has been found that the composition should be compounded with the ranges listed below in order to obtain the full benefit of the present invention.

COMPOSITION A

	Parts by weight
Methylated uron ("Karaset 2" 90% solids)	15–45
Organo-metallic catalyst ("Karaset 1" 30% solids)	5–25
Ethylene oxide surfactant ("Dexopal 555"), 70% solids)	0.5–4
Fatty ester of polyethylene ("Sewsoft EJ" 30% solids)	3–11
Polypropylene emulsion ("Abrazade" 30% solids)	.5–6

COMPOSITION B

	Parts by weight
Dimethylol ethylene urea	40–80
Zinc chloride	1–6
Fatty ester of polyethylene ("Sewsoft EJ" 30% solids)	2–8
Polypropylene emulsion ("Abrazade" 30% solids)	1–5
Emulsified polyvinyl acetate (50% solids)	1–6

COMPOSITION C

	Parts by weight
Methyl carbamate ("Karaset 1435" 90% solids)	30–70
Organo-metallic catalyst ("Karaset 1" 30% solids)	7–12
Fatty ester of polyethylene ("Sewsoft EJ" 30% solids)	.5–5
Polypropylene emulsion ("Abrazade" 30% solids)	.5–5
Emulsified polyvinyl acetate (50% solids)	2–8

The above compositions are advantageously prepared by mixing the components with water to provide a padding liquid of desired concentration. The amount of water used may vary widely, but generally will be about 1 to 4 parts water per part of added components.

The following examples illustrate the present invention without limiting the same.

EXAMPLE I

A fabric made of 50% cotton and 50% polyester in both warp and filling was mercerized and dyed a blue color in a conventional manner. Thereafter the fabric was padded to a 56% pickup with the composition noted below using a pre-saturator and a nip, followed by two dips and two nips. The padded fabric was dried on conventional drying cans at 200° F. and framed on a conventional tenter frame at 230° F. After framing, the fabric had a moisture content of 3.9%. The so treated fabric was

then passed into a pre-shrinking operation as illustrated by FIG. 2. The steam chamber was operated at 1 p.s.i. steam pressure, the drum **6** was operated at 9 p.s.i. steam pressure, and 65 ps.i. steam pressure was used on the polishing drum **9**. The drying drum was operated at approximately 15 p.s.i. steam pressure. After passing through the shrinking operation to a residual shrinkage of less than 1%, the fabric was wound on a roll at the minimum tension necessary for smooth winding. The composition of the padding solution was as follows:

Ingredients:	Parts by weight
Methylated uron (Karaset 2, 90% solids)	30
Organo-metallic catalyst (Karaset 1, 30% solids)	15
Ethylene oxide surfactant (Dexopal 555, 70% solids)	2
Fatty ester of polyethylene (Sewsoft EJ, 30% solids)	10

The above composition was mixed with water in a ratio of 1 part of the added components to 4 parts water, to make 250 gallons of liquid padding composition.

The fabric was made into a garment, pressed with steam in conventional manner and cured by heating at 340° F. for 15–20 minutes. The resulting product demonstrated outstanding crease retention with essentially no shrinkage occurring during curing thus permitting controlled sizing.

The garment was laundered five times in a conventional home washing machine, and showed a warp shrinkage of only .56%.

For comparison purposes, a garment was prepared in the same way except that the pre-shrinking step was omitted. In this case, there was considerable shrinkage during curing and the shrinkage after five launderings was 1.67% in the warp.

EXAMPLE II

The procedure of Example I was repeated using the following composition in the padding operation:

Ingredients:	Parts by weight
Dimethylol ethylene urea (45% solids)	60
Zinc chloride (25% solids)	13
Fatty ester of polyethylene (Sewsoft EJ, 30% solids)	5
Polypropylene emulsion (Abrazade 30% solids)	3
Emulsion of polyvinyl acetate (50% solids)	3

One part of the composition was mixed with 4 parts of water to make 250 gallons of padding liquid.

The fabric used in this example was made of 25% polyester yarn and 75% cotton yarn in both warp and filling. The fabric was dyed grey in a conventional dyeing operation. A sample of the fabric was taken after framing and another sample was taken after pre-shrinking. The two samples were pressed and cured and then tested. The results of the tests are shown below.

	After Framing		After Pre-shrinking	
	Warp	Filling	Warp	Filling
Tensile Strength, lb./in.²	86.3	54.0	92.0	58.3
Tear, grams	1,621	1,643	2,304	2,411
Flex abrasions, cycles	1,500+	1,500+	1,500+	1,500+
Angles of Recovery, degrees	148.3	160.7	130.3	169.7
Stretch Properties:				
Percent under 5 lbs. load for 30 minutes	1.3	4.4	6.9	7.5
Percent of stretch after load removal	100	100	100	100
Smoothness (modified overhead method AACTCC 88-A-1964):				
After 1 wash	4		4	
After 15 washes	4		4	
Crease retension:				
Afrer 1 wash	5		5	
After 15 washes	5		5	

The shrinkage of both samples was determined according to the Standard Sanforized Wash Test and the results are shown below.

	After Framing, percent		After Pre-shrinking, percent	
Number of Washes	Warp	Filling	Warp	Filling
1	2.50	0.56	0.00	0.00
5	3.61	0.56	0.00	0.75
10	3.61	0.47	0.09	0.56
15	4.17	0.56	0.28	0.28

From the above example, it can be seen that the physical properties of the fabric after pre-shrinking are significantly improved.

EXAMPLE III

The procedure and tests of Example II were repeated with a fabric made of 85% cotton and 15% nylon, warp and filling, using the following padding composition.

Ingredients:	Parts by weight
Methyl carbamate (Karaset 1435, 90% solids)	50
Organo-metallic catalyst (Karaset 1, 30% solids)	9
Fatty ester of polyethylene (Sewsoft EJ, 30% solids)	2
Polypropylene emulsion (Abrazade, 30% solids	9
Emulsified polyvinyl acetate (50% solids)	4

The results of the test are shown below.

	After Framing		After Pre-shrinking	
	Warp	Filling	Warp	Filling
Tensile Strength, lb./in.²	126.7	70.3	132.0	76.7
Tear, grams	2,048	1,600	2,389	1,941
Flex abrasions, cycles	1,500+	1,500+	1,500+	1,500+
Angles of recovery, degrees	140	153	141	163
Stretch properties:				
Percent strength under 5 lbs. load for 30 minutes	.6	3.8	8.1	3.8
Percent recovery of stretch after load removal	100.0	84.2	92.6	100.0
Smoothness (modified overhead method AACTCC 88-A-1964).				
After 1 wash	4		4	
After 15 washes	4		4	
Crease retension:				
After 1 wash	5		5	
After 15 washes	5		5	

The shrinkage of both samples was determined according to the Standard Sanforized Wash Test, and the results are shown below.

	After Framing, percent		After Pre-shrinking, percent	
Number of Washes	Warp	Filling	Warp	Filling
1	2.78	0.63	0.83	0.63
5	3.67	1.31	0.83	0.28
10	4.09	1.31	0.76	0.28
15	4.17	1.39	1.11	0.00

EXAMPLE IV

The procedure of Example I was repeated using fabric made of 50% polyester and 50% cotton in both warp and filling. The shrinkage of the fabric was determined by the Standard Sanforized Wash Test and the results are shown below.

	After Framing, percent		After Pre-shrinking, percent	
Number of Washes	Warp	Filling	Warp	Filling
1	2.50	0.00	0.00	0.63
5	3.60	0.28	0.76	0.20
10	3.67	0.63	0.83	0.09
15	3.33	0.28	0.56	0.28

It will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. A process for the production of durable press cellulosic containing textiles which have a residual shrinkage of less than 1% which comprises padding the textile with a resin selected from the group consisting of methylated urons, lower alkylated carbamates and hydroxyl carbamates and hydroxy ethylene ureas and a catalyst therefor, drying the textile to a moisture content of between 3 to 5% by weight by heating to a temperature up to 250 F., contacting the textile with steam to plasticize the textile, preheating the textile to between 220° 250° F., compressively shrinking the textile at a temperature between 300° F. and 350° F., then drying the textile at a temperature between 235° F. and 290° F., pressing and curing the textile.

2. The process of claim 1 wherein the padded textile has a 50–60% pickup of resin composition based on the textile.

3. The process of claim 1 wherein the textile is subjected to a dyeing, printing or bleaching operation prior to padding.

4. The process of claim 1 wherein the textile is framed at a temperature between 200 and 300° F. between the drying and compressive shrinking steps.

5. The process of claim 4 wherein the textile is wound up with minimum tension after the final drying and before pressing.

6. The process of claim 1 wherein the textile is made into a garment after the compressive shrinking but before pressing.

7. The product obtained by the process of claim 1.

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U.S. Cl. X.R.

38—144

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,530,510 Dated September 29, 1970

Inventor(s) C. N. Rabold

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, Example II, in the table at line 11, after "Percent" insert -- recovery--, so that the sentence reads: "Percent recovery of stretch after load removal".

Signed and sealed this 30th day of March 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

FORM PO-1050 (10-69)

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