Sept. 28, 1948. G. A. SCHREINER 2,450,022

CLOTH FINISHING

Filed Aug. 3, 1946 4 Sheets-Sheet 1

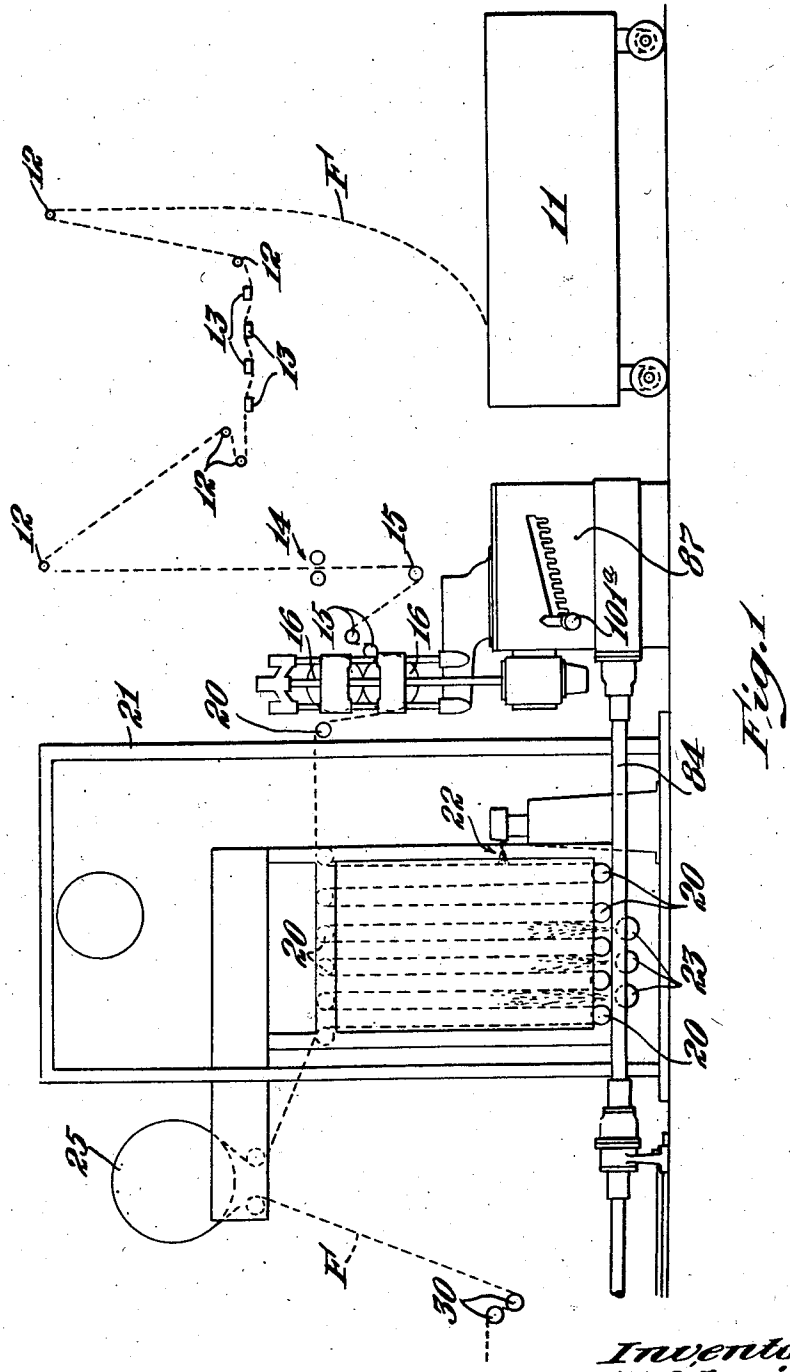


Fig. 1

Inventor
George A. Schreiner
by Pollock, Cushman & Goode
Att'ys.

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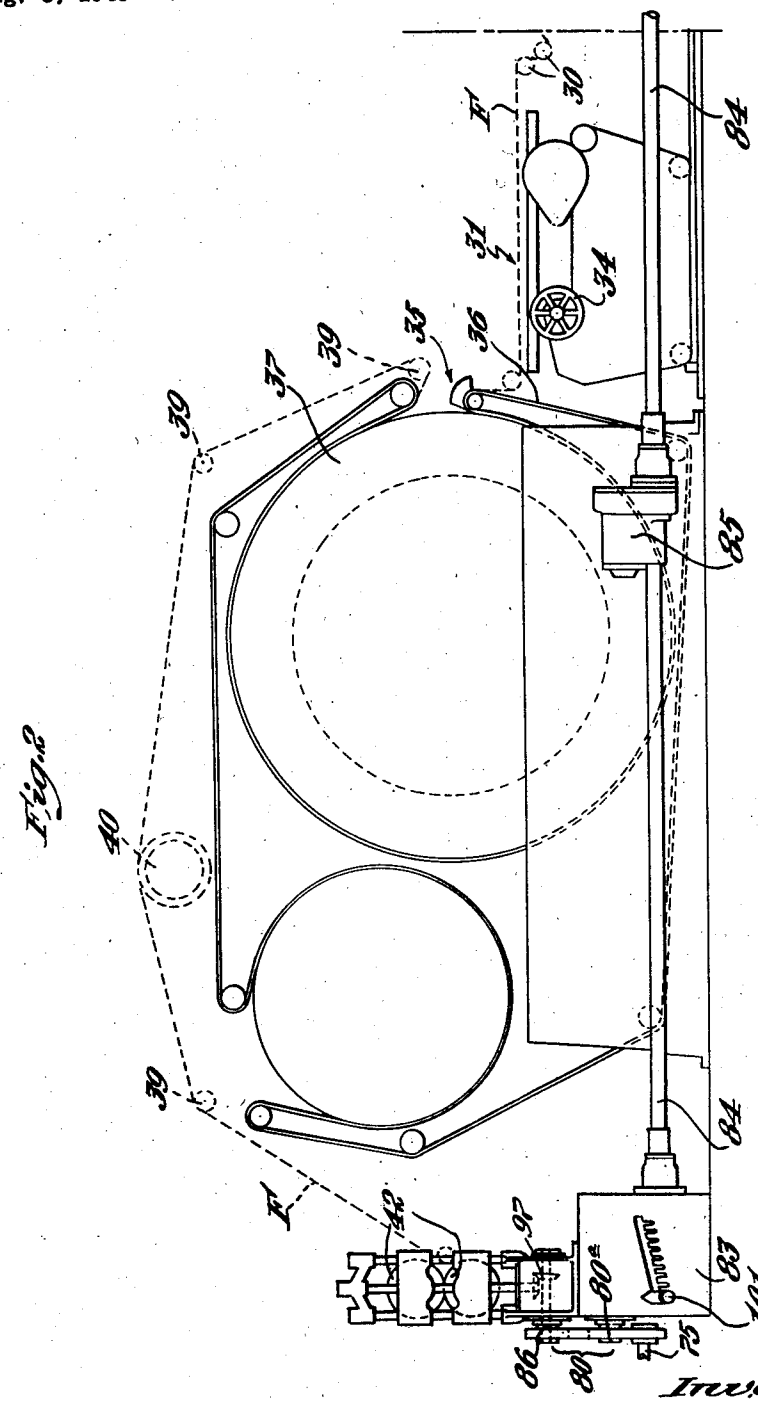


Fig. 2

Inventor
George A. Schreiner
by Pabst, Cushman & Glover
Attys.

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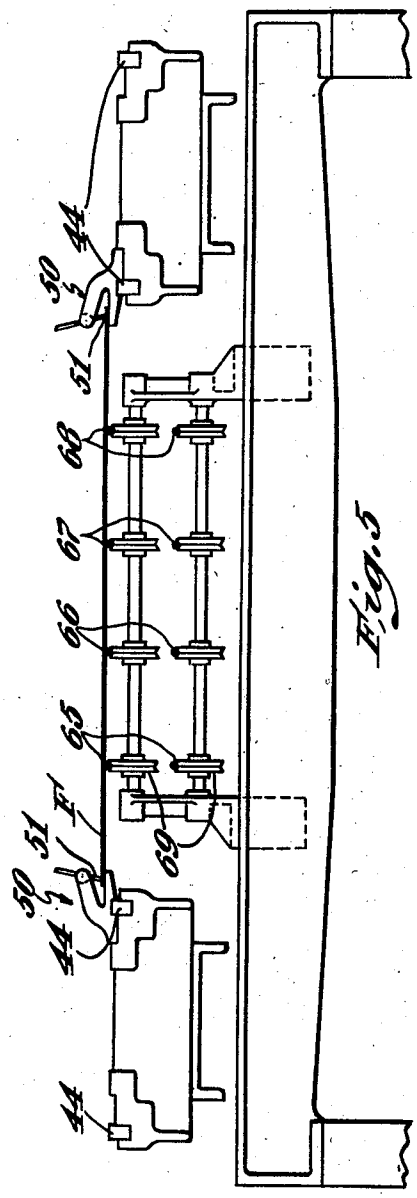


Fig. 5

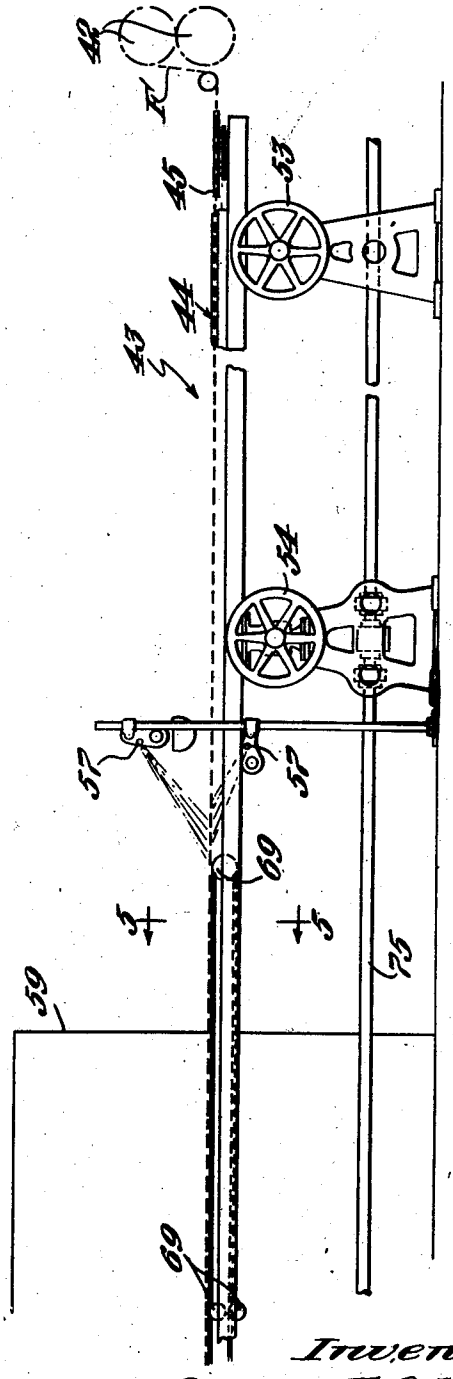


Fig. 3

Inventor
George A. Schreiner
by Roberts, Cushman & Grover
Attys.

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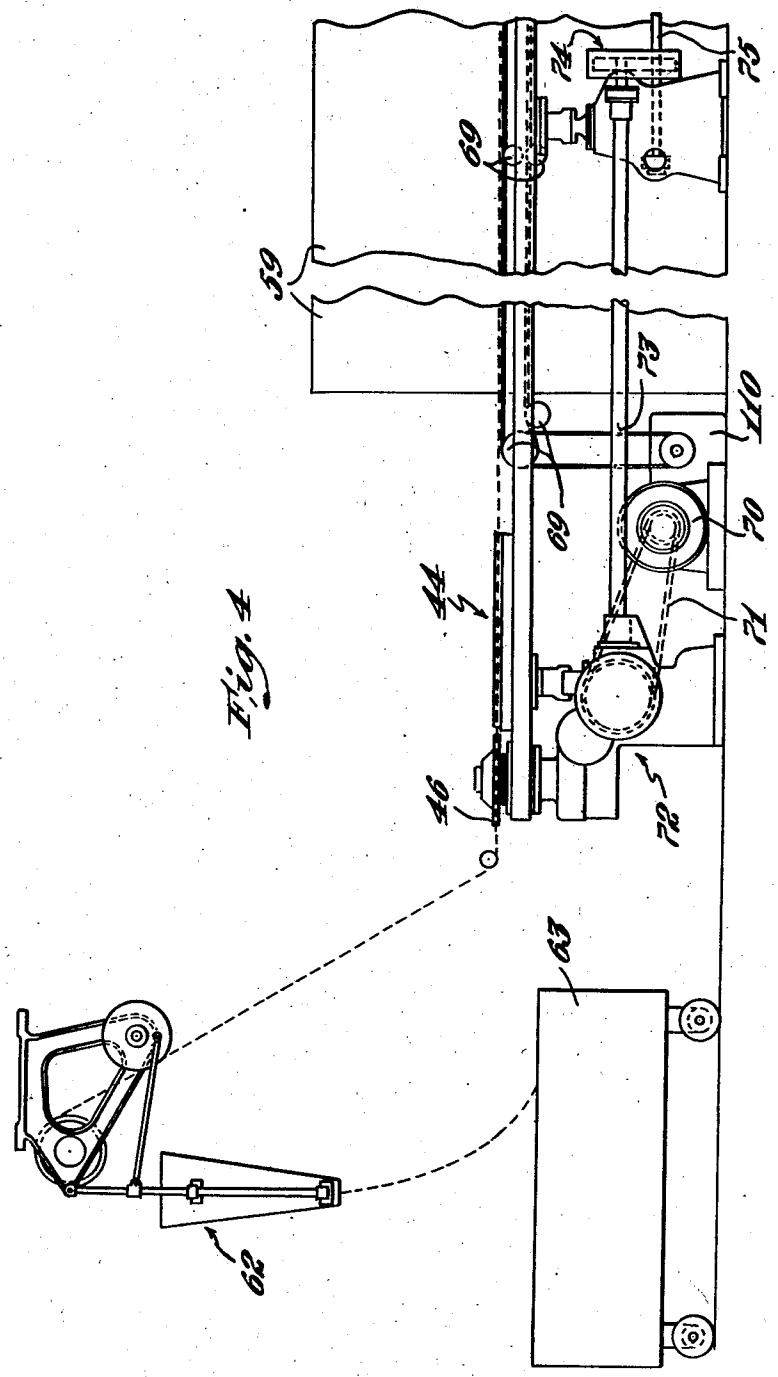


Fig. 4

Inventor
George A. Schreiner
by Roberts, Cushman & Grover
Atty's.

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UNITED STATES PATENT OFFICE

2,450,022

CLOTH FINISHING

George A. Schreiner, Troy, N. Y., assignor to Cluett, Peabody & Co., Inc., Troy, N. Y., a corporation of New York

Application August 3, 1946, Serial No. 688,239

7 Claims. (Cl. 26—18.6)

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This invention relates to cloth finishing and is an improvement on the compressive shrinking process of United States Patent No. 1,861,422 and an improvement on apparatus for practicing such process.

Some fabrics, especially fabrics of wool, synthetic fibers such as rayon, or mixtures containing either of these, acquire a glaze or a shine and a flattened or packed down surface in being compressively shrunk. This altered appearance has been a deterrent to the extensive use of compressive shrinking on fabrics made of these materials. This invention provides an improvement which facilitates removal of such glaze or shine and such flattened or packed down surface, and which in cooperation with the compressive shrinking operation delivers the fabric with the desired shrunken dimensions, and with the desired finish.

An object of this invention is to provide an improved method and apparatus for compressively shrinking fabrics including cottons, wool, synthetic fibers, and mixtures containing any of these materials; with which the potential shrinkage in a fabric of these materials may be reduced to a desired amount by compressive shrinking; with which such fabric may be shrunk as a continuous operation; with which the physical appearance of the shrunk fabric will be the same as before shrinking; with which the shrunk fabric will be free of glaze, shine and/or a flattened or packed down surface; with which a combination of existing types of apparatus may be used to practice the invention; and which will be relatively simple, effective and inexpensive.

Other features of advantage and utility will be apparent from this specification and its drawings wherein the invention is explained by the description and illustration of a preferred form thereof.

In the drawings:

Figs. 1, 2, 3 and 4 are diagrammatic side elevations of successive portions of the apparatus, in the order in which the fabric passes through the apparatus; and

Fig. 5 is a vertical transverse section on a larger scale, taken on the line 5—5 of Fig. 3.

The apparatus is shown in the drawings as arranged for the fabric to travel from right to left through the successive portions of the apparatus of Figs. 1, 2, 3 and 4 in this order.

In Fig. 1 the fabric F is shown as being drawn from a truck 11, around elevated rolls 12 and bars 13, through a guide 14, around further rolls 15, and around two rubber-covered positively

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driven nipping control rolls 16. the fabric passing through the nip of these rolls 16, 16.

After leaving the lower roll 16, the fabric is then guided around rolls 20 into, through, and out of a housing 21 in which the fabric is subjected to the action of a water spray 22 and steam sprays 23. The fabric may take various paths through the housing dependent upon the length of time during which it is desired to condition the fabric in the hot moist atmosphere of the housing, the path shown in Fig. 1 being a relatively long path employing all of the rolls 20. After emerging from the housing 21 the fabric may be further heated by passage around a steam heated cylinder 25.

In Fig. 2 the fabric F is shown as guided by rolls 30 to a clip expander 31 preferably constructed generally as described in United States Patent No. 2,082,981, wherein the fabric is gripped at its selvedges by traveling clips and stretched to a predetermined width. The clip expander may be provided with any suitable means such as a Schwarz or similar guider for automatically adjusting the width of its inlet end to the width of the fabric. A hand wheel 34 may be provided to adjust the width of the exit end of the clip expander.

The clip expander 31 discharges the fabric close to a compressive shrinking mechanism indicated by the reference character 35 operating according to the principle disclosed in United States Patent No. 1,861,422, and constructed generally as described in United States Patent No. 1,861,424. In this compressive shrinking mechanism contraction of the surface of a traveling blanket 36 is imparted to the moist fabric to shrink the fabric in length. A large steam heated drum 37 against which the fabric is pressed by the blanket dries the fabric in its shrunken condition. Leaving the compressive shrinking mechanism, the fabric is guided by rolls 39 and drum 40.

It will be understood that at this stage, fabrics of synthetic fibers such as rayon, or of wool, or of mixtures containing either of these, will have acquired a glaze or a shine and a flattened or packed down surface as a result of passage around the hot metal drum 37 of the compressive shrinking mechanism. When fabrics of these classes emerge from the compressive shrinking mechanism, compressively shrunk to a predetermined residual shrinkage (for instance to a residual shrinkage of zero or thereabout), these fabrics may tend to elongate to a greater or lesser extent, if subjected to tension or moistening. The succeeding portion of the apparatus and its opera-

tion in conjunction with the apparatus thus far described facilitates removal of the glaze or shine and flattened or packed down surface, while at the same time controlling the fabric so as to permit it to be delivered with predetermined dimensions and in a predetermined condition as to residual shrinkage.

From the compressive shrinking mechanism of Fig. 2 the fabric passes around two rubber covered positively-driven nipping control rolls **42** shown at the left of Fig. 2 and again indicated at the right of Fig. 3, passing through the nip of these rolls, and thence into a clip tenter **43**, for example 90 feet in length. As shown in Figs. 3, 4, and 5, this clip tenter has the usual two clip-carrying chains indicated diagramatically at **44**, each of which travels in an endless path around sprockets **45** and **46**, the sprockets **45** and **46** for the nearer chain being shown in Figs. 3 and 4. The inner runs of the two chains **44** are suitably spaced to receive the fabric F between them, as indicated in Fig. 5. Clips **50** carried by the chains are provided with the usual pivoted gates **51** adapted to close upon and grip the selvedge of the fabric. It is preferred to grip the fabric in this way by means of clips, which avoids the puncturing of the fabric which occurs in tenters of the pin type. The two tenter chains are adjustable to various distances between their inner runs, in the usual manner, as by handwheels **53** and **54**, to accommodate fabrics of different widths, and also to vary the extent, if any, to which the fabric is widened by divergence of the chains.

The fabric may be made to emerge from the compressive shrinking mechanism with any desired width, which may, for instance, be a width corresponding to any desired widthwise residual shrinkage. The longitudinal tension with which the fabric is led away from the compressive shrinking mechanism may cause some narrowing of the fabric from this desired width. Also, near the point where the tenter chains receive the fabric, the selvedges of the fabric may draw slightly nearer together than the actual width of the fabric. Thus the two sets of traveling tenter clips at opposite sides of the tenter may initially receive the fabric when they are spaced widthwise a distance less than the desired finished width of the fabric, and may then diverge sufficiently to bring the fabric to such desired width.

In the first section of the tenter extending up to the handwheel **54**, the fabric, in a dry state, is gripped by the tenter clips and, as indicated above, the clips may somewhat widen the fabric, to restore it to a desired width. Thereafter, in succeeding sections of the tenter, there will ordinarily be no further widening of the fabric, and the operation of the tenter will be to remove the glaze or shine and the flattened or packed down surface from the fabric, and to set the fabric in the dimensions, lengthwise and widthwise, in which it is held by the tenter clips.

The fabric, after leaving the first section of the tenter, is carried past one or more water sprays **57**, and thence through a heated drier housing **59** which occupies the main part of the length of the tenter and extends close to the exit end of the tenter. The fabric is delivered from the exit end of the tenter, set in its final dimensions, and with its former glaze or shine and flattened or packed down surface removed. A folder **62** may be employed to distribute the fabric into a suitable truck **63**.

During the time that the fabric in the tenter is moist, it is supported from beneath by a suitable traveling support, and thus prevented from sagging between the tenter chains and becoming enlarged. In Fig. 5 such movable support is shown as comprising a series of endless rubber belts **65**, **66**, **67** and **68**, of which the upper run of each belt supports the traveling fabric from beneath. The belts **65**, **66**, **67** and **68** are supported in both their upper runs and their lower runs by suitable pulleys **69**, at appropriate intervals along the tenter.

The whole apparatus is shown as driven from a single source of power, which may, for example, be an electric motor **70**, Fig. 4, connected by a chain drive **71** to gearing indicated generally at **72** which drives the tenter sprockets **46**.

Gearing **72** also drives a short longitudinal shaft **73** which is geared at **74** to a further longitudinal shaft **75** extending to the entering end of the tenter. At the entering end of the tenter the two rubber-covered control rolls **42**, **42** are driven from shaft **75** in synchronism with the tenter and preferably at the same surface speed as the tenter by geared connections indicated diagrammatically at **80**. This portion of the apparatus may include the general type of change speed gear connections shown in Figs. 4 and 6 of United States Patent No. 2,037,676, indicated herein as contained in a gear casing **83**. A horizontal shaft which carries a bevel gear **97** serving to drive the control rolls is indicated in this application, as in said patent, by the reference character **86**, but is herein shown as driven by the previously mentioned geared connections **80** from shaft **75**, so that the speed of control rolls **42**, **42** is the same as that of the tenter chains and is unaffected by adjustments of the set of change speed gearing within casing **83**.

A set of change speed gearing such as shown in Figs. 4, 5 and 6 of Patent No. 2,037,676 is included in the casing **83** (Fig. 2), this gearing being controlled by a handle **101** and having the effect of establishing predetermined speed ratios between the shaft **75** (and the rolls **42**, **42** which are driven thereby) and a further shaft **84** which drives the compressive shrinking mechanism and preceding control rolls **16**, **16**.

Shaft **80a**, corresponding to the shaft of the same number in Fig. 4 of Patent No. 2,037,676, rather than being driven by the set of changeable gears as in said patent, here serves to drive such set of changeable gears, and this shaft **80a** is itself driven by the previously mentioned geared connections **80** from shaft **75**. The shaft **84**, occupying the position of the shaft **30** of Figs. 4 and 6 of Patent No. 2,037,676, but here driven by the set of changeable gears rather than driving such set of changeable gears, extends out the right end of casing **83**, as indicated in Fig. 2. Thus, changes of the setting of the gear handle **101** alter the speed of shaft **84** but leave the speed of control rolls **42**, **42** constant.

The large drum **37** of the compressive shrinking mechanism is driven by suitable connections, indicated diagrammatically at **85**, from shaft **84**.

Control rolls **16**, **16** at the entering end of the apparatus are driven from shaft **84** through a further set of change speed gearing within a casing **87**, this gearing being under the control of a handle **101a** and having the effect of establishing predetermined speed ratios between the compressive shrinking mechanism, control rolls **42**, **42** and tenter chains **44**, **44**, on the one hand, and the control rolls **16**, **16** on the other hand.

The relations between the speeds of the various portions of the apparatus, as determined by the

two sets of change speed gearing in casings 83 and 87 will, in operation, ordinarily be as follows:

The tenter chains and the control rolls 42, 42 at the entrance to the tenter, operate at a constant speed.

The belts 65, 66, 67 and 68 are driven through any suitable adjustable speed gearing such as a Reeves drive indicated at 110, Fig. 4. Ordinarily the adjustable speed gearing 110 will be adjusted to cause the speed of the belts to equal the speed of the tenter chains.

The control rolls 16, 16 at the entering end of the apparatus operate at a speed which is greater than that of the tenter, the ratio of the speed of the tenter to the speed of these rolls 16, 16 representing the ratio of length of fabric leaving the apparatus to length of fabric entering the apparatus.

The drum 37 of the compressive shrinking apparatus operates at a speed somewhat less than that of the tenter, thus shrinking the fabric to a somewhat shorter length than the fabric will have when it is subsequently received by the tenter.

The speeds of the compressive shrinking apparatus and the rolls 16, 16 are regulated as a unit with respect to the speed of the tenter by means of the set of change speed gearing in casing 83.

The speed of the rolls 16, 16 is regulated with respect to the speed of the compressive shrinking apparatus and the speed of the tenter by means of the set of change speed gearing in casing 87.

While reference has been made to the sets of change speed gears in casings 83 and 87 as regulating the speeds of the several parts of the apparatus, the various settings of these gears are for convenience preferably marked in terms of inches per yard of gain and shrinkage. Thus when the gears of casing 87 are set for 4" per yard shrinkage and the gears of casing 83 are set for 3" per yard gain, each yard of fabric entering the rolls 16, 16 will emerge from the compressive shrinking apparatus with a length of 32" and will enter the tenter with a length of 35".

In operation of the apparatus, the running fabric acquires a predetermined constant width in the clip expander 31, following which the compressive shrinking apparatus shrinks the fabric lengthwise to a predetermined proportion of the length which the fabric had when it passed the control rolls 16, 16, for example to a length of 32". Such length which the fabric has when it emerges from the compressive shrinking apparatus will not ordinarily be the ultimately desired length of the finished fabric but rather a transient somewhat overshrunk length.

Conveyance of the longitudinally shrunk fabric from the drum 37 to the control rolls 42, 42 at the entrance to the tenter then stretches the fabric lengthwise and delivers the fabric to the tenter in the ultimately desired correctly shrunk length. The stretching to which the shrunk fabric is subjected in passing between the drum 37 and control rolls 42, 42, is of assistance in causing the fabric to resist elongating or developing slackness during its passage in its desired correctly shrunk length from the rolls 42, 42 into the tenter.

While gripped at its selvedges by the tenter clips and supported from beneath by the traveling belts 65, 66, 67 and 68, the fabric first absorbs moisture delivered to one or both sides of the fabric by the water spray or sprays 57, and then is dried by the heat within the housing 59. Although the tendency of moistening is to cause elongation and sagging of shrunk fabrics containing wool or rayon, the manner in which the fabric is held and supported in the tenter until dry prevents dimensional change in the fabric during this moistening stage of the present process. The moistening and drying removes the glaze or shine and flattened or packed down surface effects which the fabric has acquired in the compressive shrinking apparatus, and the fabric is delivered by the tenter with a natural unsmoothed or unpolished finish and predetermined desired shrunken dimensions.

It will be observed from the foregoing that the fabric is first subjected to a typical compressive shrinking operation, by which the fabric is shrunk lengthwise by an amount which is substantial and in known excess of the amount required to bring the fabric to the net potential shrinkage that one desires eventually to leave in the fabric. The fabric, as shown in Fig. 2, after it leaves the blanket 36 at the first roller 39 of the compressive shrinking machine is conducted to the feed rolls 42 which operate at a rate slightly faster than the rate at which the fabric is delivered to the first roller 39, and because of this the fabric F between the first roll 39 and the rolls 42 is stretched lengthwise. The relative rate of travel of the feed rolls 42 is so selected that it will give the desired elongation or stretch of the fabric that has been previously overshrunk. This elongation should be in an amount approximately equal to said excess of compressive shrinking, which restores the shrunk and now tensioned fabric to that potential shrinkage which is desired for the final fabric. The fabric then is immediately delivered by the said rollers 42, as shown in Fig. 3, to the clip tenter machine, the receiving end of which is preferably close to the feed rolls 42.

The result is that the fabric, which is under lengthwise tension and still somewhat elastic as it leaves the feed rolls 42, is delivered under tension to the entrance end of the tenter machine where it is gripped by the clips and held in lengthwise tensioned condition as it travels through that machine. The fabric is pulled to its desired width in the tenter machine by the time it reaches the section controlled by the hand wheel 54 and during the remainder of its travel in the tenter machine, the fabric is moistened, such as by steaming or spraying it with water by the devices 57, and the moistened fabric is carried through the housing 59 in which it is air dried. When the fabric is discharged from the tentering machine, there are no forces acting thereon and tending to cause either tensioning or shrinking, and the fabric is folded into the container 63 without being stretched greatly.

It will be noted that it is necessary that the fabric be under tension as it passes into the tenter machine, so as to feed properly under the gates or clamps, in order that it will remain taut or under tension lengthwise until clamped, otherwise the fabric may be wrinkled or pleated while being clamped and thus present an undesirable and unfinished appearance. The moistening and subsequent air drying of the tentered fabric effectively removes the glaze, shine and flattened or packed down surface which was imparted thereto in the compressive shrinking operation, and hence fabric treated in accordance with this invention leaves the machine with its physical appearance unaffected by the shrinking opera-

tion, yet the potential shrinkage of the fabric has been substantially reduced to the desired extent for which the apparatus is set.

The overshrinking by the compressive shrinking operation should preferably be a known amount, and the subsequent stretch should be a known amount in order that the fabric leaving the entire machine after treatment will have the net potential shrinkage which is desired. In other words, in accordance with this invention this type of fabric is first compressively overshrunk a known amount, then stretched a known and lesser amount in order to have a predetermined net potential shrinkage remaining therein, and then this tensioned fabric is held under tension as it is engaged by the clips in the tenter machine, so that the shrunk fabric will be held in that degree of stretch or tension while the fabric is first moistened and then air dried to remove the glaze, shine or packed down appearance. While this invention makes it practical to compressively shrink fabrics formed of wool, synthetic fibers and blends containing either of these and obtain a treated fabric which is free of shine, glaze or packed down appearance, the invention is also useful in treating some cotton goods particularly with certain colors on which a shine or glaze is objectionable. For example, the herringbone twills, particularly colors such as blue or black, have been difficult to compressively shrink without an objectionable shine or glaze, but, for other cotton goods the public sometimes prefer the glaze or shine which is imparted in the compressive shrinking operation. Where the glaze or shine is not desired, the advantages of the compressively shrunk treatment are possible without alteration of the physical appearance of the fabric.

I claim:

1. Apparatus for finishing fabrics comprising in combination mechanism for compressively shrinking the fabric in length, a tenter arranged to receive the fabric shrunk by the compressive shrinking mechanism, the tenter including means for moistening and drying the fabric, a set of nipping rolls adapted to receive the fabric passing from the compressive shrinking mechanism to the tenter, and means for varying the ratio between the speeds of the tenter and the said set of nipping rolls on the one hand and the compressive shrinking mechanism on the other hand.

2. Apparatus for finishing fabrics comprising in combination mechanism for compressively shrinking the fabric in length, the tenter arranged to receive the fabric shrunk by the compressive shrinking mechanism, while the fabric is under lengthwise tension, the tenter including means for moistening and drying the fabric, a set of nipping rolls adapted to receive the fabric passing from the compressive shrinking mechanism to the tenter, and means for varying the ratio between the speeds of the tenter and the said set of nipping rolls on the one hand and the compressive shrinking mechanism on the other hand.

3. The method of compressively shrinking a fabric formed of materials such as cotton, wool, synthetic fibers, and blends containing any of these, without altering the physical appearance of the fabric, which comprises compressively shrinking said fabric to a shorter lengthwise state than corresponds to the final desired lengthwise residual shrinkage potential of the fabric, then stretching the shrunk fabric sufficiently to bring the fabric to a lengthwise state corresponding to said final desired shrinkage potential and place the fabric under lengthwise tension, immediately tentering said stretched fabric while it is still under tension, moistening the tensioned fabric while tentered and then air-drying the moistened fabric while still tentered and remaining flat.

4. The method of compressively shrinking a fabric formed of materials such as cotton, wool, synthetic fibers, and blends containing any of these, without altering the physical appearance of the fabric, which comprises compressively shrinking said fabric a known excess amount greater than desired finally for the fabric, then tensioning the shrunk fabric sufficiently to remove such excess compressive shrinking, clamping the tensioned fabric along its selvedges while said fabric is under tension, leaving both faces of the fabric largely exposed to the air, moistening the clamped and tensioned fabric, and then air drying the moistened fabric while it is still clamped.

5. The method of compressively shrinking a fabric formed of materials such as cotton, wool, synthetic fibers, and blends containing any of these, without altering the physical appearance of the fabric, which comprises compressively shrinking said fabric in a moist condition to a shorter lengthwise state than corresponds to the final desired lengthwise residual shrinkage potential of the fabric, drying the shrunk fabric in such lengthwise state, stretching the shrunk and dried fabric under lengthwise tension to a lengthwise state corresponding to said final desired shrinkage potential, thereby enhancing resistance of the shrunk fabric to further elongation, immediately tentering said shrunk, dried and stretched fabric while at such stretched length, widening the fabric, while tentered, to bring the fabric to the final desired widthwise dimension, moistening the fabric while tentered and then air-drying the fabric while still tentered and remaining flat.

6. Apparatus for compressively shrinking a fabric formed of materials such as cotton, wool, synthetic fibers, and blends containing any of these, without altering the physical appearance of the fabric which comprises means for compressively shrinking said fabric progressively along its length to a shorter lengthwise state than corresponds to the final desired lengthwise shrinkage potential of the fabric, means for stretching the fabric under lengthwise tension, progressively as it leaves said shrinking means, sufficiently to bring the fabric to a lengthwise state corresponding to said final desired shrinkage potential, tentering means immediately receiving and clamping the stretched fabric while it remains under lengthwise tension, means for moistening the fabric while tentered and while remaining under tension in said tentering means, and means for air drying the moistened fabric while it remains clamped in said tentering means.

7. Apparatus for compressively shrinking a fabric formed of materials such as cotton, wool, synthetic fibers, and blends containing any of these, without altering the physical appearance of the fabric which comprises means for compressively shrinking said fabric progressively along its length to a shorter lengthwise state than corresponds to the final desired lengthwise shrinkage potential of the fabric, means for stretching the fabric under lengthwise tension, progressively as it leaves said shrinking means, sufficiently to bring the fabric to a lengthwise state corresponding to said final desired shrinkage potential, tentering means immediately receiving the stretched fabric and

clamping it under lengthwise tension, means for moistening the fabric while tentered and while remaining lengthwise taut in said tentering means, and means for air drying the moistened fabric while it remains clamped in said tentering means, and means for locally supporting the fabric, from said moistening means onward substantially throughout subsequent travel of the fabric through said tentering means, at least at one intermediate point across the width of the fabric, leaving both faces of the fabric largely exposed to the air.

GEORGE A. SCHREINER.

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