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FABRIC FINISHING METHOD

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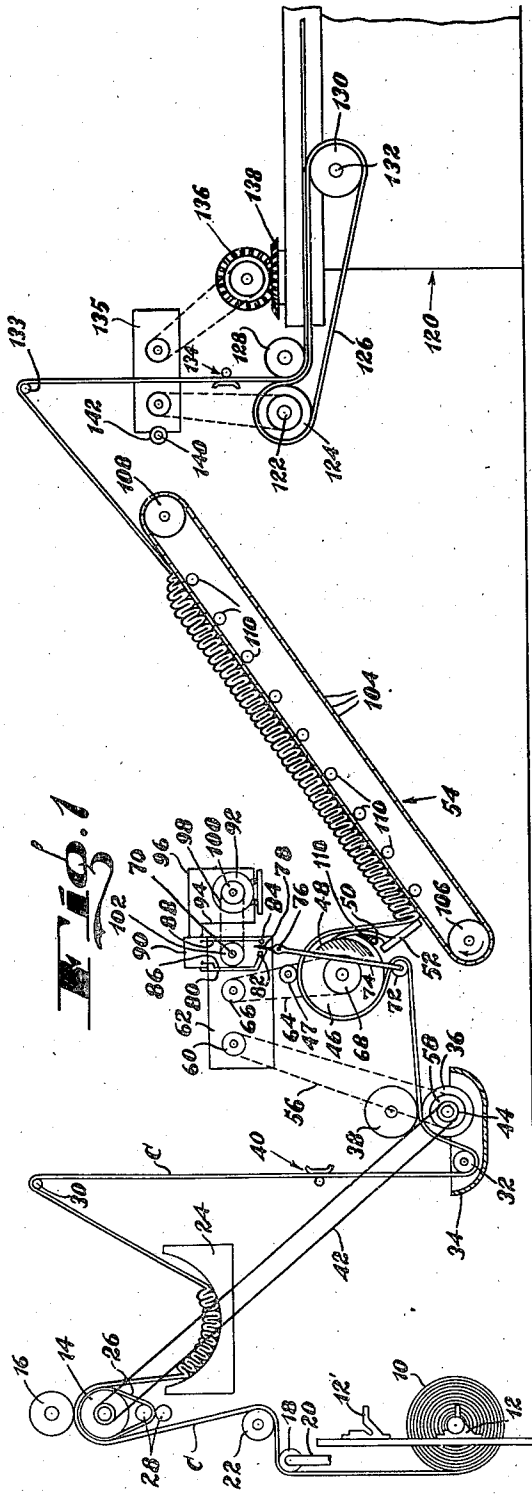

Fig. 1

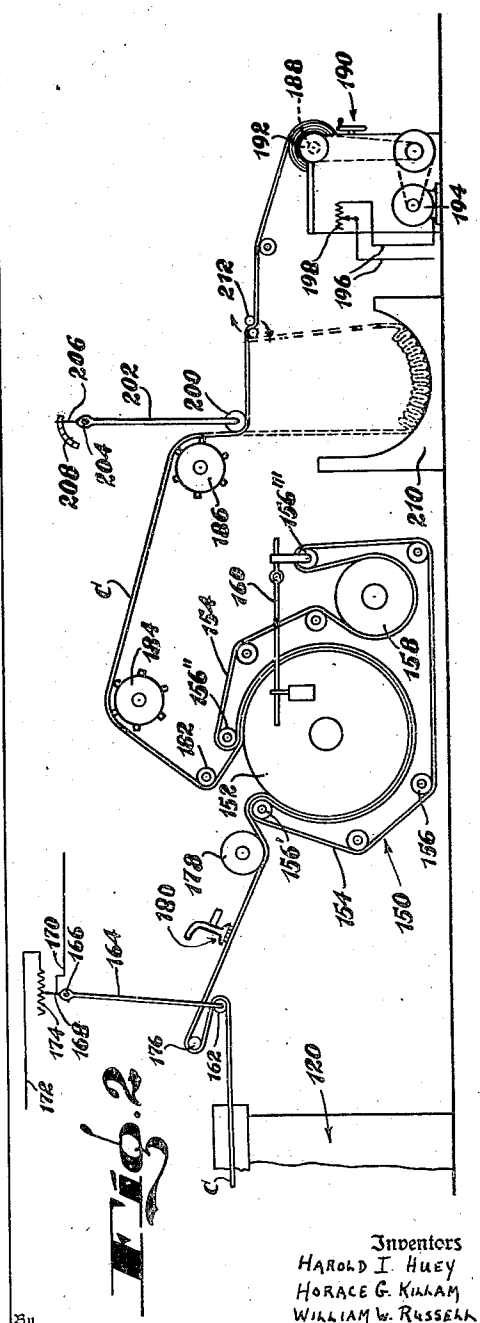

Fig. 2

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FABRIC FINISHING METHOD

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This invention relates to methods for treating cloth, and more particularly to methods for imparting a smooth, pre-shrunk finish to cotton cloth.

In the past, much difficulty has been experienced in providing cotton cloth with a smooth, stable, pre-shrunk finish. During the finishing operations, the cloth is subjected to severe warpwise tension which, if not counteracted in some manner, leaves the goods in a stretched condition in which they will shrink substantially on laundering and are therefore not satisfactory for many uses. To avoid this condition it has been a common practice to subject the cloth to a final finishing operation in which it is mechanically compressed warpwise and is smoothed in a compressed state. In this manner, the cloth may be shortened in the warpwise direction from 6 to 12% and rendered substantially non-shrinkable in laundering. But such artificial shrinkage, unlike the natural shrinkage which results when cotton cloth is wet and slack dried, leaves the cloth in an unstable condition in that it is readily subject to permanent distortion in normal handling, as in cutting up or laundering.

An object of this invention is to provide a novel method for finishing cotton cloth whereby the cloth is finished in a stable condition in which it is not subject to appreciable distortions. A further object is to provide such a method which imparts a smooth finish to the cloth. Another object is to provide such a method wherein the cloth is shrunken warpwise naturally—i. e., by release of fabric yarn tensions by moisture, and the cloth is then dried and smoothed without substantial change of said shrinkage to produce a balanced fabric—i. e., one possessing a predetermined low residual shrinkage both warpwise and fillingwise. An additional object is to provide novel apparatus for performing certain steps of the process. Other objects and advantages of the invention will be apparent from the ensuing more particular description, taken in conjunction with the appended drawing, wherein:

Fig. 1 is a partial, largely diagrammatic, side view of apparatus suitable for practicing steps of the method up to the framing step;

Fig. 2 is a similar view of apparatus suitable for practicing the steps of the method following the framing step.

Cotton cloth to be treated in accordance with the present invention will ordinarily have received certain preliminary finishing treatments, such as kiering, bleaching and mercerizing, which may be performed in any conventional manner. The cloth may or may not also have been dressed with starch and softeners, or calendered, or both dressed and calendered.

Cotton cloth in the condition mentioned is normally subjected to further finishing operations which usually comprise: wetting out by passing the cloth through a water bath or spray and between squeezing rolls, or their equivalent such as suction devices, for removing excess water; framing the wet cloth to desired width on a tenter frame having traveling chains with clips which grip the cloth selvages; and, if desired, pressing and smoothing the cloth after framing by passing the cloth through a Palmer. The finished cloth issuing from the Palmer or frame is then batched, usually in roll form. In the past, the cloth, while undergoing these several operations, and in passing between them, has been subjected to considerable longitudinal tension which was applied in order to prevent the cloth from becoming wrinkled and creased, and in order to secure the proper performance of the machines used in the several operations. The cloth has not been permitted to exercise its full natural capacity for warpwise contraction on wetting and such natural shrinkage as did take place has been substantially lost by stretching in ensuing operations. Where a pre-shrunk finish was desired, shrinkage has been obtained largely or entirely by a mechanical compression and shortening of the warp yarns, usually as the cloth is passed from the tenter frame into the Palmer.

The present invention deals with these same finishing operations but provides novel, improved procedures and apparatus for performing them and for controlling machinery for performing them and for handling the cloth during and while traveling between these operations, so that the cloth shrinks naturally on wetting to substantially its full capacity for such shrinkage and so that this natural shrinkage is substantially completely preserved and realized in the finished, batched cloth. These procedures include:

1. Steaming the cloth and permitting it to rest in a relaxed state shortly prior to wetting out with water. We have found that this treatment of the cloth considerably increases the extent to which the cloth will shrink when relaxed after the water wetting, apparently because it softens the waxes or other water repellent materials that may be contained in the yarns, and permits the water to penetrate more thoroughly into the yarns to their component fibres.

2. Passing the cloth without substantial warpwise tension through a wetting out bath of warm

water which may contain starch, softeners, wetting agents, tinting colors, etc., and squeezing the wet cloth.

3. Supporting the wet cloth for a period of time in a loose, undulated condition, preferably agitating the cloth and also steaming the cloth while in this condition. This treatment permits and facilitates warpwise shrinkage of the cloth by the swelling of the wet fibres.

4. Feeding the cloth to the frame with practically no warpwise tension by positively carrying the cloth in a longitudinally relaxed condition into the grip of the chain clips of the frame. By this procedure, any substantial warpwise stretching of the cloth while it is fed to and carried by the frame may be avoided.

5. Subjecting the cloth carried by the frame to dry heat at a temperature and for an interval sufficient to dry or nearly dry the cloth. This tends to fix the cloth in the shrunken condition in which it was fed to the frame and renders it resistant to stretching under any slight tensions encountered in subsequent operations. In prior pre-shrinking processes it has been common to dry the cloth but little on the frame leaving the cloth in a highly pliable state in which it is readily stretched by ensuing tension. Such pliability facilitates mechanical shrinkage following framing but is undesirable in the present process.

6. Maintaining only light or minimum warpwise tension on the cloth while it is pressed, smoothed and batched, thereby preventing signficant stretching during these operations.

In efficient commercial practice, the cloth must be advanced through the several finishing operations concerned at a high rate of speed, usually around eighty yards per minute. The present invention provides an arrangement of apparatus and operating controls by means of which the steps of the improved method may be efficiently performed at such commercial speeds. Such an arrangement is illustrated in the appended drawing with reference to which the improved procedures of the invention will now be more particularly described.

Referring to Fig. 1, the cloth C to be treated is contained in the usual roll 10 which is rotatably received in let-off bearings 12 or 12'. The cloth is drawn upwardly from the roll 10 by means of a driven drum 14 and rider roller 16, each mounted in suitable bearings (not shown) above the roll 10. As it is drawn upwardly by the drum 14, the cloth is steamed by passing over a suitably apertured cylinder 18 fed with steam under pressure through a pipe 20. From the cylinder 18, the cloth passes over an idler roll 22 and thence to the drum 14. Drum 14 drops the cloth upon the downwardly curved end of a concave slack pan 24, the cloth being stripped from the drum 14 by means of endless stripper belts 26 received in grooves in the drum surface which drives the belts between tensioning idler rolls 28 below the drum.

From the pan 24, the cloth is withdrawn upwardly over a smooth bar 30, thence downwardly under an idler roller 32 disposed below the level of water in a wetting out tank 34, then upwardly between a pair of squeeze rolls 36, 38 of which the roller 36 is driven at a predetermined rate from a suitable source of power (not shown) to cause the withdrawal of the cloth from slack pan 24. Tank 34 is continuously fed with warm water by suitable connections (not shown) at a rate such as to maintain a substantially constant level of water in the tank. As previously stated, the water supplied to tank 34 will preferably be warm, a temperature of from 130° to 160° F. being satisfactory, and may or may not contain starch, wetting agents, softeners, tinting colors, etc. In passing downwardly to the roller 32, the cloth is engaged by cloth guides, indicated at 40, which may be of the well known Foxwell type.

It will be observed from the drawing that a considerable quantity of cloth is contained in loosely folded, longitudinally relaxed condition in the slack pan 24. This slacking of the cloth after steaming and before wetting out, preferably for an interval of at least a minute, is an important feature of the process. In order to provide this slack continuously, drum 14 is driven from squeeze roll 36 by a belt 42 having a two speed driving connection with the shaft of roll 36, indicated at 44, by means of which drum 14 may be driven at a surface speed greater than that of roll 36 to provide slack, or at a surface speed substantially equal to that of roll 36 to maintain slack. Belt 42 may be shifted back and forth between its two speeds by an operator through the usual shipper lever (not shown). The loosely folded condition of the cloth results automatically from the provision of slack and from the forward and downward curvature of the pan surface on which the cloth is deposited.

As previously stated, slacking of the fabric between the steaming cylinder and the wetting-out tank permits a reaction to take place in the steamed fabric which improves the extent of shrinkage which takes place after wetting, apparently because it increases the water absorptivity of the yarns. Moreover, it practically eliminates back pull, and consequently warpwise tension, on the fabric as it passes through the water bath and between the squeeze rolls. We have found that absence of longitudinal tension on the fabric during wetting also contributes to increasing the extent of natural warpwise shrinkage of the fabric which takes place.

From the squeeze rolls 36, 38 the fabric passes over a rotating drum 46 and under a rider roll 47, drum 46 being provided on its surface with peripheral grooves indicated at 48 which receive the upper ends of metallic stripper fingers 50 whose lower ends are attached near the top of a fixed, downwardly and forwardly inclined slide 52. Fingers 50 act to strip the wet fabric from the drum 46 causing it to fall onto the slide 52 which guides it onto a conveyor 54, hereinafter described, which operates beneath the slide.

In accordance with the invention, the cloth is transferred from the squeeze rolls to the conveyor 54 with practically no warpwise tension on the cloth. In the instance illustrated in the drawing, this is accomplished as follows: Drum 46 is driven from squeeze roll 36 by means of a chain 56 connecting a sprocket 58 on the shaft of roll 36 with the driving sprocket 60 of a variable speed transmission 62, and by means of a chain 64 connecting the driven sprocket 66 of the transmission 62 with a sprocket 68 on the drive shaft of drum 46. Transmission 62 may be of any type capable of ready adjustment to change the ratio of the speed of rotation of drum 46 to that of roll 36, that indicated in the drawing being a type known and commercially available under the designation "P. I. V. variable speed drive," and which is adjustable to increase

or decrease the rate of rotation of driven sprocket 66 relative to that of drive sprocket 60 by turning a rod 70 in one direction or the other.

Through transmission 62, the speed of drum 46 is kept constantly adjusted to the speed of squeeze roll 36 to take up the fabric delivered by the squeeze rolls without exerting any substantial longitudinal pull thereon. In the embodiment illustrated in the drawing, regulation of transmission 62 is effected automatically in the following manner. As the cloth passes from the squeeze rolls to drum 46, it passes over a freely rotatable idler roll 72 suspended by arms 74 which are sensitively pivoted at 76 upon a horizontal axis. Preferably arms 74 and pivots 76 are so arranged that roll 72 normally hangs with its axis vertically below pivots 76, below drum 46 and somewhat forwardly of the drum axis, and in substantial horizontal alignment with the bite between the squeeze rolls. The cloth, in passing over roll 72, therefore extends forwardly substantially horizontally from the squeeze rolls to roll 72, has substantially 180° wrap on said roll and then extends rearwardly to drum 46 at a slight angle to the horizontal. By virtue of this arrangement a mechanical advantage is secured in that substantially equal small tensions will exist in the two lengths of cloth passing to and from roll 72 but a force equal to the sum of these individual small tensions will be available to move roll 72 about its pivot 76. Thus a slight tension applied to the cloth by drum 46 will cause the roll 72 to move readily about its pivot 76 in substantially a horizontal arc, and in the clockwise direction as viewed in Fig. 1.

One of the arms 74 carries, on the opposite side of its pivot 76, a contact arm 78 to which is connected one lead 80 of an electric circuit. Adjustably fixed adjacent the arm 78, and arranged for electric conducting engagement with said arm at predetermined positions of roll 72 relative to a vertical plane through pivots 76, are a pair of spaced contacts 82, 84 to which are connected circuit leads 86, 88. Engagement of arm 78 with one of the contacts 82, 84 closes a circuit through lead 80 and the corresponding lead 86 or 88 to a relay 90 which acts to close one or the other of the two operating circuits of a reversible electric motor 92 through one or the other of the leads 94, 96 in said circuits. Motor 92 is connected by chain 98 and sprockets 100, 102 to adjustment rod 70 of transmission 62 to turn said rod in one direction or the other, and therefore to increase or decrease the drive ratio of drum 46 to roll 36, according to which of its two operating circuits is closed.

In the arrangement shown, contact 84, which is engaged by moving of roll 72 in the clockwise direction in Fig. 1 when the speed of drum 46 is a little too fast, controls the circuit which operates motor 92 to turn rod 70 in the direction to decrease the drive speed of drum 46. As said drive speed is decreased, roll 72 moves by gravity in a counter-clockwise direction, thus moving arm 78 away from contact 84 toward contact 82, opening the operating circuit to motor 92. As tension on the cloth is further relaxed, arm 78 swings into engagement with contact 82 which controls the other operating circuit to motor 92 and a reverse action to that just described takes place. Contact 82 is positioned for engagement by arm 78 before roll 72 reaches its idle position vertically below pivots 76. Adjustability of the position of contacts 82, 84 permits regulation of the maximum and minimum limits of tension applied to the cloth in passing to drum 46.

We have found that the arrangement just described provides a highly sensitive and effective control for the tension on the cloth leaving the squeeze rolls and for keeping said tension extremely light, as is desirable in the process of this invention. Other methods of control may, however, be utilized.

After the cloth passes over the drum 46, it is preferably agitated and also steamed while in a relaxed condition. This is accomplished on the conveyor 54 on which, as previously stated, the cloth is deposited as it leaves the drum 46. Conveyor 54 may, as shown, comprise an endless belt made of a series of closely adjacent articulated slats or bars 104 and extending over rollers or sprocket wheels 106, 108, one of which is driven from a suitable source of power (not shown) at a predetermined rate such that the cloth is advanced by the conveyor considerably more slowly than the cloth is fed thereto and removed therefrom. Consequently, as indicated in Fig. 1, the cloth is deposited upon the conveyor in deep, loose folds or ripples and is carried along in that state to the point of withdrawal.

Preferably, as shown, a plurality of steam pipes 110 are provided immediately beneath the upper stretch of the conveyor 54, these pipes being arranged to discharge steam under considerable pressure and, if desired, intermittently toward the adjacent under surface of the conveyor. The steam discharged from pipes 110 passes in jets between the slats 104 of the conveyor and into the cloth, heating the cloth and at the same time agitating it. This steam heating of the cloth and the agitation produced by the steaming, added to the agitation produced by the movement of the conveyor, are beneficial in producing natural shrinkage of the cloth. The cloth will ordinarily be retained on the conveyor for a period of from three to five minutes which provides sufficient time for substantially complete natural shrinkage to take place.

The procedures so far described have been found effective to cause natural warpwise shrinkage of the cloth to substantially its full capacity, while yet enabling processing of the cloth at the high speeds necessary in commercial practice. To complete the process, the wet, shrunken cloth is framed to predetermined width, dried, smoothed and batched in finished form by procedures now to be described which enable substantially complete retention of this longitudinally shrunken condition of the cloth attained in the initial steps of the process.

Referring again to the drawing, 120 designates a tenter frame, of which the cloth receiving end is shown in Fig. 1 and the cloth discharging end in Fig. 2. Frame 120 is, or may be, of the well known type which includes a pair of endless chains at the opposite sides of the frame and extending longitudinally thereof, these chains operating over driven and idler sprocket wheels at opposite ends of the frame and carrying closely spaced clips which are constructed to grip the selvages of the cloth presented thereto at the receiving end of the frame to carry the cloth to the discharging end of the frame while stretching the cloth weftwise, and thereupon to release the cloth. These chains, clips and their operating means are not illustrated in the drawing as their construction and operation are well known.

In accordance with the invention, the cloth, in a wet, shrunken condition, is removed from the conveyor 54 without substantial longitudinal tension and is supported in a longitudinally relaxed state as it is fed into the grip of the tenter chain clips. This may, as illustrated in Fig. 1, be accomplished in the following manner.

In front of the frame 120, there is rotatably mounted in suitable supports (not shown) a horizontally disposed shaft 122, extending transversely of the frame and having fixed thereto a plurality of spaced pulley wheels 124. Each of the wheels 124 receives and drives one of a plurality of narrow, spaced endless belts 126 which pass over the wheels 124, under an idler roller 128 and over a plurality of idler pulleys 130 located in spaced relation between the tenter chains upon a horizontal shaft 132 mounted in the frame 120 and extending transversely thereof forwardly of its entrance end. Wheels 124 are rotated to drive the upper stretch of the belts 126 forwardly, and roller 128 and pulleys 130 are so located that the forwardly moving belt portions between them lie substantially in the plane of the tenter chain clips advancing at opposite sides of the belts.

The cloth is withdrawn from conveyor 54 upwardly over a bar 133 and downwardly through cloth guides 134 similar to the guides 40, by passing through the bite between the roller 128 and the belts 126, roller 128 pressing, and thereby adhering, the wet cloth onto the belts which support the cloth and carry it forwardly until they pass downwardly over the pulleys 130. Due to the loosely slacked condition of the cloth on the conveyor 54, there is very little tension upon it as it is transferred to the belts 126 and belts 126 are driven at a speed regulated to the speed of the tenter chains so that the belts carry the cloth into the grip of the tenter clips, which engage the cloth selvages in advance of pulleys 130, in a thoroughly relaxed condition. This regulated drive speed of the belts 126 is accomplished through a variable speed transmission 135, which may be a "P. I. V." drive similar to the transmission 62, connected by chains and sprockets to a bevel gear 136 driven by a bevel gear 138 on the shaft of one of the tenter chain sprockets (not shown) of frame 120, and to the operating shaft 122 of drive pulleys 124. The speed of drive of shaft 122 by transmission 135 relative to gear 138 can be increased or decreased by turning an adjustment rod 140 in one direction or the other. In this instance, adjustment of the transmission will usually be made by hand and rod 140, is, therefore, shown as provided with a hand wheel 142.

Once the tenter clips have firmly gripped the cloth, the operation of the tenter exerts little or no warpwise stretching action upon the cloth and, consequently, feeding of the cloth to the tenter substantially without tension, as in the manner above described, is effective to prevent any substantial loss of shrinkage in the cloth up to the time it issues from the tenter.

As the cloth passes from the receiving end to the discharging end of the frame 120, it is subjected to dry heat by means of suitable heating apparatus (not shown). Preferably, the temperature of heating is sufficiently high and the heating interval is sufficiently long so that the cloth issuing from the frame is in at least a nearly dry state. The cloth is thus substantially fixed in the shrunken condition in which it was supplied to the frame and is not readily subject to permanent elongation by any small longitudinal tension in the ensuing steps.

On issuing from the tenter clips, the cloth is passed through a pressing and smoothing device 150 (Fig. 2) which, in the instance shown in the drawing, is a Palmer of conventional construction which comprises: a large, heated, smooth-surfaced drum 152 which is rotated by suitable power connections (not shown); an endless pressing felt blanket 154 mounted to run over idler rollers 156 so arranged that the blanket passes around the major part of the periphery of the drum from intake roller 156' to exit roller 156'', thence over a drying drum 158 and over a tensioning roller 156''' mounted upon a pivoted, weighted lever 160 for tension adjustment, thence back to intake roller 156' over intervening rollers 156. The cloth is pressed and smoothed between the surface of drum 152 and blanket 154, the rotation of the drum acting to advance continuously both the cloth and the blanket.

In accordance with the invention, the cloth, in passing from the frame 120 to Palmer 150 is preferably under only very light, carefully controlled longitudinal tension. In the embodiment illustrated in the drawing, this control is exercised by means of an idler roller 162 over which the cloth passes as it issues from the frame, said roller being similar to control roller 72 previously described and being suspended by arms 164 pivoted at 166 upon a horizontal axis so that the axis of roller 162 is normally disposed vertically below said pivot axis. Above said pivot axis, one of the arms 164 carries a conductor member 168 connected, through lead wires 170, 172, into the electric circuit to an electric motor (not shown) which operates the tenter chains of frame 120. Member 168 constitutes the control element of a rheostat of which the resistance 174 is connected to wire 172 so that movement of roller 162 about pivots 166 in the clockwise direction as viewed in Fig. 2 decreases the resistance 174 in the motor operating circuit, thereby increasing the speed of the motor and of cloth delivery by the tenter and tending to decrease tension on the cloth between the tenter and the Palmer, and so that movement of roller 162 in the opposite direction has the opposite effect.

The cloth passes from frame 120 forwardly substantially horizontally under roller 162, has about 180° wrap around said roller and then passes rearwardly to an idler roller 176 over which it passes again forwardly. This arrangement allows the cloth to move roller 162 about its pivots 166 in a nearly horizontal arc and, therefore, with a minimum of cloth tension.

A similar result may, of course, be obtained by varying the speed of the Palmer drum, instead of the tenter chains. We prefer, however, to maintain the speed of the Palmer drum substantially constant and to control cloth tension through variation of tenter speed, as just described. Increase of tenter speed for purposes of this control does not cause any increased tension upon the cloth in advance of the tenter, as the tenter feeding device is driven by the tenter and a large quantity of slack cloth is provided between said device and drum 46.

From idler roller 176, the cloth passes forwardly under an idler roller 178 and enters between the surface of drum 152 and blanket 154 as the latter passes over intake roller 156'. If, as is preferred, the cloth is nearly dried on the

tenter frame, it is apt to contain wrinkles or undulations at the selvages due to the action of the tenter clips thereon. The cloth, in this nearly dry state, is not sufficiently pliable to enable the Palmer to smooth out these wrinkles completely. Accordingly, we preferably provide devices, such as the water and steam sprayer partially indicated at 180 in Fig. 2, for moistening the cloth in each wrinkled selvage region only as the cloth passes from the tenter to the Palmer. This restricted wetting increases the pliability of the cloth selvages without disturbing the fixation of the shrinkage in the main body of the cloth and enables the Palmer to impart the same smooth finish to the wrinkled selvages that it applies to the smoother, drier, less readily distortable body of cloth between the selvages.

In practice we prefer to position the intake roller 156' of Palmer 150 with its axis sufficiently removed from the surface of drum 152 so that said roller does not compress the blanket and cloth passing thereover between its surface and the surface of the drum. Roller 156' may, however, be arranged to apply such compression if desired.

Cloth which has been treated in accordance with the procedures of the invention so far described, issues from the Palmer in a finished, smooth, dry, longitudinally shrunken condition in which it is substantially shrinkproof and is not as readily subject to permanent distortion by stretching in ensuing handling as is cloth in which shrinkage has been effected substantially entirely by mechanical compression treatments. It remains, however, to batch the cloth in the form of the large, smoothly wound rolls in which it is subsequently handled without substantially distorting this finish. In accordance with the invention, this may be accomplished in the following manner.

From the Palmer exit roller 156'' the cloth passes rearwardly off drum 152 over an idler roller 182, thence forwardly over rotary reels 184, 186 which are rotated, through suitable drive connections (not shown), in timed relation to the speed of Palmer drum 152, so that said reels support and advance the cloth in a longitudinally relaxed condition at the speed at which it is delivered by the Palmer. From the reel 186 the cloth is drawn forwardly and rolled up on a suitable chuck roller 188 by a batcher 190 which removably, rotatably mounts the chuck roller 188 and continually rotates it through sprocket 192 driven by an electric motor 194 through suitable sprocket and chain drive connections.

It will be evident that if the cloth is to be taken up by the batcher at the substantially constant rate at which it issues from the Palmer, the speed of rotation of roller 188 must be frequently varied within considerable limits, since the diameter of the cloth roll, and consequently the length of cloth wound thereon at each complete rotation of roller 188, are continually increasing. In accordance with the invention, control of rotation speed of the batcher roller 188 is partially accomplished automatically by using, as the batcher electric motor 194, a so-called "constant torque motor" which, under a given operating current, automatically increases or decreases its drive speed as the load thereon decreases or increases, and which consequently acts automatically to decrease the speed of rotation of batcher roller 188 as the load, or weight of cloth thereon, increases. Motors of this type are well known and readily obtainable.

The exercise of further control is, however, necessary, since, as the cloth roll becomes larger, its weight increases at a faster rate than does its diameter. To this end there is provided in one of the circuit leads 196 to motor 194 a rheostat 198, shown arranged for hand manipulation, by which the amount of current flowing to the motor may be adjusted. With the aid of occasional adjustment of rheostat 198, the automatic speed control exercised by the motor serves to maintain a substantially constant rate of cloth take-up on roller 188. To keep the operator informed of the amount of tension being applied to the cloth by the batcher at any time there is provided an idler roller 200 partially around which the cloth passes between reel 186 and the batcher, said roller being rotatably suspended by vertical arms 202 pivoted at 204 on a horizontal axis above the roller. Above said pivot axis, one of said arms carries a pointer 206 adapted to indicate on a suitable dial 208 the amount of tension on the cloth according to the resultant displacement of the roller 200 from its normal position vertically below the pivot axis of arms 202.

At intervals it is necessary to remove the roll of cloth from the batcher and to substitute a new roller 188. When this is done, the cloth, not being removed, drops into a slack pan 210 below roller 200, as indicated by dotted lines in Fig. 2. After the new batcher roller has been substituted and the cloth started thereon, the batcher is operated rapidly by manipulating rheostat 198 to take up the slack that has accumulated in pan 210. In order to provide some tension on the cloth at this time and avoid undesirable looseness in the winding that would otherwise occur, there is provided a pair of tension bars 212 engaging opposite surfaces of the cloth between pan 210 and the batcher roller and mounted for turning as a unit about a horizontal axis, as indicated by arrows in Fig. 2. After the slack has been taken up and the pivoted roller again functions, these bars will ordinarily be returned to their position of Fig. 2 in which they apply only very light resistance to the pull of the batcher. An additional function of pivoted roller 200 is to exert a control on the batcher speed. It is obvious that such a pivoted roller will exert a minimum tension on the cloth with which it contacts only when the roller shaft, here 202, hangs vertically downward. Thus when the roller 200 in Fig. 2 is moved more and more in a counterclockwise direction by the cloth, it places a greater and greater load through the cloth upon the constant torque motor driving the batcher. The increased load slows down the batcher motor and thereby allows the roller shaft 202 to seek an essentially vertical position in which roller 200 exerts a minimum tension on the impinging cloth.

It will be understood that, by showing and describing herein preferred apparatus and controls for the commercial practice of the procedures of the invention, we do not intend that the invention shall be limited thereto; and that various departures may be made therefrom and from the details of the described procedures within the scope of the invention as described in the following claims.

The word "batching" is used in the appended claims to mean not only batching in rolls but also in other ways as for example withdrawing

the fabric into boxes or in general withdrawing the fabric in a suitable manner for the next operation.

We claim:

1. In a method of producing natural shrinkage in a continuous strip of cotton cloth and for maintaining such shrinkage in tentering, smoothing, drying and batching the cloth, while continuously advancing the cloth at substantially a uniform, high rate of speed, the steps which comprise: wetting out the cloth, squeezing the cloth to remove excess moisture, and relaxing the cloth in loosely folded condition while supporting the cloth between its selvages in a manner and for a sufficient time to produce substantially complete shrinkage of the cloth by swelling of its wet fibres, without drying the cloth; advancing the cloth between said squeezing and relaxing steps by carrying the strip about a horizontal axis at a rate timed to substantially equal the rate of squeeze to prevent the exertion of substantial longitudinal tension on the cloth; tentering the cloth and during the initial stages of the tentering carrying the cloth forwardly while supporting it between its selvages; pressing and ironing the cloth while advancing the cloth about a horizonal axis; timing the rate of tentering the cloth with relation to the rate of pressing and ironing to prevent the exertion of substantial longitudinal tension on the cloth advancing between said steps; and batching the cloth without exerting substantial longitudinal tension thereon.

2. In a method as set forth in claim 1, the steps as described in said claim wherein the wet cloth is steamed and agitated while relaxed after wetting with water and before tentering.

3. In a method as set forth in claim 1, the steps as described in said claim wherein the cloth is brought to a nearly dry state while being tentered and is moistened at the selvages only while advancing between the tentering and pressing and ironing steps.

4. In a method as set forth in claim 1, the steps as described in said claim wherein the cloth is steamed and then relaxed in a loosely folded condition prior to wetting out the cloth.

5. In a method as set forth in claim 1, the steps as described in said claim wherein batching of the cloth without exerting substantial longitudinal tension thereon is accomplished by winding up the cloth into a roll at a rate kept substantially equal to the rate of pressing and ironing the cloth by reducing the rate of rotation of the cloth roll approximately in proportion as its diameter increases.

6. In a method as set forth in claim 1, the steps as described in said claim wherein the rate of advance of the fabric in one of said steps is timed with relation to the rate of advance of the fabric in another of said steps by: passing the fabric advancing between said two steps about a horizontal support with the fabric moving to and from the support in opposite directions in substantially horizontal planes, suspending said support for opposite swinging movements in an arc of large radius about a horizontal axis, and oppositely varying the rate of advance of the fabric in said one of said steps according to predetermined opposite swinging movements of said support toward and from a position with its center of gravity vertically below said axis in a manner to maintain said support normally at one side of said position and at a small angular distance therefrom.

7. In a method of producing and maintaining natural shrinkage in a continuous strip of fabric wherein the fabric is advanced by two successive machines, the steps for controlling the rate of operation of one of said machines relative to another to prevent stretching of the cloth in advancing through and between said machines which comprise: passing the fabric advancing between said machines about a horizontal support with the fabric moving to and from the support in opposite directions in substantially horizontal planes, suspending said support for opposite swinging movements in an arc of large radius about a horizontal axis, and oppositely varying the rate of advance of the fabric by said one of said machines according to predetermined opposite swinging movements of said support toward and from a position with its center of gravity vertically below said axis in a manner to maintain said support normally at one side of said position and at a small angular distance therefrom.

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