

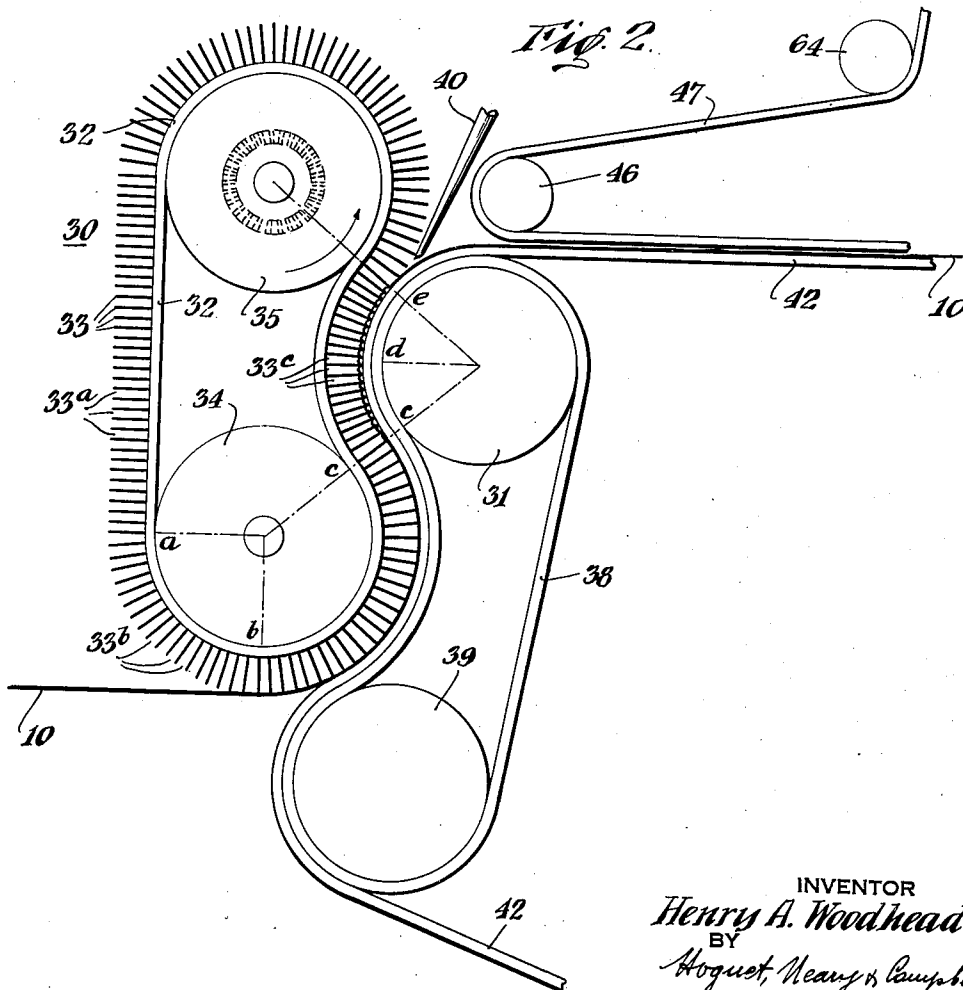
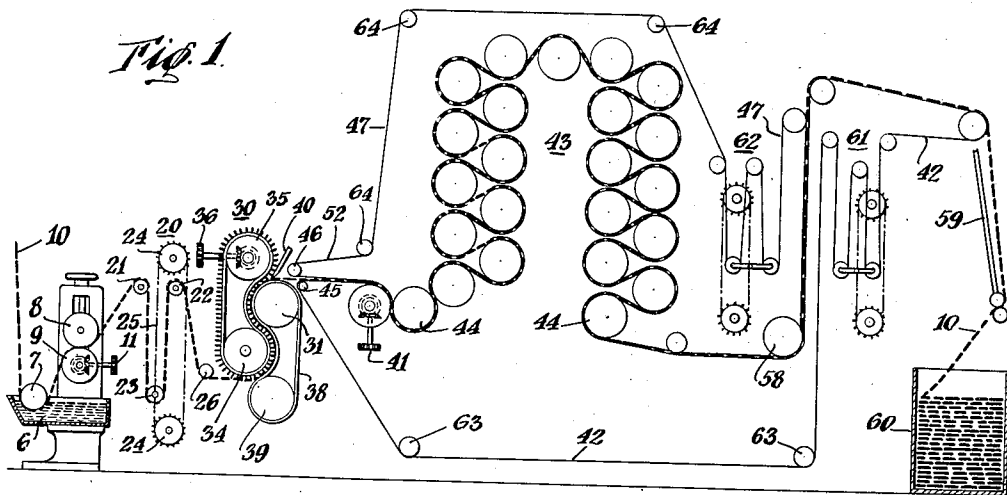
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2,120,536

METHOD AND APPARATUS FOR PRESHRINKING CLOTH

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR PRE-SHRINKING CLOTH

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14 Claims. (Cl. 26—18.6)

This application relates to apparatus for pre-shrinking cloth for the purpose of substantially eliminating shrinkage in both weft and warp in subsequent laundering operations.

I have found that shrinkage in a fabric resulting from laundering operations is not due solely to increased crinkle which may be induced in the warp or weft yarns but that it is also due to a physical rearrangement and readjustment of the yarns and fibers due to the mechanical working and reconditioning and flexing of the fabric in all directions while in its plastic condition during laundering. It is this rearrangement of the warp and weft yarns which I obtain by mechanically working rapidly and positively. My process for preshrinking is preferably carried out after the usual preliminary steps, such as singeing, removing the warp sizing, bleaching, dyeing, printing, mercerizing, drying, calendering and polishing, or other customary operations have been performed upon the web so that no subsequent operation is necessary which might impair the full advantages of the preshrunk condition attained.

In a co-pending application, Serial Number 674,495, filed June 6, 1933, I have disclosed processes and apparatus for mechanically working a fabric web to effect readjustment of the positions of the yarn components of the web within the body thereof for compressing the web to impose the desired preshrunk condition thereon. The present invention is similar in its more general aspects to that described in said application inasmuch as the preshrinking effect is attained herein also by mechanically working within the body of the fabric web.

In carrying out the present invention, the fabric web is advanced through a working zone while in face to face contact with the wires of an endless card-cloth band, or other member having projections adapted to penetrate the surface of the web or at least firmly grip the latter. As the web and fabric advance through the working zone the card-cloth band is flexed thus changing the spaced relationship between the outer ends of the elements making up the fabric gripping means, for example in connection with card-cloth, its wires are caused to exert a loosening, shoving and pulling action on the yarn components of the web for compressing the latter to impose a preshrunk condition thereon.

The present invention will be more fully understood upon consideration of the following description of and illustrative embodiment thereof and the appended claims when read in

conjunction with the accompanying drawing, in which:

Figure 1 is a side elevational view in simplified diagrammatic form of apparatus suitable for carrying out my preshrinking process in accordance with the present invention; and

Figure 2 is an enlarged view of a portion of the apparatus shown in Figure 1, the figure being slightly changed to also illustrate another arrangement.

Referring to the drawing, the dotted line represents the center line of a fabric web which it is assumed has previously been subjected to processing operations such as bleaching, dyeing, printing, calendering, etc., for combinations thereof. The web is drawn from a bin or other source (not shown) by a mangle comprising a vat 6, an idler roll 7, and presser rolls 8, 9, the latter of which is positively driven as indicated at 11. The vat 6 may contain a sizing solution of starch, dextrin, gums or soluble oils customarily used in finishing operations for imparting a final sizing to the web. At the same time the web is rendered plastic in preparation for the subsequent steps of my preshrinking process.

Upon delivery from the mangle the web passes through a tensioning frame 20 comprising a pair of fixed guide rolls 21, 22 and an intermediate movable compensator roll 23. The weight of roll 23 stretches all the goods to substantially the same degree so that goods of uniform tension and stretch are fed to the subsequent apparatus for mechanically working the web.

As shown in Figure 1 tensioning frame 20 is also provided with a pair of fixed sprocket wheels 24 and an associated endless chain 25 to which one end of the shaft of compensator roll 23 is connected. This sprocket and chain arrangement is duplicated at the other side of the tensioning frame so that lowering or raising of either end of the shaft of roll 23, as web slack accumulates or is taken up, results in driving the chains 25 to effect a corresponding movement of the other end of roll 23. In this way the roll 23 is maintained on an even keel to assure proper guiding of the web and obviate side-wise skewing thereof.

From the roll 22 of the tensioning frame the web extends around a guide roll 26 and is directed into a position between a web-working band 30 and a companion blanket 38 to be carried forwardly thereby. Blanket 38 provides a working surface for band 30 and cooperates with the latter to impose a preshrunk condition on the

web. In the form described herein, the web-working band 30 comprises an endless belt 32 of card-cloth. The bristles or wires 33 of band 30 are adapted to penetrate the surface of fabric web and yarn components thereof, or at least firmly grip the web for effecting a mechanical readjustment of the positions of both the warp and weft yarns of the web. The card-cloth belt 30 extends around the rolls 34, 35, at least one of which is positively driven as indicated at 36. The blanket 38, which is preferably of rubber, extends around the adjacently positioned rolls 39, 31 and may also be positively driven at the same rate as band 30.

In passing around roll 34 through the zone *a-c*, Figure 2, the band 30 is bent locally as it conforms to the curvature of the roll. As a result, the longitudinal spacing of the outer ends of the then radially extending wires 33 is first increased, as indicated at 33*b*, with respect to their neutral or normal longitudinal spacing, indicated at 33*a*, and then decreased toward the normal spacing as indicated at 33*c*.

On entering the working zone between band 30 and blanket 38 the web is pressed against the wire teeth of the band by the blanket. Thus the band and blanket form a restraining zone in which crinkling or undulating of the surface of the web is prevented. Upon contacting and gripping the web, the ends of the wires 33 may in some instances enter into and between the fibers of both the warp and weft yarns. Because of the change in the longitudinal spacing of the ends of the wires as the band 30 travels about roll 34 a corresponding change is effected in the spacing of the points or portions of the fabric gripped by the wires 33. Consequently, the wires 33 exert a shoving and pulling action on both the weft and warp yarns that tends to work them and results in readjusting their positions within the body of the web, the surface of blanket 38 permitting a slight slippage of the web thereon. As the band 30 passes through the zone *c-d* Figure 2, the resulting decrease in the longitudinal spacing of the ends of the wires 33 causes them to exert a shoving action that forces the web forwardly while surface undulations of the web are prevented with the result that the web is contracted or compressed warpwise.

The roll 31 for blanket 38 is positioned vertically between the rolls 34, 35 provided for band 30 and is disposed in a horizontal position with respect to these rolls for causing it to effect a concave flexing of band 30 from a common tangential relation with respect to both rolls 34 and 35. This inward flexing of the web-working band 30, as it conforms to the convexly curved surface of roll 31 produces another localized bend in band 30 and causes the ends of the wires 33 thereon to be more closely crowded together longitudinally than in passing about roll 34. Inasmuch as roll 31 also produces a correspondingly located bend in blanket 38, the latter continues to press the web against the wires 33 for maintaining the web-restraining zone to prevent undulations in the surface of the web. The further reduction in the longitudinal spacing of the ends of wires 33 causes them to exert an accentuated shoving and pulling action on the yarns of the web that positions the weft yarns more closely together and which acts longitudinally of the warp yarns to shove them together into a fatter or thicker state, i. e., with increased diameters, with the result that the web is contracted or

compressed and worked warpwise in passing through the zone *c-e*, Figure 2.

The numeral 40 in Figures 1 and 2 designates an air jet, or other suitable device, located at the delivery end of the web-working zone and extending into the nip between roll 31 and the band 30 on roll 35 for stripping or disengaging the web from the ends of the wires 33 of the card-cloth band 30.

As shown in Figure 1, the web is delivered from the working zone formed by card-cloth band 30 and blanket 38 onto the surface of a band 42, of canvas or other suitable material, which forms part of a drier 43 having a series of heated drying drums 44 which are positively driven as indicated at 41. The band 42 is directed around a guide roll 45 located closely adjacent the roll 31 and a guide roll 46 directs a similar drier band 47 into engagement with the upper surface of the web so that the web is carried forward fully supported and retained between the bands 42, 47 of the drier.

The arrangement illustrated in Figure 2 is similar to that of Figure 1 in all respects except that the lower drier band 42 passes around the rolls 39, 31 also. In this arrangement the supporting blanket 38, shown in Figure 2, may be eliminated. Thus, the drier band 42 is brought into contact with the web as it enters the working zone and continuously supports the web from the time it enters the working zone until it is discharged from the drier in fully finished condition.

In passing over the heated drums 44 of the drier 43 the web is supported by the bands 42, 47 and thus dried and set in its treated condition without being subjected to further strain. After passing around an idler roll 58, at the end of the series of drying cans, the bands separate and the web is carried by one of them to an oscillating device 59 which folds the finished pre-shrunk fabric into piles in the bin 60. Slack take-up devices 61 and 62, similar to that previously described, are provided for the bands 42, 47, respectively, and suitable guide rolls 63 and 64 direct the bands back to the rolls 45, or 39, and 46.

With certain types of fabrics, particularly those of a heavy, close-woven construction, it may be desirable to provide for effecting a greater degree of working and loosening of the yarn components of the web as it passes around roll 34. This may be attained by employing a roll 34 of smaller diameter than that employed with the usual type of fabric. Because of the smaller radius of curvature of such a roll the maximum angular separation of the wires 33 of the band is increased as the latter conforms to the more rapidly changing curvature of the roll. Consequently, the spacing of the wire ends is increased and in passing about the roll the wire ends move through a greater distance while in engagement with the web. Thus, the working action of the wires of the band may be increased in order to properly work heavier types of fabrics.

As an alternative to its functions of effecting a warpwise compression of a fabric web to impose a preshrunk condition thereon, the web-working band 30 may, if desired, be employed to pull out or extend a fabric warpwise. This may be effected by transposing the rolls 31, 39 and blanket band 30 with respect to rolls 34, 35 and web-working band 30 so that the fabric enters the working zone between roll 31 and band 30 and is delivered from band 30 and roll 39 to the drier, or other subsequent apparatus. This arrangement may

be understood from consideration of Figure 2, by assuming that the direction of operation of band 30 and the companion blanket 38 is reversed so that the movement of the web is in the opposite direction, or from right to left. In this manner the web first passes through the zone $e-c$ where the component yarns of the fabric are first subjected to an intimate shoving and pulling action that loosens the yarns. Then in passing through the zone $c-b$, where the spacing between the ends of the teeth increases as the band 30 passes from roll 31 and about roll 34, the teeth exert a pulling action on the yarn components that results in extending it warpwise. Thus, the net effect of the apparatus when arranged in this manner is to extend the web warpwise rather than compress it.

It can be seen from the drawing, particularly Figure 2, that as soon as the band 30, in conforming with the roll 34, begins to be flexed in a convex position, that the spaces between the outer ends of the wires become greater than the spaces at the inner ends. The space between the wires at their point of attachment to the band represents the normal spacing of the wires 33. The spacing at the outer ends of the wires remains substantially the same within the zone $a-c$, during which time the band is flexed to a convex position in conforming with the surface of the roll 34. It is desirable that the web to be preshrunk should be affixed to the band 30 within this zone and, furthermore, should be retained against the band in a state in which surface undulations are inhibited by an enclosing means, for example, the bands 38 or 42. At the point c the direction of flexure of the band is changed and it passes through a normal or neutral point to one in which, due to a concave flexure, the outer ends of the wires become closer together than normally indicated by the spacing at their bases. This contraction of the surface formed by the outer ends of the wires takes place in the zone $c-d$ and it is in the change to this zone that the primary shrinking, working, compressing and rearranging of the fabric web take place.

As the web is affixed to the card-cloth, the contraction in the card-cloth wire surface also contracts the web, and the great number of wire fingers affixed to the web cause a desirable working action during compression. In the zone $d-e$ the web remains in a compressed state but in a diminishing amount as the outer ends of the wires of the band 30 return to a neutral position at e , after which zone the flex of the band is again reversed to a concave position. The web is removed from the band 30 preferably at this point of flexure where the wires are at their neutral point.

It will be noted that in the apparatus, as shown, the actual compression that is finally accomplished is made up of the sum per unit of the differences between the distance intermediate the outer ends of a pair of the wires attached to the band when it is flexed to a convex position and the distance between the outer ends of the wires when in a neutral position, that is, without any flexure in the band. However, the over-compression given to the web when it passes through the zone $c-d-e$ facilitates the working and flexing of the web and tends to make permanent the contraction given to it.

In the zone $c-d-e$ the web is compressed beyond the normal amount and then brought back to the normal at which point it is removed from the band. It is possible, however, if de-

sired, to remove the web from the band at a point in the zone $c-d-e$, for example, at the point d , in which case the band 30 could be maintained in the concave flexed position by other agencies than the roll 31, such as rollers or guides. In that case the roll 31 could be made sufficiently small so that it would act only to carry the blanket 38 or 42 against the web 30 to a point midway, for example, in the concave zone $c-d-e$.

The essential factor is that the card-cloth carrying the affixed fabric web must be so flexed that the angular relation of the wires or teeth, and consequently the spacing of their free ends, is changed. The amount of working which may be given to the fabric web is dependent upon the number of reversals which are made in the carrying band. However, to obtain compression or contraction of the web, it is necessary that there be a final differential of contraction in the surface formed by the free ends of the band 30.

The web on delivery from the control rolls 8, 9, after being plasticized, may be found to have the width desired in the finished preshrunk fabric. In this event the web may be guided directly from the tensioning device 20 to the working zone between bands 30 and 38, or 42. If, however, the web is found to have a greater width than desired, it may be reduced weftwise by passing it through a tentering frame, or other suitable apparatus, as disclosed in the above mentioned application. The tentering frame would be located between the tension control device 20 and bands 30, 38 to take up the web from the tensioning frame, stretch it weftwise to the desired width and deliver it to the working zone between band 30, 38 to be compressed warpwise, as described above.

I claim:

1. Apparatus for mechanically working a fabric web to effect a change in its superficial dimensions comprising; a web working band having a plurality of pointed elements thereon with their outer ends disposed in longitudinally spaced relation and forming a multi-point surface adapted to grip and advance the web; means for holding the web against said band; means for driving said band; and means for effecting changes in the longitudinal spacings of said ends of said pointed elements, as said band is driven, to cause said pointed elements to mechanically work the web by exerting a working action on the component yarns of the web for readjusting their positions within the body of the web.

2. Apparatus for mechanically working a fabric to effect a change in its superficial dimensions comprising; a flexible web-working band having a plurality of pointed elements thereon with their outer ends disposed in longitudinally spaced relation and forming a multi-point surface adapted to grip and advance the web; means for flexing said band to produce a localized bend therein adapted to cause a change in the longitudinal spacings of said ends of said web-engaging pointed elements as successive portions of said band are flexed; means for holding the web against said band; and means for driving said band to cause flexing thereof, as the latter is driven, for changing the longitudinal spacings of web-engaging pointed elements thereon to mechanically work the web by effecting corresponding changes in the spacings of portions of the web engaged by said pointed elements.

3. Apparatus for mechanically working a fabric web to effect a change in the superficial di-

mensions thereof comprising; a pair of endless bands positioned in closely-spaced parallel relation and adapted to receive the web therebetween; means for driving said bands to advance the web therewith; a plurality of longitudinally spaced web-gripping pointed elements on one of said bands; and means co-operating with said bands for varying the longitudinal spacings of said pointed elements on said one band to cause said pointed elements to readjust the positions of the yarn components of the web within the body thereof as the web is advanced between said bands.

4. Apparatus for mechanically working a fabric web to effect a change in the superficial dimensions thereof comprising; a pair of flexible bands positioned in closely spaced parallel relation; means for directing the web into a position between and in contact with said bands; means for driving said bands to advance the web; a plurality of rows of longitudinally spaced web-gripping pointed elements on one of said bands; and means for flexing said bands during their movement to produce correspondingly located bends therein for changing the longitudinal spacings of said web-gripping pointed elements on said one band to readjust the positions of the yarn components of the web within the body thereof and for maintaining said second band in contact with the web for preventing the formation of undulations in the surface thereof as the positions of the yarn components thereof are readjusted.

5. Apparatus for mechanically working a fabric web to effect a change in its superficial dimensions comprising; a flexible web-working band having a plurality of rows of longitudinally spaced pointed elements adapted to grip the web; a second flexible band positioned to press the web against the ends of said pointed elements on said web-working band; means for driving said bands to advance the web therewith; and means cooperating with said bands for flexing the latter to produce correspondingly located bends therein to cause changes in the longitudinal spacings of said pointed elements on said web-working band, as said bands advance the web, to effect readjustment of the positions of the yarn components of the web within the body thereof.

6. Apparatus for mechanically working a fabric web to impose a preshrunk condition thereon comprising; a pair of endless bands positioned in closely-spaced parallel relation; a plurality of rows of longitudinally spaced web-gripping pointed elements on one of said bands; means for directing the web into engagement with said pointed elements on said one band and into contact with the other band to be advanced by said bands, said bands conjointly forming a retaining zone in which undulations in the surface of the web are prevented; means for driving said bands to advance the web; and means acting to decrease the longitudinal spacings of said pointed elements on said one band, as said bands advance the web, to cause said pointed elements to readjust the positions of the yarn components of the web within the body thereof while the web is retained to prevent undulations of its surface.

7. Apparatus for mechanically working a fabric web to impose a preshrunk condition thereon comprising; a flexible band provided with a plurality of rows of pointed elements the ends of which are longitudinally spaced and adapted to grip the web; a second flexible band engaging the

web to press the latter against the ends of the pointed elements on said web-working band and forming with the latter a retaining zone in which undulations in the surface of the web are prevented; means for directing the web into a position between said bands to be advanced thereby; means for driving said bands to advance the web; and means acting on said web-working band to flex the latter, as the web is advanced by said bands, for causing changes in the longitudinal spacings of the ends of said pointed elements on successive portions thereof for exerting shoving and pulling actions on the component yarns of the web to readjust their positions within the body of the web.

8. Apparatus for mechanically working a fabric web to impose a preshrunk condition thereon comprising; a flexible band provided with a plurality of rows of pointed elements the ends of which are longitudinally spaced and adapted to grip and advance the web; a guide positioned to cause flexing of said band for changing the longitudinal spacing of the ends of the web-gripping-pointed elements thereof; and means for driving said band to advance said band and web past said guide for causing said pointed elements to effect readjustment of the positions of the yarn components of the web within the body thereof.

9. Apparatus for mechanically working a fabric web to effect a change in its superficial dimensions comprising; an endless, flexible web-working band having a plurality of rows of longitudinally spaced pointed elements adapted to grip the web; guide rolls for said band; a second endless, flexible band engaging said web and pressing the latter against said pointed elements on said web-working band; means for directing the web into a position between said bands to be advanced thereby; means for driving said bands to advance the web; and a guide roll for said second band positioned with respect to the guide rolls for said web-working band for flexing the latter to cause changes in the longitudinal spacings of said pointed elements on successive portions of said web working band to effect readjustment of the yarn components of the web within the body thereof as the web is advanced between said bands.

10. Apparatus for mechanically working a fabric web to effect a change in the superficial dimensions thereof comprising; an endless, flexible card-cloth band the wires of which project from the outer surface thereof with their ends disposed in longitudinally spaced relation and adapted to grip and advance the web; means for driving said band; retaining means engaging the web to prevent the formation of undulations in the surface thereof; means acting on said band for flexing the latter to cause changes in the longitudinal spacings of the ends of the wires on successive portions of said band, as the latter advances the web, for exerting loosening, shoving and pulling actions on the component yarns of the web to readjust their positions within the body of the web; and means for disengaging the web from engagement with wires of said card-cloth band subsequent to readjustment of the yarn components of the web by said projections.

11. A process for treating a fabric web to place its component yarns in a state of equilibrium and substantially free from further changes in dimensions upon subsequent laundering operations, comprising plasticizing the fabric web, affixing the plastic web to a contractible surface made up of a plurality of pointed elements capable of movement with relation to each other, re-

5 taining the web against said surface whereby any material surface undulations of the web are prevented, moving the pointed elements affixed to said web into closer relationship, removing said web from said surface and subsequently drying the same.

10 12. A process for treating a fabric web to place its component yarns in a state of equilibrium and substantially free from further changes in dimensions upon subsequent laundering operations, comprising plasticizing the fabric web, affixing the plastic web to a contractible surface made up of a plurality of pointed elements capable of movement in relation to each other, retaining the web against said surface whereby any material surface undulations of the web are prevented, moving the pointed elements affixed to said web into a closer relationship, moving the pointed elements affixed to said web apart but a distance less than they were originally moved together, removing said web from said surface, and setting the same.

15 13. Apparatus for mechanically working a fabric web to effect a change in its superficial dimensions comprising; a web working band of at least the width of the fabric web having a plurality of pointed elements thereon with their outer ends disposed in longitudinally spaced relation and adapted to grip and advance the web, means for driving said band, means for effecting changes in the longi-

tudinal spacings of said ends of said pointed elements as said band advances the web to cause said pointed elements to mechanically work the web by exerting shoving and pulling actions on the component yarns of the web to readjust their positions within the body of the web, means engaging the side of the web opposite said band for holding said web against formation of surface undulations therein during the web working operation, and means positioned adjacent said band for disengaging the web from said pointed elements thereon subsequent to said web working operation.

10 14. An apparatus for treating a fabric web to impose a preshrunk condition thereon comprising means for rendering the web plastic, web working means comprising a card cloth belt of at least the width of the fabric web having bristles constituting web penetrating projections adapted to grip said web, means for varying the spacing of the ends of the projections to effect a working and compressing of the web, means engaging the side of the web opposite the web working means to hold the web against said web working means to prevent the formation of surface undulations therein during the web working operations and means for drying and setting the web in its preshrunk condition.

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