Dec. 4, 1934. H. A. WOODHEAD 1,982,720

METHOD AND APPARATUS FOR TREATING CLOTH

Filed June 6, 1933 3 Sheets-Sheet 1

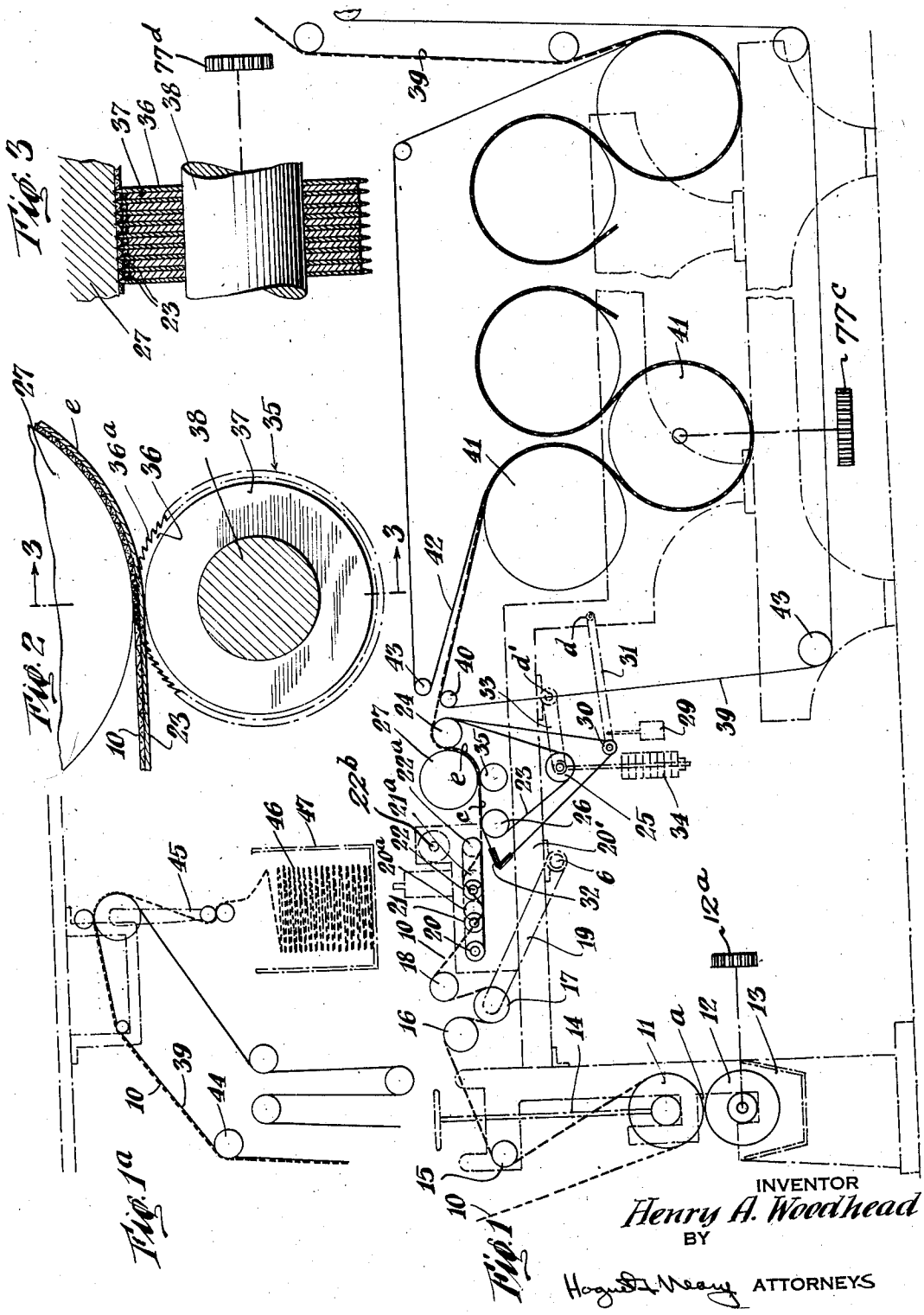


Fig. 3

Fig. 2

Fig. 1a

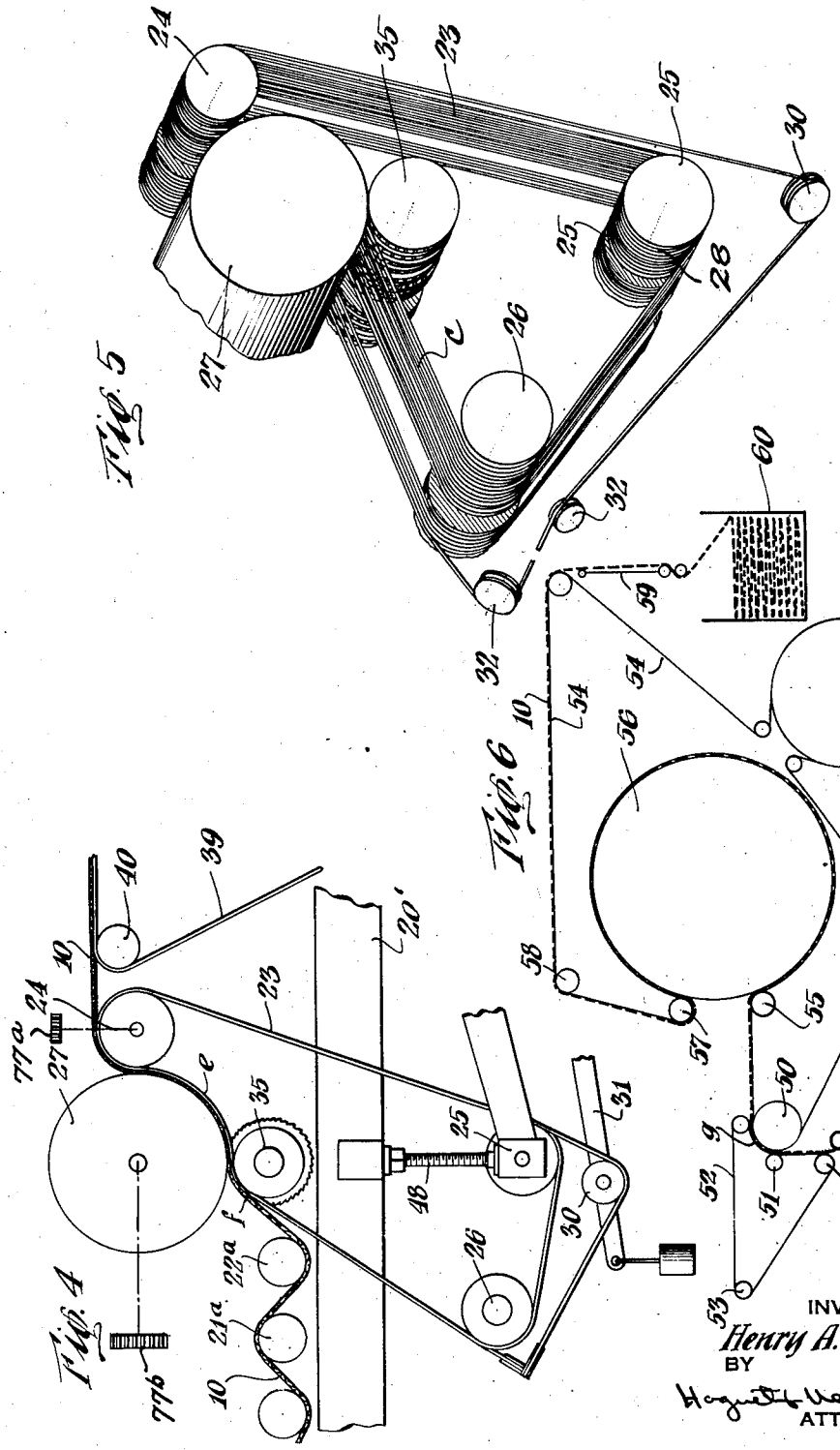
Fig. 1

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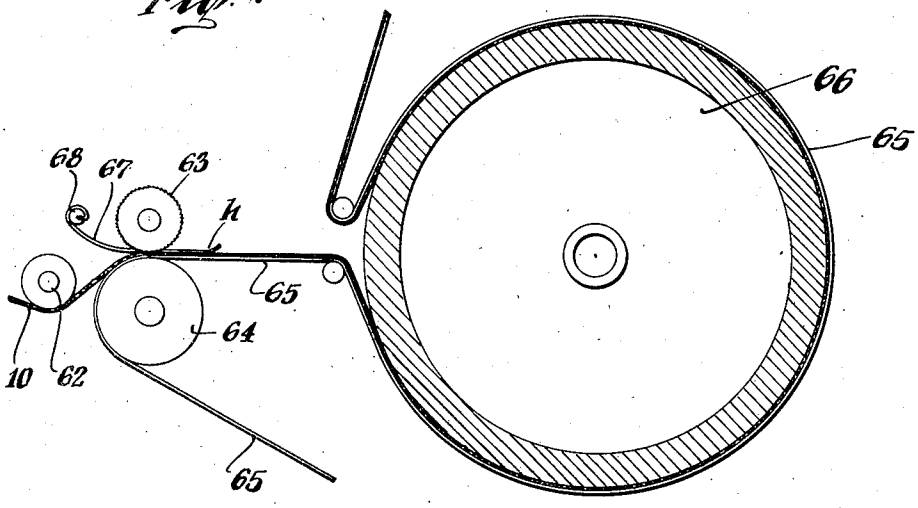


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METHOD AND APPARATUS FOR TREATING CLOTH

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Fig. 7



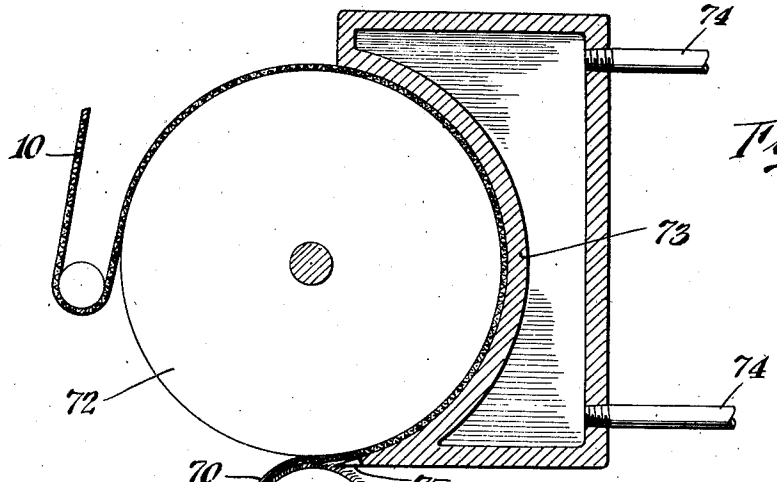


Fig. 8

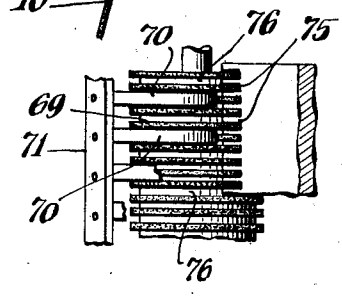


Fig. 9

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UNITED STATES PATENT OFFICE

1,982,720

METHOD AND APPARATUS FOR TREATING CLOTH

Henry A. Woodhead, Graniteville, S. C.

Application June 6, 1933, Serial No. 674,495

42 Claims. (Cl. 26—38)

My invention relates to process and apparatus for pre-shrinking cloth for the purpose of substantially eliminating in subsequent laundering operations shrinkage in both warp and weft. More particularly my invention relates to process and apparatus for mechanically diminishing the superficial extent of the web and readjusting the yarn components by positive and closely controlled mechanical operations which may be performed as part of the fabric finishing operations or subsequent thereto. These operations may be carried out in my process and by means of my apparatus in a sure and effective manner to obtain in a fabric dimensions and characteristics which have been predetermined by carrying out a test laundering operation on a unit portion of the fabric. Furthermore, the dimensions and characteristics imposed upon the fabric by my process and apparatus may be varied easily as desired within relatively wide limits so that not only can specific conditions be positively imposed on the web under treatment, but also these conditions can be varied easily to become adaptable to modifying circumstances.

The early methods of pre-shrinking consisted essentially in wetting the cloth and hanging it in loops from carrier frames and allowing it to remain in this condition until shrinking had taken place. Notwithstanding an unsatisfactory pre-shrink was obtained as only about one-half of the normal shrinkage of the cloth was taken up in this manner and, furthermore, the fabric resulting from this operation did not have a finished appearance and further operations were necessary in order to make it satisfactory to the trade.

Other pre-shrinking operations have been developed in an attempt to get away from this pre-shrinking by wetting. Certain of these subsequent operations consisted in imposing an excessive crinkle on one set of yarns by pulling out or straightening the opposite set of yarns. This was accomplished by treating the web on a tentering frame, stretching it weftwise, while allowing a takeup warpwise. The operation, it is true, gave a pre-shrunk condition warpwise but allowed an excessive amount of shrinking weftwise. Attempts to avoid this condition consisted in following the weft stretching operation with a moistening step, the purpose being to permit a return of the weft yarns to a condition approaching their normal crinkle. These operations, however, were commercially unsuccessful and failed to give a satisfactory, uniform, pre-shrunk material. Usually fabric processed in this manner had an excessive shrinkage in one direction with substantially no shrinkage in the opposite direction and, furthermore, the control of the pre-shrinking imposed upon the material was difficult to maintain and, as a result, a product having undesirable characteristics was obtained.

Another type of apparatus which has been used in carrying out a pre-shrinking operation has been one which makes use of a thick blanket to which the web under treatment is affixed while the blanket is flexed in such a position that the surface to which the web is affixed is convex. The blanket is then flexed to a concave position and due to its considerable thickness, its surface is diminished and thus the web affixed to it is diminished to a degree in surface in one direction. This setting operation is usually carried out on well known equipment such as a Palmer dryer except that the blanket used is made thicker than is usual with such equipment. The disadvantages, however, of this type of apparatus are many. The blankets, are of such thickness that there is a great amount of internal wear which gives them a relatively short life. As they are an expensive element of the equipment, this is disadvantageous. Furthermore, such blanket flexing apparatus is not readily adaptable to processing different types of material as there is no means for controlling or adjusting the amount of reverse flexure given to the blanket without considerable difficulty. Also, the operation can only be carried out subsequent to a finishing operation in view of the fact that the blanket and the ironing part of the equipment must be kept free from any sizes which if present to any extent in a wet condition tend to impregnate, gum and cake up the apparatus and thus soon prevent effective operation. It is necessary for the blanket to be kept relatively porous for it holds the web against a heated drying drum and the moisture to be removed in a setting operation must pass out through the blanket. This blanket contracting operation which diminishes the web warpwise has sometimes been used with other equipment which attempts to control the width weftwise. It is seen, therefore, that there have been many objections to these pre-shrinking operations both as to process and apparatus and, furthermore, a satisfactory pre-shrunk material has not been obtained. Also, there has been no delicate and positive control for carrying out the pre-shrinking operations as adjusted to various types of material.

By my invention the objections set forth above are avoided.

An object of my invention is to obtain a positive, continuous, pre-shrinking operation which is effective under all conditions.

Another object of my invention is to obtain an apparatus which is relatively simple to operate and which is effective in positively imposing a suitable pre-shrunk condition in a web.

Other objects and advantages will become apparent from my following specific description and drawings which, however, are for the purposes of illustration only, and to which I do not wish to be limited.

Figure 1 of my drawings is a diagrammatic outline of a form of my pre-shrinking apparatus suitable for carrying out my process.

Figure 1*a* is a continuation of Figure 1.

Figure 2 is an enlarged detail of the compression roll and upper roll of Figure 1.

Figure 3 is a detail taken at 3—3 of Figure 2.

Figure 4 is a detail of a modified form of my apparatus.

Figure 5 is a broken detailed view in perspective of a supporting surface.

Figure 6 is a diagrammatic outline of a modification of my pre-shrinking apparatus.

Figure 7 is an outline of another modification of my device.

Figure 8 is also an outline of a modification of my device.

Figure 9 is a detailed view of a portion of Figure 8.

Referring now more particularly to the drawings in which like reference characters denote like parts, Figures 1 and 1*a* indicate in simplified outline a side elevational view of a preferred form of my apparatus suitable for carrying out my pre-shrinking process and there is indicated by the dotted line 10 the center line of a fabric or web passing through this apparatus. The web first passes between the sizing rolls 11 and 12. These rolls are driven from a power source 12*a* which permits a close control and variation in their speed of rotation and thus permits a control of the rate at which the web 10 passes into the apparatus. The lower roll 12 dips into the sizing trough 13 and carries sizing material on its surface up to the zone *a* in the nip where it is pressed into the web 10. The application of this size converts the web from its original dry condition into a plastic soft condition.

It is to be understood, of course, that various modifications of this sizing apparatus may be used. The web may, for example, be led directly into sizing bath 13 and then pass through the rolls as in a slop starched operation. The sizing used may be of any desired type, depending upon the particular characteristics to be imparted to the web in its finished condition. Starch, dextrin, gums and soluble oils customary in finishing operations may be used.

The spacing of the rolls may be adjusted in the usual manner by the control 14. The web, after passing through finishing sizing operations goes over idler rolls 15 and 16, and around a tensioning roll 17 and another idler roll 18. The tension roll 17 is carried by a bar 19 connected to the frame 20' and pivoting at the point 6. If slack develops in the web after passing through the sizing rolls, the tension roll 17 tends to drop down and take up such slack. The tension imposed by the roll 17 on the web may be regulated if desired, for example, by weighting means, not shown, on the bar 19.

I have shown the web after passing over the roll 18 as being brought into contact with a means for stretching it weftwise. This step will not necessarily always be found essential to the process as will be later pointed out. I have indicated in this figure the use of curved expander rolls 20, 21 and 22 driven if desired by the means 22*b*, the outermost portions of curve of each of these rolls being indicated by the reference characters 20*a*, 21*a*, and 22*a*, respectively. I have indicated the web 10 by its center line as passing over the outer portions of the curve of these rolls. Other types of stretching device may be used in place of these expander rolls such as, for example, driven or undriven belt expanders or driven edge gripping rolls acting as expanders.

The web is delivered from the expanding means on to a supporting surface 23. This supporting surface can best be seen from the perspective detail of the apparatus indicated at Figure 5. In my preferred form this surface is made up of a series of sections extending across the width of the rolls of an endless continuous cord. This cord passes around the rolls 24, 25 and 26 and bears against an upper roll 27, the operation of which will be later described. This cord is wound around these rolls a sufficient number of times to substantially cover them with only narrow intermediate spaces. The windings run, for example, in the grooves 28 on the idler rolls. These cord grooves extend over the surface of these rolls for any desired width such as, for example, something greater than the width of the web usually run. In many cases this width may approximate 40''. It is necessary that the supporting surface formed by this continuous cord should be even at all times and this result is accomplished by maintaining a tension upon the cord windings sufficient to avoid slackness in any cord winding, particularly the portion forming the surface *c* where it is in actual contact with the plastic web. This slackness is avoided by maintaining a tension on a single strand as indicated by the weight 29 bearing on the idler roll 30, over which a strand passes. This roller can be connected to a bar 31 which is pivoted to the frame at *d*. The cord then passes over idler pulleys 32 and back to the main portion of the cord windings forming the supporting surface. Tension is also maintained on the series of cord loops as a whole, by adjustment of the roll 25 which is carried by the supporting arm 33 pivoting at *d'* where it is attached to the frame 20'. I have shown in the modification of Figure 1 that this tension may be applied by hanging a weight 34 so as to act on the roll 25. The cord may be of any tough material which is not unduly softened by wetting and which has good wearing qualities. By means of this arrangement I am able to obtain an endless supporting surface having intermediate and continuous interstices and which has an even and uniform tension over its entire operative surface. Other means may be used to obtain a supporting surface. If desired, it may be made up of a series of resilient belts or a metallic material may be used.

The web 10 is carried by this surface 23 and passes between the upper roll 27 and a lower roll 35. The lower roll 35, as can be seen from detail Figures 2 and 3, is made up in the form illustrated by a series of thin toothed discs 36 having intermediate spacers 37 extending nearly to the outer toothed portion of the discs 36. Both the intermediate spacers 37 and the discs 36 preferably are fitted upon a shaft 38 and pressed

tightly together into a rigid position and so retained. It will be noted that due to the fact that the spacing discs 37 do not extend out to the outer periphery of the toothed discs that grooves are left between the toothed discs. It is in these grooves that the series of cord loops or belts forming the supporting surface 23 pass. It should also be noted that the grooves are of sufficient depth to permit the teeth 36*a* of the discs 36 to extend through and beyond the surface 23 when the loops lie within the grooves. The teeth 36*a* have been somewhat exaggerated in Figure 2 for the purposes of illustration. These toothed discs are preferably made of stainless steel and the teeth 36*a* designed to penetrate the cloth and yarn components or at least firmly grip it without injuring or tearing. These teeth 36*a* are preferably relatively fine, pointed at their ends and beveled on the sides to permit easy penetration. The teeth are also preferably undercut about 15 degrees from the radius to obtain a firm grip on the fabric to be treated and yet to permit a withdrawal of the web or fabric from the toothed roll without tearing. The upper roll 27 is preferably made of rubber to allow the teeth to bear against it, if desired, without injuring them. Also the rubber surface when wet is slippery and permits the slippage of the web over its surface as will be later described.

The upper roll 27 and the roll 24 driving the supporting surface rotate at the same surface velocity, and thus the portion of the supporting surface 23 where it bears against the upper roll 27 within the zone *e*, travels at the same rate as the roll 27. These rolls 24 and 27 may be driven through a positive drive from the same source as the drive for the drying cans which will be later described as indicated in Fig. 4, by the means 77*a*, 77*b*, and 77*c*. The toothed roll 35 can also be driven by the means 77*d* through idler gears by the roll 27. However, the intermediate drive of the roll 35 is so arranged by means of gears or otherwise that the roll 35 has a greater surface velocity than the roll 27 and the supporting surface 23. The toothed roll 35 is preferably driven by a gear which can be quickly and easily changed to permit a variation of the differential in surface velocities between the roll 35 and the rolls 24 and 27. This can be easily accomplished, of course, by having several driving gears for the roll 35 with a different number of teeth on each and thus the velocity of the roll 35 will be proportional to the number of teeth in the particular driving gear which is attached to it.

While I have illustrated and described a working roll comprising a toothed roll composed of thin spaced discs, I do not wish to be so limited. The primary object of this roll is to secure a firm grip upon the cloth to force it forward and also to work the cloth which facilitates the readjustment of the component yarns mechanically and causes a rearrangement of them to a pre-shrunk condition. It is preferable to have a roll which has the penetrating and working action of my toothed disc roll. However, it is possible to use a roll covered with card clothing in which the wire bristles are the effective agents. Also, if desired the roll may be covered with an abrasive material such as carborundum.

After the web has been delivered on to the supporting surface 23 at the zone *c*, it is gripped by the toothed roll 35 and carried forward at a faster rate than the web is being carried between the roll 27 and a supporting surface 23 in the zone *e*. The operations carried out upon the web between the zones *c* and *e* are later described in detail. The supporting surface, as already pointed out, passes over the roll 24 and continues down to the idler roll 25 and thence around the roll 26 into position in the zone *c* again. The roll 26 is adapted to be moved up and down to vary the grip or bind on the web 10 between the roll 27 and the surface 23 as desired.

The web is delivered from the confinement in the zone *e* and from the roll 24 on to a canvas band 39 which is carried at that point by an idler roll 40. This canvas band carries the web to a series of heated drying cans 41. The web is further supported by a second endless canvas band 42 carried by appropriate guides and rolls 43 which comes in contact with its opposite side before reaching the first of the drying cans 41. The compressed web thus is dried between two supporting surfaces and is set in its treated condition without being subject to further strain. At the end of the series of drying cans 41, the canvas bands separate and the web is carried by one of them by means of appropriate guide rolls 44 to an oscillating device 45 which folds the finished fabric into suitable piles 46 in the bins 47.

I have shown in Figure 4 a detail of a modification of my apparatus in which the web 10 passes over a means for stretching it weftwise, in this case indicated as expander rolls 21*a* and 22*a*, similar to those in Figure 1. However, instead of delivering the material on to a supporting surface formed by the cords 23 as indicated at the zone *c* of Figures 1 and 5, I have lowered the idler roll 26 to a position which permits the web to be delivered directly on to the toothed roll 35 at a zone *f* prior to entrance between the roll 27 and the toothed roll 35. By this arrangement I am able to positively assure a firm grip between the roll 35 and the web 10 and, if desired, obtain a more complete entrance of the fine teeth of the roll 35 into the fabric web. The cords of the supporting surface 23 continue around the upper roll 27 through the zone *e* in the same manner as described in connection with the apparatus of Figure 1. The web is delivered to the canvas band 39 carrying the web to the drying cans 41 also in the same manner.

I have indicated also in Figure 4 another means for obtaining a positive tensioning of the supporting surface 23. In this case I have shown the lower roll 25 around which the series of cord loops pass as having its tensioning pressure controlled by a screw mechanism 48 which bears against the frame 20′ and the journal of the roll 25. By this means I am able to exert a positive and tremendous pressure on the roll 25 and thus obtain a fixed adjustment of its tensioning position and as a consequence, a fixed adjustment of the tension on the supporting surface 23.

In Figure 6, I have shown an outline of another modification of an apparatus suitable for carrying out my pre-shrinking operation. The web 10 may be delivered from the weft stretching or expanding means indicated by the reference character 49 to the nip between a roll 50 and a roll 51. The roll 50 corresponds generally to the resilient upper roll 27 of Figure 1 and the roll 51 is preferably a roll similar in operation to the roll 35 of Figure 1. Also passing between these rolls is a supporting surface 52 preferably of a type similar in operation to the supporting surface 23 of Figure 5 so as to permit the roll 51 to operate on the web through it. This supporting surface 52 is driven and is carried by suitable idler rolls 53. The supporting surface carries the web

in contact with the roll 50 in the zone *g*. The surface 52 and the roll 50 as in my previous modifications travel at the same surface velocity. The roll 51 travels at a somewhat greater surface velocity, depending upon the type of material being processed. Thus the cloth or web 10 is forced forward by the roll 51 faster than it is being carried away in the zone *g*. Also passing around the roll 50 is a band 54. This band 54 which may be of canvas, against which the web 10 lies, supports it after its delivery from the zone *g* and carries it over a guide roll 55 which positions the canvas band and web 10 in close contact with the large drying drum 56. The web is supported by the canvas band and held in contact with the drying drum 56 until it is set after which it is delivered from the drum and passes around the idler rolls 57 and 58, while still supported by the canvas band 54 and is delivered to an oscillating means 59 which folds it in a bin 60. The band 54 is directed around a drying drum 61 by suitable idler rolls and continues back around the roll 50. It will be noted that by means of this arrangement the web is continuously supported at all points until it is set and delivered in a dry finished condition into the bin 60. There is thus no loss of the pre-shrunk characteristics which have been imparted to it during its processing.

In Figure 7 I have disclosed an outline of a modification of an apparatus suitable for carrying out my process which, while it makes use of a working roll similar in operation to the roll 35 of Figure 1 for operating upon the fabric, yet it has eliminated the supporting surface which moves at the same surface velocity as the fabric and cooperating roll and which holds the web between restraining surfaces. In this modification as illustrated in Figure 7, the web 10 can be delivered from a weft expanding means of any desired type, indicated by the reference character 62. This web is delivered into the nip between an upper working roll 63 preferably of the same type as the roll 35 of Figure 1 and a lower roll 64 which corresponds generally to the resilient upper roll 27 of Figure 1. In order that the web may be held between restraining surfaces, I have provided a band 65 of substantially the same type as band 54 of Figure 6. This band 65 acts in cooperation with a drying drum 66, and suitable guide and idler rolls as well as drying drums are provided as indicated in Figure 6. I provide as a means for holding the web against the band 65, flexible wire or spring like members 67 which may be attached to a support 68 extending across the length of the rolls and parallel thereto. The resilient retaining means 67 pass between the toothed discs of the roll 63 for example and lie in recesses therebetween in substantially the same manner as the cords already described and indicated in Figure 5. The members 67 extend out beyond the nip a considerable distance and lie substantially parallel with the canvas bands supporting surface 65 as can be seen at the retaining zone *h*. The surface velocity of the roll 64 and band 65 is the same as that of the web 10 within the zone *h* and, of course, is the same as surface velocity of the drying drum 66. The surface velocity, however, of the toothed roll 63 is greater than that of the roll 64 and as a consequence the web is worked upon and shoved forward and compressed in substantially the same manner as in the operation of my device described in connection with Figure 1, except that the upper surface formed by the flexible member 67 extending through the toothed rolls is not movable and the web slides along over this surface. However, these members may be made of a flexible material such as stainless steel and do not exert any material frictional resistance upon the web particularly when it is in a plastic moist condition due to a starch sizing operation. The web is carried by the band 65 through the zone *h* and is delivered into close contact with a drying drum 66 by the canvas band 65. After the material has been properly dried and set and is in a finished condition, it is delivered to suitable containers, similar to the manner indicated in Figure 6.

In Figures 8 and 9 I have indicated also somewhat diagrammatically another modification of my device. In this apparatus the web may be delivered directly on to a suitable working or friction member from weft expanding means or from other prior processing equipment. The working roll 69 may be of the same type as the toothed disc roll 35 already described or may be made for example from card cloth having narrow longitudinally extending space portions free from wire bristles. I have indicated in my drawings the use of such card cloth. The web 10 is maintained in close contact with this card cloth by means of flat curved spring-like members 70 which at space intervals hold the web to be treated against the curvature of the roll 69. These curved flexible members 70 may be held by a central retaining member 71 extending the width of the web. The web 10 is delivered from the friction means on to a revolving drum 72 which may, if desired, be covered with resilient material or padding. This drum has following a portion of its surface curvature a heated polished ironing device 73 which has means 74 for supplying heat to the same. At the lower portion of this smooth polished ironing means 73 there are spaced teeth 75 which are adapted to fit into the narrow spaced portions on the card cloth which are free from bristles. These teeth 75, therefore, penetrate below the surface or outer periphery of the friction roll 69 and thus act to lift the web 10 from this roll. The free spaces or grooves on the friction roll 69 can be seen at 76 of Figure 9 and also the teeth 75 can be seen extending into these grooves. In operation, the cloth in a plastic condition is delivered on to this friction roll, if desired, at the proper width after having passed through means for stretching the web weftwise. The friction roll 69 is driven at a greater surface velocity than the roll 72 and thus the web is delivered from the roll 69 at a greater speed than it is taken away by the roll 72. Furthermore, the web is held into close contact with the friction roll by means of the flexible curved members 70 and thus there is a working and penetrating action on the surface of cloth which further facilitates adjustments in superficial dimensions to a pre-shrunk condition. After the cloth has passed in between the drum 72 and the curved heated ironing means 73 it is dried and set and given a finished appearance. Subsequent operations performed upon the cloth as well as the prior operations may be similar to those described in connection with the operation of the apparatus outlined in Figures 1 and 6. I have shown in connection with these several apparatuses an exaggerated view of cross section of a fabric material. This has been done for the purposes of illustration only and is not to be considered as indicating necessarily the actual modifications imposed upon the fabric.

In my process of mechanical working, the

treated fabric is forced into a contracted and reconstituted condition in which it is substantially immune from further contraction and rearrangement due to the wetting and working of a subsequent laundering operation. I have found that the shrinkage resulting from laundering operations is not solely due to increased crinkle which may be induced in the warp or weft yarns but that it is also due to a rearrangement and readjustment of the yarns and fibers due to the working and reconditioning and flexing of the fabric in all directions in its plastic condition while laundering. It is this rearrangement which I obtain by mechanically working rapidly and positively. My process for pre-shrinking is preferably carried out at such a point in the processing of the fabric that no further operation is necessary which will destroy pre-shrunk advantages obtained. I thus preferably carry out my pre-shrinking operations as part of the finishing operation upon a fabric.

In my preferred process the fabric is delivered to the rolls 11 and 12 which carry out a sizing operation on the web or fabric 10 and convert the fabric to a plastic condition. This step in the process is performed after the usual preliminary steps of singeing, removing the warp sizing, dyeing, mercerizing, bleaching, printing, drying or other customary operations have been performed upon the web. The fabric may be made plastic by merely moistening or may be processed in a wet condition resulting from some preliminary operation. In any event to have the web in the most suitable condition for carrying out my mechanical pre-shrinking operation, I prefer to have it in a plastic condition, although with certain conditions and types of fabric, a dry operation may be carried out. The web when in a plastic condition is more easily adaptable to the mechanical workings which are imposed upon it. The tension of passing the web 10 through the equipment subsequent to plasticizing tends to impose a warp strain on the web and thus tends to straighten out the warp threads and induce a crinkle in the weft threads. This results in a shrinkage weftwise of the web. The amount of such shrinkage weftwise I can control by means of my tensioning mechanism 17 and 19. I also can control this weft shrinkage by varying the differential in surface velocities between the web feeding rolls 11 and 12 on one hand, and the toothed compression roll 35. For example, it is possible to drive the toothed working roll 35 which firmly grips the cloth at such a speed as to make it pull against the cloth delivered to it by the feed roll 11 and 12 over and above the normal warp tension on the web in processing. On the other hand, I can drive the rolls 11 and 12 at a greater surface velocity than the roll 35 and thus minimize the tension on the web between these two points.

The web after passing between the control rolls 11 and 12 may be found to have the desired width in which case it can be delivered directly to the working roll 35. If, however, the web is found to have a greater width than desired, it may be reduced weftwise by imposing a tension on it warpwise as described between the control rolls 11 and 12 and the working roll 35. For the purposes of illustration I have described a pre-shrinking operation in which the web is narrower, that is more contracted weftwise, than desired and, therefore, it is stretched weftwise to a desired width. In this operation I preferably pass the web while still in its plastic condition over a weft stretching means and remove that portion of weft shrinkage which I desire. That is, I stretch the weft back to the desired width normally present in the final pre-shrunk materials. If desired, I may use a driving mechanism for the weft and stretching means and thus eliminate the warp tension induced by friction in passing the web over such expander roll as indicated at 20, 21 and 22 of Figure 1 for example. This weft stretching should be carried out to deliver the web to the toothed compression roll at that width which I have found will be present in a fabric which has been properly pre-shrunk in two directions. For example, a yard of grey material which had an original woven width of 31" may have a width of only 27" upon delivery to the size rolls 11 and 12. This would be due to the drawing out of the web warpwise by the preliminary operation carried out in processing. The desired and proper shrunk dimensions which can be determined by performing a normal laundering operation upon a square yard cloth may be found to be 33" by 29½". Therefore, I draw out the web weftwise by means of the expander rolls 20, 21 and 22 to 29½" in width. The web is then delivered immediately to the working roll which rearranges the fabric to a warpwise dimension of 33" in length. The weft dimension is unaffected and remains at 29½". This is accomplished by always supporting the web until it is in a final set condition for marketing and thus eliminating all warpwise tension.

There may be, of course, a certain loss in the weft of the material after its discharge from the expanding means 20, 21 and 22 due to the warp tension which must be imposed upon the material to pull it through such equipment when not driven. This loss can be taken care of by over-stretching in width an amount equal to the subsequent loss in width due to the warp tension. For example, if the loss in width in transferring to the zone *c* is found to be about 20%, the fabric may be over-stretched an equivalent amount and thus a desired width of the web obtained on the supporting surface 23.

Another means for avoiding such loss and obtaining a positive and accurately controlled weft dimension would be to use a weft stretching mechanism which was driven, and thus eliminate the warp strain due to the resistance of friction in driving such equipment. For example, a driven belt stretcher may be used or driven edge gripping rolls.

In the modification of my apparatus indicated in Figure 4, I have shown an arrangement for substantially avoiding such loss in weft by obtaining a support for the stretched web substantially immediately upon its delivery from the weft stretching means.

The weft stretched plastic web is carried by the supporting surface 23 and no further warp tension is permitted on the web. Thus its weft dimension will be preserved as completely as possible until the web is delivered into the nip between the toothed compression roll 35 and the resilient upper roll 27. The supporting surface 23 formed by the series of loops of the cord 23 and the upper roll 27 travel at the same surface velocity. The cords of the supporting surface 23 are held in a position by roll 24 to bear against the upper roll 27 over a portion of its surface as indicated by the reference character *e* and thus the web is prevented from flexing while retained between these two surfaces. On the other hand, the roll 35

travels at a greater speed than the surface 23 and the roll 27 and thus at a greater speed than the web 10 when within the zone *e*.

The teeth of the thin discs making up the roll 35 should be adapted to the material which is being run. Preferably these discs have teeth of something less than one-sixteenth of an inch in depth and are cut back at an angle of about 15° from the line of the radius of the disc. The outer edges of the discs have a double bevel so that the teeth have thin points adapted to easily penetrate the cloth and its yarn components and withdraw from it without tearing. If desired, a brush roll for removing lint from the working roll 35 may be positioned adjacent to it.

I have found that the shrinking of a fabric which takes place in the normal, usual laundering operation is not all due to an increase in the crinkle of the yarns in the warp and weft directions. In carrying out a laundering operation, there is a considerable variety of strains imposed upon the fabric when it is in a soft plastic condition. It is, for example, pulled and crumpled and subjected to tensioning strains at angles to the warp and weft. This considerable working in laundering permits a complete readjustment, rearrangement and reconstituting of the yarns and their fibers making up the fabric and it is this readjustment which is one of the primary causes for a change in dimension in a fabric upon laundering. It is possible, for example, to have a fabric actually increase in a dimension upon laundering. This condition arises when the fabric has been contracted mechanically in a superficial dimension to a greater amount than the fabric would normally assume by laundering. Such a web upon being laundered assumes its normal, laundered state of equilibrium and the overly contracted dimension is found to have increased. I have found that a material portion of the results which I obtain in diminishing the superficial extent of a web is due to the readjustment and rearrangement which takes place within and between the component yarns of such web, and can be distinguished in part from an actual increase in crinkle of the yarn components. It should be kept in mind that it is possible to increase the number of crinkles per inch over those normally present in the fabric as woven without perhaps increasing the amount of crinkle, that is, without increasing the angularity of the undulations or crinkles of the yarn.

It can be seen from the enlarged detail and somewhat exaggerated view of the toothed discs operating upon a fabric, as indicated in Figure 2, the teeth 36*a* come into contact with the web at an angle to the surface of the web and the teeth are forced into the web and penetrate it. The teeth also leave the web at an angle and tend to pull and work on the component yarns. The teeth are so small that they tend to operate not only upon the individual weft yarns but also actually enter between the fibers making up the warp yarns. This operation causes a loosening and readjustment of the yarns and in view of the fact that the roll 35 is travelling faster than the web in the zone *e* there is a consequent shoving together of the warp yarns as well as a compacting operation on the weft yarns which are gripped by the teeth. It may well be that the actually increased crinkle induced into the warp yarns by my operation is not the important factor in preshrinking when considered in connection with the readjusting and reconstituting of the component yarns by the penetrating and working action of the fine teeth of the toothed roll. It should be noted that the teeth in penetrating the fabric and entering between the fibers of the component yarns do so at an angle and that this tends to cause a movement or loosening upon both the warp and weft yarns such as a shoving operation at an angle to the surface of the cloth and with a vector in the direction of movement of the web. The teeth in withdrawing from the fabric also exert a similar action in that they pull on the yarn components and tend to bring about a readjustment.

I have found that it is possible to obtain from 5 to 12% contraction or compression warpwise with an averaged operation of my toothed compression roll upon the web as described. Of this 4 to 5% may be due to the readjustment of the yarns in view of the piercing, pulling, loosening, readjusting, compressing and related working actions on the individual yarns and their fibers by the operation of the working roll 35. Another 4 or 5% may be due to an actual increase in crinkling, that is, an actual increase in the number of crinkles per inch and possibly in the amount of angularity. It is possible, of course, to obtain an increased amount of working and compressing action by increasing the differential between the surface speeds of the roll 35 as against the speeds of the upper roll 27 and the supporting surface 23. In such case the roll 35 shoves the web forward to an even greater degree than it is being removed in the zone *e* and a greater compacting and working of the web results. For example, I have carried out a compressing operation in which the surface has been diminished approximately 20%. The upper limit of such action is the point at which the differential becomes so great that the cloth can no longer take care of the readjustment but resists to such an extent that the teeth of the discs on the roll 35, or other means, tear the fibers and yarns of the web.

The web is delivered from the zone *e* to a means for setting the web in its pre-shrunk warp and weft dimensions and which means delivers the web as a fabric having desired finished characteristics. This is accomplished in my process by delivering the web, as indicated in Figure 1, to a position between endless carrier bands which hold the web without imposing any strain upon it in carrying it around drying cans 41. The web is tightly retained while drying between these canvas bands and is delivered in a dry, smooth condition. The surface velocity of the bands is the same as the surface velocity of the roll 27 and the supporting surface 23 so that the web is carried away from the zone *e* without any strain being imposed upon it and without any slack accumulating. It may be found, however, that there is some disadvantage in permitting the web to be unsupported between the rolls 24 and 40 due to a possible loss in the amount of preshrink given to the web in its warp dimension. This, however, can be taken care of by over-compressing the web warpwise by proper adjustment of the speed of the roll 35 to the speed of the web. Another arrangement, for example, the modification of my apparatus indicated by Figure 6, may be used to avoid this difficulty. In this apparatus the web is at no time unsupported but is carried by canvas band 54 directly from the compression zone *g* to the drier 56. The speed at which the web travels through my apparatus is limited substantially only by the drying capacity of the series of drying cans 41. These cans may be heated by saturated steam at 10 to 15 pounds

pressure and at temperatures of 225° to 235° F. The web may travel at a rate of from 30 to 60 yards per minute.

It will be noted that in my process it is unnecessary to dry the fabric after the sizing operation and before carrying out the pre-shrinking operations. Such a step has usually been necessary previously in pre-shrinking devices due to the fact that the sizing in its original moist condition upon the web was found to clog the apparatus used and to render it inoperative or at least materially reduce its effectiveness within a relatively short period. My pre-shrinking apparatus is unaffected by the size in the web from the preliminary sizing operation. In fact, in compressing certain heavier materials in which a maximum amount of size is desired, my process has been found efficacious in incorporating size into the material. This is due to the working action of the roll 35 upon such material. While in the specific modifications described I have shown the sizing operation as an important element thereof in view of the fact that it renders the web in a plastic condition for effective pre-shrinking operation, it should be appreciated that other plasticizing means may be substituted for this sizing operation. For example, although my process is particularly effective in making a pre-shrinking operation a part of the finishing operation, it is possible to carry out my process upon a finished material which has been moistened to a degree sufficient to render it somewhat plastic and yet not to a degree to destroy the commercial finish. Also, in certain cases I have found it is possible to obtain satisfactory results when operating upon a fabric in a dry condition without the necessity of a preliminary softening operation.

While I have described only specific forms of my process and apparatus, I do not wish to be limited thereby for it will be apparent to those skilled in the art that other modifications may be made which would not depart from the spirit of my invention. I have found that by means of my process I am able to rapidly and with a minimum number of operations convert a fabric to a pre-shrunk condition. Also my process permits the obtaining of a fabric in which the pre-shrunk condition can be evenly adjusted in both dimensions and avoids a fabric in which the amounts of pre-shrinkage in each direction are not proportional. This mechanically imposed pre-shrunk condition simulates the type of fabric resulting from an actual laundering operation due to the working imposed upon the fabric during its processing except, of course, that the operation can be performed without affecting the commercial finish. My device can be used upon various types of fabrics made from cotton, wool, silk, linen or other materials used for fabrics, which tend to shrink upon laundering. It should be noted that by means of my process I am able to obtain a positive and delicate control in imposing the pre-shrunk conditions which control can be easily adjusted to give the desired results and adapted to the fabric processed.

I claim:

1. An apparatus for treating cloth comprising a web feeding means, a plurality of web retaining means adapted to prevent surface flexure of said web, a web gripping means operating through the surface of one of said web retaining means, and means for driving said web gripping means at a greater surface velocity than the web normally travels between said web retaining means.

2. An apparatus for treating cloth comprising a web cloth feeding means, a plurality of web retaining means adapted to prevent wrinkling of said web and acting on said web subsequent to said web feeding means, a web gripping means operating through the surface of one of said web retaining means and positioned to act upon the web intermediate said web feeding means and said web retaining means, means for driving a web retaining means, means for driving said web gripping means, and means for setting said web.

3. An apparatus for treating cloth comprising means for rendering the cloth web in a plastic condition, a plurality of web retaining means act ng on said web subsequent to said plasticizing means and positioned on each side of said web to substantially prevent formation of surface undulations, a web working means operating through the surface of one of said web retaining means and positioned to act upon the web intermediate said web plasticizing means and said web retaining means, means for driving said web working means at a greater surface velocity than that of said web, and means for setting said cloth.

4. An apparatus for treating cloth comprising a cloth web feeding means, a plurality of web retaining means positioned upon opposite sides of said web and adjacent portions of their surfaces forming a zone within which surface undulations of said web are substantially avoided, a web working means operating through the surface of one of said web retaining means and positioned to act upon the web intermediate said web feeding means and said web retaining means, means for driving at least one of said web retaining means, means for driving said web working means at a greater surface velocity than said web retaining means, and means for setting said web.

5. An apparatus for treating cloth comprising a cloth web feeding means, a plurality of web retaining means having a portion at least of their surfaces contiguous to form a retaining zone through which said web passes, said plurality of web retaining means comprising a roll and a supporting band lying against said roll, a web working means operating through the surface of said supporting band, means for driving said roll and said supporting band at identical surface velocities, means for driving said web working means at a surface velocity greater than that of said roll and supporting surface, and means for setting said web.

6. An apparatus for treating cloth comprising cloth web feeding rolls, means for rendering the web plastic, cooperating web retaining means comprising an upper resilient roll and an endless supporting band adapted to lie contiguously about said roll over a portion of its surface whereby a retaining zone is formed about said web adapted to prevent wrinkling of the same, a web working roll operating through the surface of said endless supporting band and positioned to act upon the web intermediate said feeding roll and said upper roll and endless supporting band, means for driving said upper roll and said endless supporting band at an identical surface velocity, means for driving said web working roll at a surface velocity greater than that of said upper roll and said endless supporting band, a series of drying cans, two endless bands moving around said drying cans and in contact therewith, and means for delivering said web subsequent to said upper roll and said supporting surface

into a position between said bands, and means for delivering said finished web into suitable containers.

7. An apparatus for treating cloth comprising a web feeding means, means for stretching the web weftwise, a plurality of web retaining means adapted to prevent surface flexure of said web, a web gripping means operating through the surface of one of said web retaining means, and means for driving said web gripping means at a greater surface velocity than the web normally travels between said web retaining means.

8. An apparatus for treating cloth comprising a cloth web feeding means, a web weft stretching means, a plurality of web retaining means adapted to prevent wrinkling of said web and acting on said web subsequent to the web feeding means, a web gripping means operating through the surface of one of said web retaining means and positioned to act upon the web intermediate said web weft stretching means and said web retaining means, means for driving a web retaining means, means for driving said web gripping means, and means for setting said web.

9. An apparatus for treating cloth comprising a cloth web feeding means, a web weft stretching means, a plurality of web retaining means having a portion at least of their surfaces contiguous to form a retaining zone through which said web passes, said plurality of web retaining means comprising a roll and a supporting band lying against said roll, a web working means operating through the surface of said supporting band, means for driving said roll and said supporting band at identical surface velocities, means for driving said web working means at a surface velocity greater than that of said roll and supporting band, and means for setting said web.

10. An apparatus for treating cloth comprising cloth web feeding rolls, means for stretching the web weftwise, means for rendering the web plastic, cooperating web retaining means comprising an upper resilient roll and an endless supporting band adapted to lie contiguously about said roll over a portion of its surface whereby a retaining zone is formed about said web adapted to prevent wrinkling of the same, a web working roll operating through the surface of said endless supporting band and positioned to act upon the web intermediate said weft stretching means and said upper roll and endless supporting band, means for driving said upper roll and said endless supporting band at an identical surface velocity, means for driving said web working roll at a surface velocity greater than that of said upper roll and said endless supporting band, a series of drying cans, two endless bands moving around said drying cans and in contact therewith, means for delivering said web subsequent to said upper roll and said supporting band into a position between said bands, and means for delivering said finished web into suitable containers.

11. An apparatus for treating a fabric comprising a fabric web feeding means, retaining means positioned at each side of said web to form a confined zone for said web wherein surface undulations are prevented, a web working means intermediate said web feeding means and said retaining means, said retaining means cooperating with said working means to inhibit the formation of surface undulations in the web delivered from said web working means, and driving means for said web working means and said web retaining means, said web working means being driven at a surface velocity different than the velocity of the web between said web retaining means, and means for setting said web in its treated condition.

12. An apparatus for treating a fabric comprising a fabric web feeding means, retaining means positioned at each side of said web to form a confined zone for said web wherein surface undulations are prevented, said retaining means comprising a roll and a supporting structure having open spaces therein extending longitudinally with the movement of the web, a web working means intermediate said web feeding means and said web retaining means, driving means for said web feeding means, said web working means and means in said confining zone, said web working means being adapted to be normally driven at a surface velocity greater than the velocity of the web with said confined zone.

13. An apparatus for treating a fabric comprising a fabric web feeding means means for plasticizing said web, a roll positioned against said web, a supporting structure positioned on the opposite side of said web and against said roll whereby a zone of confinement is formed about said web, a web working roll intermediate said web feeding means and said roll and supporting structure, said working roll acting through the surface of said supporting structure, means for driving said web feeding means, said web working roll and said web retaining roll, said working roll being adapted to be normally driven at a surface velocity greater than the velocity of the web in the zone between said roll and said supporting structure, and means for setting said web in its treated condition.

14. An apparatus for treating a fabric comprising a fabric web feeding means, retaining means positioned at each side of said web to form a confined zone through which said web passes and wherein surface undulations of the web are prevented, a web working roll intermediate said web feeding means and said retaining means adapted to work through the surface of one of said web retaining means, said working roll having web penetrating projections for gripping and working said web, driving means for said web feeding means, said web working roll and said web retaining means, said web working means being adapted to be normally driven at a surface velocity greater than the velocity of the web between said web retaining means, and means for setting said web in its treated condition.

15. An apparatus for treating a fabric comprising a fabric web feeding means, retaining means positioned at each side of said web to form a confined zone for said web wherein surface undulations are substantially prevented, a web working roll intermediate said web feeding means and said web retaining means and acting on the web through the surface of one of said web retaining means, said web working roll comprising a series of spaced thin toothed discs adapted to act upon the individual yarn components of said fabric web, means for driving said web feeding means, said web working roll and said web retaining means, said working means being adapted to be normally driven at a surface velocity greater than the velocity of the web between said roll and said supporting surface, and means for setting said web in its treated condition.

16. An apparatus for treating a fabric comprising a fabric web feeding means, retaining means positioned at each side of said web to form a confined zone for said web wherein surface un-

dulations are prevented, a web working means intermediate said web feeding means and said retaining means, said retaining means cooperating directly with said web working means to inhibit surface undulations in said web and to retard in said confined zone the delivery of said web from said web working means, driving means for said web working means, said web working means being adapted to be driven at a surface velocity different than the velocity of the web between said web retaining means, and means for setting said web in its treated condition.

17. An apparatus for treating a fabric comprising a fabric web feeding means, means for stretching the web weftwise, retaining means positioned at each side of said web to form a confined zone through which said web passes and wherein surface undulations of the web are prevented, a web working roll intermediate said web weft stretching means and said retaining means adapted to work through the surface of one of said web retaining means, said working roll having web penetrating projections for gripping and working said web, driving means for said web feeding means, said web working roll and said web retaining means, said web working means being adapted to be normally driven at a surface velocity greater than the velocity of the web between said web retaining means, and means for setting said web in its treated condition.

18. An apparatus for treating cloth comprising a cloth web feeding means, a plurality of web retaining means positioned adjacent to and on opposite sides of said web, means for driving at least one of said retaining means at the same surface velocity as said web, a web gripping and working means intermediate said web feeding means and said web retaining means, said web retaining means cooperating with said web working means to inhibit the formation of surface undulations in said web, said web gripping and working means being adapted to lie in contact with and positively grip said web, means for driving said web gripping and working means at a greater surface velocity than that of the web intermediate said web retaining means, and means for setting said web.

19. An apparatus for treating cloth comprising cloth web feeding rolls, means for rendering plastic said web, a plurality of web retaining means positioned adjacent to and on opposite sides of said web, means for driving at least one of said web retaining means at the same surface velocity as that of said web, a web gripping and working means intermediate said web feeding rolls and said web retaining means, said web gripping and working means being adapted to lie in contact with and positively grip said web and having a surface adapted to act upon the individual yarn components of said cloth web, means for driving said web gripping and working means at a greater surface velocity than that of the web between said web retaining means, and finally means for setting said web in its treated condition.

20. An apparatus for treating cloth comprising a cloth web feeding means, a plurality of web retaining means positioned adjacent to and on opposite sides of said web, one of said web retaining means having a surface with longitudinal openings extending in the direction of the movement of said web, means for driving at least one of said web retaining means at the same surface velocity as said web, a web gripping and working roll intermediate said web feeding means and said web retaining means, said web gripping and working roll operating through the surface of said open spaced supporting web retaining means, said working roll having web penetrating projections upon its surface adapted to act upon the individual yarn components of said cloth web, means for driving said working and gripping roll at a greater surface velocity than that of the web between said plurality of web retaining means, and means for setting said web in its treated condition.

21. An apparatus for treating cloth comprising a web feeding means, means for stretching the web weftwise, a plurality of web retaining means positioned adjacent to and on opposite sides of said web, means for driving at least one of said retaining means at the same surface velocity as said web, a web gripping and working means intermediate said web weft stretching means and said web retaining means, said web gripping and working means being adapted to lie in contact with and positively grip said web, said web retaining means cooperating with said web working means to inhibit the formation of surface undulations in said web, means for driving said web gripping and working means at a greater surface velocity than that of the web intermediate said web retaining means, and means for setting said web.

22. An apparatus for treating cloth comprising a web feeding means, means for stretching the web weftwise, a plurality of web retaining means positioned adjacent to and on opposite sides of said web, one of said web retaining means having longitudinal openings extending in the direction of the movement of said web, means for driving at least one of said web retaining means at the same surface velocity as said web, a web gripping and working roll intermediate said web weft stretching means and said plurality of web retaining means, said web gripping and working roll operating through the surface of said open spaced web retaining means, said working roll having web penetrating projections upon its surface adapted to act upon the individual yarn components of said cloth web, means for driving said working and gripping roll at a greater surface velocity than that of the web between said plurality of web retaining means, and means for setting said web in its treated condition.

23. In a fabric treating apparatus suitable for modifying the superficial dimensions of said fabric, rotating means for gripping and penetrating the fabric, and driven fabric retaining means acting subsequent to said gripping means, said retaining means having a slower surface velocity than said gripping means.

24. In a fabric treating apparatus suitable for modifying the superficial dimensions of said fabric, rotating means for gripping and working within the body of the fabric, and fabric retaining means acting subsequent to said gripping means and having contiguous elements bearing upon opposite sides of the fabric, said retaining means having a slower surface velocity than that of said gripping means.

25. In a fabric treating apparatus suitable for modifying the superficial dimensions of said fabric, a rotating roll for gripping and working the fabric, said roll having a surface adapted to penetrate the fabric and act upon substantially individual yarn components thereof, and driven fabric retaining means acting subsequent to said working roll, said web retaining means having a slower surface velocity than said working roll.

26. In a fabric treating apparatus suitable for modifying the superficial dimensions of said fabric, a means for rendering said fabric in a substantially plastic condition, means for stretching the fabric weftwise, rotating means for subsequently gripping and working the fabric, and driven fabric retaining means acting subsequent to said gripping and working means and cooperating therewith to inhibit the formation of surface undulations in said web, said retaining means having a slower surface velocity than said gripping means.

27. In a fabric treating apparatus suitable for modifying the superficial dimensions of a fabric, a fabric plasticizing means, a means for stretching the fabric weftwise, a rotating roll for subsequently gripping and working the fabric, said roll having fabric penetrating projections upon its surface adapted to act upon substantially individual yarn components of said fabric, and driven fabric retaining means acting subsequent to said working roll positioned on opposite sides of said fabric and operating contiguously, said retaining means having a slower surface velocity than said gripping means.

28. The process for treating cloth comprising rendering the same in a soft plastic condition and subsequently performing a series of working operations on said cloth web to permit a readjustment of the component yarns to a condition adapted to minimize change in dimensions during a subsequent laundering operation, said working operations comprising tensioning the cloth web weftwise and subsequently while free from tension subjecting the individual yarn components of the web to a shoving, loosening and pulling action whereby the warp yarns are loosened and readjusted and compressed along their length and the weft yarns are also readjusted and shoved together in closer parallel relationship, retaining the cloth web during and immediately subsequent such readjusting operations in a condition to prevent surface wrinkling, and finally subjecting the cloth web to conditions whereby it is set in its readjusted pre-shrunk condition.

29. The process for treating cloth comprising rendering the same in a soft plastic condition and subsequently performing a series of working operations on said cloth web to permit a readjustment of the component yarns to a condition adapted to minimize change in dimensions during a subsequent laundering operation, said operations comprising relieving the web from tensional stresses and subjecting the individual yarn components of the web to a shoving, loosening and pulling action whereby the warp yarns are loosened and readjusted and compressed along their length and the weft yarns are also readjusted and shoved together in closer parallel relationship, retaining the cloth web during and immediately subsequent such readjusting operations within a zone in which wrinkling of the surface of the web is prevented.

30. The process for treating cloth comprising sizing the cloth to render the same in a soft plastic condition and subsequently performing a series of working operations on said cloth web to permit a readjustment of the component yarns to a condition adapted to minimize change in dimensions during a subsequent laundering operation, said working operations comprising tensioning the cloth web weftwise and subsequently while free from tension subjecting the individual yarn components of the web to a shoving, loosening and pulling action whereby the yarn components are loosened and readjusted and compressed along their length and the weft yarns are also readjusted and shoved together in closer parallel relationship, retaining the web during and immediately subsequent such readjusting operations in a zone wherein surface wrinkling is prevented, and finally subjecting the cloth web to conditions whereby it is set in its readjusted pre-shrunk condition.

31. The process for treating cloth comprising rendering the same in a soft plastic condition maintaining the web under tension warpwise and subsequently performing a series of working operations on said cloth web to permit a readjustment of the component yarns to a condition adapted to minimize change in dimensions during a subsequent laundering operation, said working operations comprising tensioning the cloth web weftwise and subsequently while free from tension subjecting the individual yarn components of the web to a shoving, loosening and pulling action whereby the warp yarns are loosened and readjusted and compressed along their length and the weft yarns are also readjusted and shoved together in closer parallel relationship, retaining the cloth web during and immediately subsequent such readjusting operations in a condition to prevent surface wrinkling and finally subjecting the cloth web to conditions whereby it is set in its readjusted preshrunk condition.

32. The process for treating cloth comprising performing a series of working operations on said cloth web to permit readjustment of the component yarns to a condition adapted to minimize change in superficial dimensions during a subsequent laundering operation, said working operations comprising stretching the cloth web weftwise, delivering said cloth web to a zone wherein warp and weft tension of the cloth web is relieved, and within said zone subjecting the individual yarn components of the cloth web to a working action within the body of the web whereby the warp yarns are readjusted and compressed longitudinally and the weft yarns are readjusted and shoved together into closer parallel relationship, retaining the web within the zone to prevent surface wrinkling and subsequently subjecting the cloth web while still relieved from tension to drying condition whereby it is set in its reconstituted pre-shrunk condition.

33. A process for treating cloth comprising performing a series of working operations on said cloth web to permit readjustment of the component yarns to a condition adapted to minimize change in superficial dimensions during a subsequent laundering operation comprising delivering said cloth web to a zone wherein warp and weft tension of the cloth web is relieved, and within said zone subjecting the individual yarn components of the cloth web to a working action within the body of the web whereby the warp yarns are readjusted and compressed longitudinally and the weft yarns are readjusted and shoved together into closer parallel relationship, retaining the web within the zone to prevent surface wrinkling and subsequently subjecting the cloth web while still relieved from tension to drying condition whereby it is set in its reconstituted pre-shrunk condition.

34. A process for treating cloth comprising performing a series of working operations on said cloth web after the same has been rendered in a plastic condition to permit readjustment of the yarn components to a condition adapted to minimize change in superficial dimensions during a

subsequent laundering operation, said working operations comprising stretching the cloth web weftwise, delivering said cloth web into a zone wherein warp and weft tension of the cloth web is relieved and subjecting the individual yarn components of the cloth web to a working action within the body of the web whereby the warp yarns are readjusted and compressed longitudinally and the weft yarns are readjusted and shoved together into closer parallel relationship, retaining the web within the zone to prevent surface wrinkling and subsequently subjecting the cloth web while still relieved from tension to drying condition whereby it is set in its reconstituted pre-shrunk condition.

35. A process for treating cloth comprising performing a series of working operations on said cloth web after the same has been rendered in a plastic condition to permit readjustment of the component yarns to a condition adapted to minimize change in superficial dimensions during a subsequent laundering operation, said working operations comprising applying a tension to said web warpwise whereby the web is diminished in a weftwise dimension, stretching the cloth web weftwise, delivering said cloth web to a zone wherein warp and weft tension of the cloth web is relieved, and subjecting the individual yarn components of the cloth web to a working action within the body of the web whereby the warp yarns are readjusted and compressed longitudinally and the weft yarns are readjusted and shoved together into closer parallel relationship, retaining the web within the zone to prevent surface wrinkling and subsequently subjecting the cloth web while still relieved from tension to drying conditions whereby it is set in its reconstituted pre-shrunk condition.

36. A process for imparting to a fabric a rearranged condition of yarn components simulating a shrunken condition resulting from a laundering operation while producing a fabric having a finish, comprising rendering said fabric plastic, stretching the fabric weftwise and discharging it with a minimum of web tension into a retaining zone free from web tension, gripping the yarn components of said web subsequent to said weft stretching and forcing them toward said zone at a greater rate than the passage of the web through said zone while inhibiting the formation of surface undulations in said web, delivering the web from said zone to a second retaining zone free from web tension and setting therein the component yarns of the web in their rearranged positions.

37. A process for imparting to a fabric a rearranged condition of the yarn components simulating a shrunken condition resulting from a laundering operation while producing a fabric having a finish, comprising sizing said fabric whereby it is rendered in a plastic condition, stretching the fabric weftwise and discharging it with a minimum of web tension into a retaining zone free from web tension, gripping the yarn components of said web subsequent to said weft stretching and forcing them toward said zone at a greater rate than the passage of the web through said zone while inhibiting the formation of surface undulations in said web, delivering the web from said zone to a second retaining zone free from web tension and setting therein the component yarns of the web in their rearranged positions.

38. A process for imparting to a fabric a rearranged condition of yarn components simulating a shrunken condition resulting from a laundering operation while producing a finished fabric comprising rendering said fabric plastic and discharging it into a retaining zone free from web tension, gripping the yarn components of said web and forcing them toward said zone at a greater rate than the passage of the web through said zone while inhibiting the formation of surface undulations in said web, delivering the web through said zone to a second retaining zone free from web tension and setting therein the component yarns of the web in their rearranged positions.

39. A process for imparting to a fabric a rearranged condition of yarn components simulating a shrunken condition resulting from a laundering operation while producing a fabric having a finish, comprising rendering said fabric plastic, imposing a warpwise tension upon said fabric, stretching the fabric weftwise and discharging it with a minimum of web tension into a retaining zone free from web tension, gripping the yarn components of said web subsequent to said weft stretching and forcing them toward said zone at a greater rate than the passage of the web through said zone while inhibiting the formation of surface undulations in said web, delivering the web from said zone to a second retaining zone free from web tension and setting therein the component yarns of the web in their rearranged positions.

40. A process for imparting to a fabric a rearranged condition of the yarn components such that subsequent shrinking of said fabric upon laundering operations is materially diminished, comprising rendering said fabric in a plastic condition, loosening, rearranging and shoving the yarn components within the body of the web and forcing said web toward a retaining zone free from web tension at a greater rate than the passage of the web through said zone, delivering the web through said zone to a second retaining zone free from web tension, and setting therein the yarn components of the web in their rearranged position.

41. A process for imparting to a fabric a rearranged condition of yarn components whereby shrinking upon subsequent laundering operations is substantially avoided, comprising loosening and rearranging the fibers composing the warp yarn components of said web while simultaneously shoving said warp yarns forward in the direction of movement of said web to decrease the length of said warp yarns while increasing their diameters, and immediately discharging said web into a confined retaining zone wherein surface flexure of said web is prevented.

42. In a fabric treating apparatus suitable for modifying the superficial dimensions of said fabric, gripping means for working within the body of the fabric and retaining means operating immediately subsequent and adjacent to said gripping means operative to prevent surface flexure of said fabric and further operative to retard the movement of said fabric from said gripping means.

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