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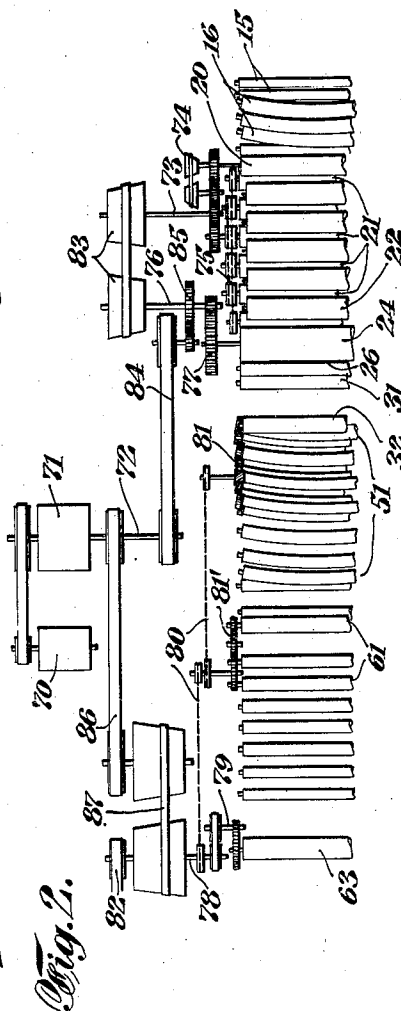
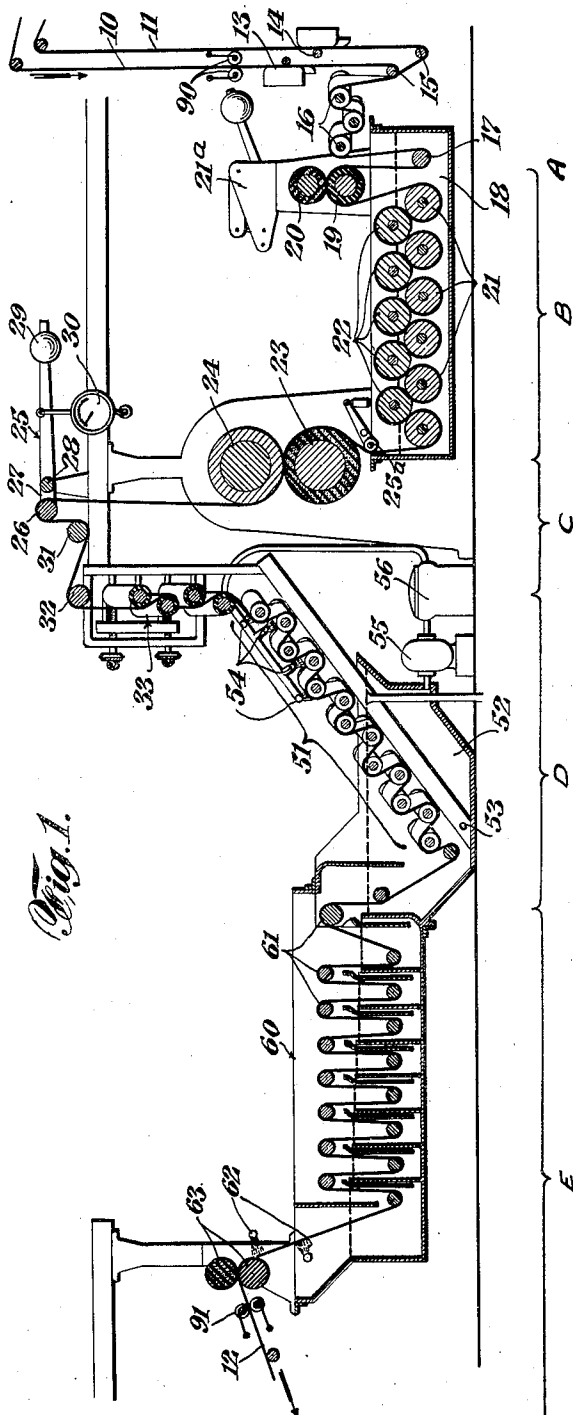
E. WEISS

2,239,636

MERCERIZING APPARATUS

Filed May 22, 1939

3 Sheets-Sheet 1



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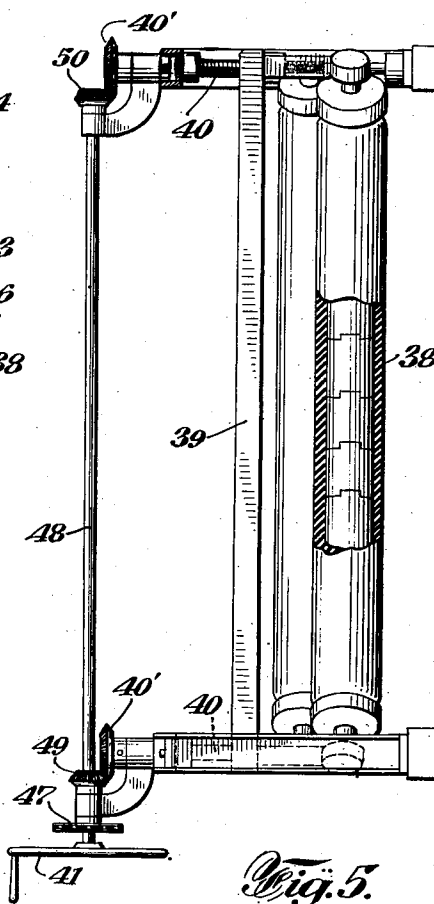
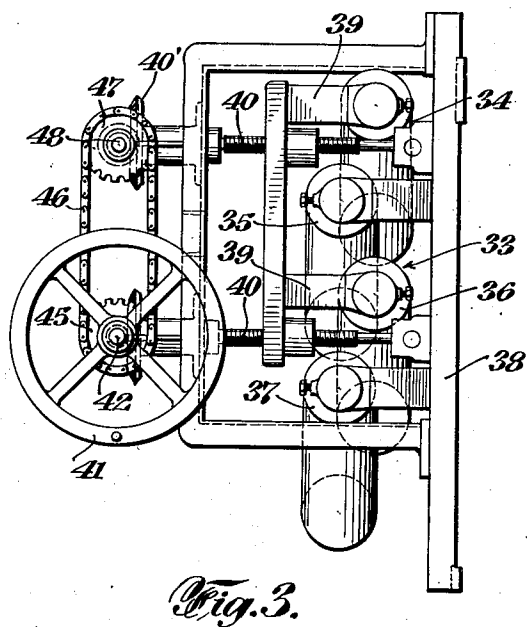
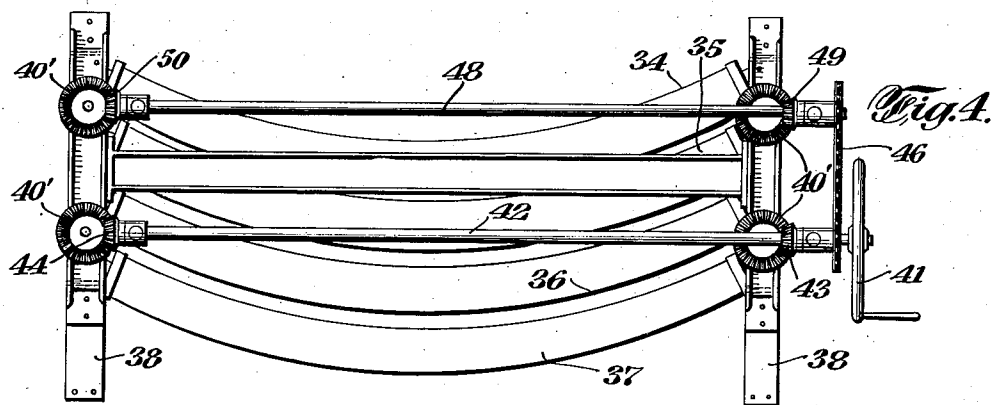
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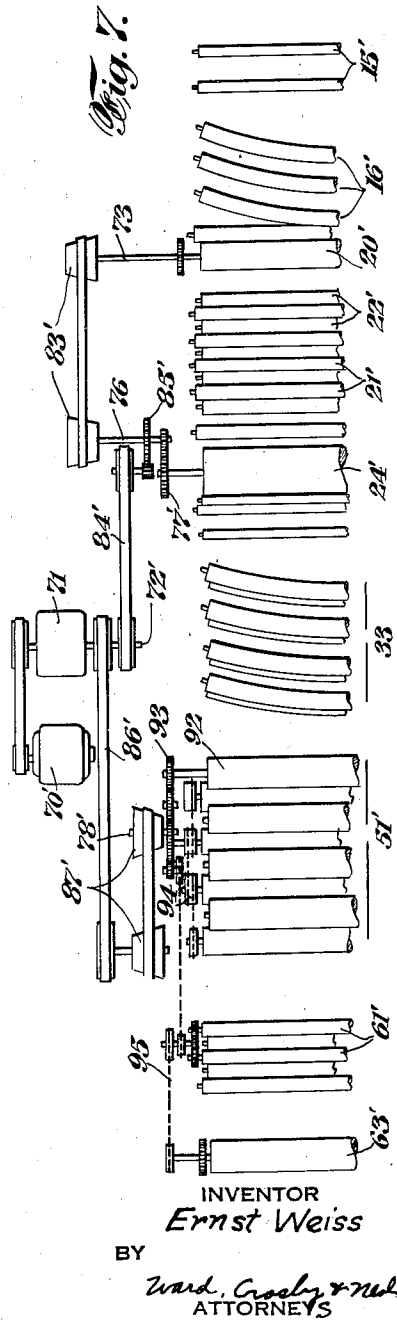
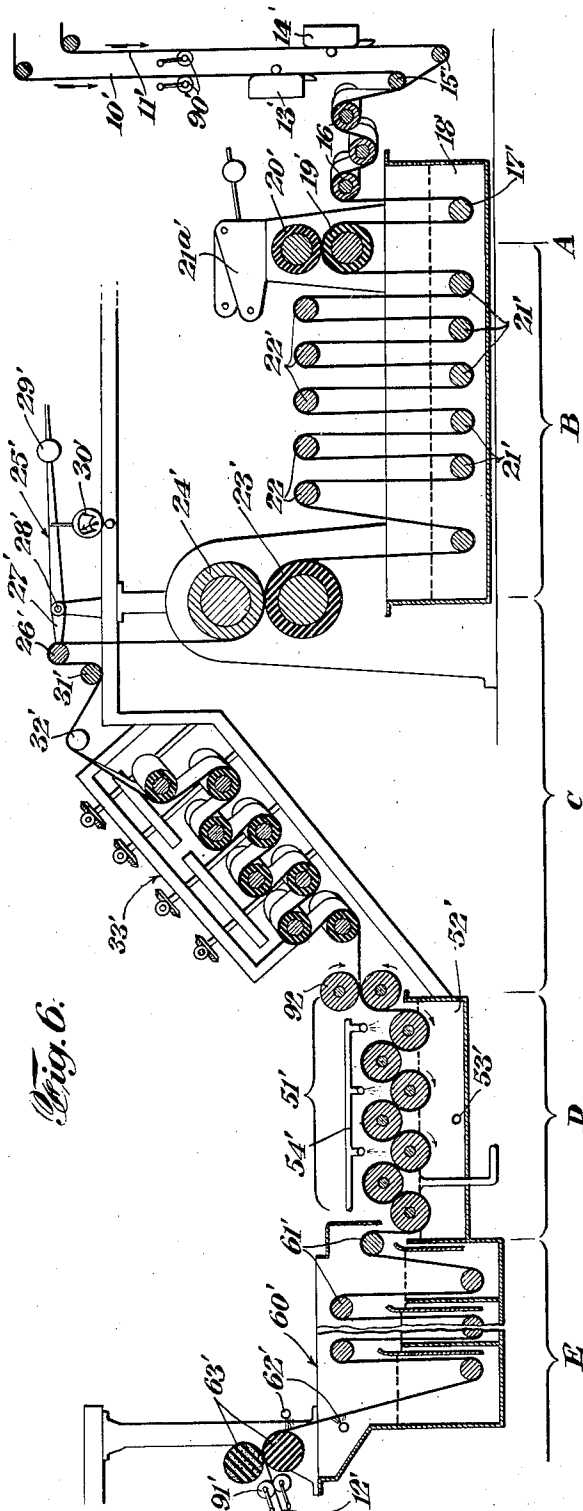
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,239,636

MERCERIZING APPARATUS

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Application May 22, 1939, Serial No. 274,967
In Germany October 15, 1937

7 Claims. (Cl. 26—1)

This invention relates to apparatus for mercerizing fabrics and is especially adapted for the mercerization of fabrics according to processes such as disclosed in my Patent No. 2,203,375 granted June 4, 1940, reference to which is hereby made.

Some of the features of the apparatus herein-after disclosed are also shown and described in said patent. This application is a continuation in part of my copending application Ser. No. 256,443, filed February 15, 1939.

According to the improved mercerization processes described in said patent, piece goods may be so mercerized as to have an exceptionally high luster, while retaining their other good textile properties such as tensile strength, etc. A further characteristic feature of the piece goods mercerized by said processes, consists in the fact that the goods after completion, possess an increased dimension as compared with the original measurement, in at least one direction, that is, an increase in length or width, even if they have been subjected to a mechanical or chemical shrink-proofing process after mercerization. Yet notwithstanding such increased measurement, the finished goods are stabilized to a high degree against subsequent shrinkage and therefore shrink comparatively little or substantially not at all, when subjected to repeated washing.

The objects of the present invention include the provision of a novel arrangement and combination of apparatus parts especially adapted for dependably and rapidly carrying out in various ways the processes above referred to and for effectively controlling the proper performance of the various steps of the process. The apparatus according to one of the phases of this invention, is made so adjustable as to give to the fabric the predominant high mercerization sheen or luster, and the increased measurement, either along the direction of the warp or the weft as desired, or to varying degrees in either or both directions. The apparatus is also adaptable, if desired, for the improved mercerization of fabric in accordance with other processes.

Various further and more specific objects, features and advantages will clearly appear from the detailed description given below taken in connection with the accompanying drawings, which form a part of this specification and illustrate merely by way of example preferred forms of the invention. The invention consists in such novel features, arrangements and combinations of parts shown and described in connection with

the examples of the apparatus herein disclosed.

In the drawings,

Fig. 1 is a side elevational view illustrating somewhat schematically the portions of a preferred example of the mercerization apparatus to which this invention more particularly relates;

Fig. 2 is a top plan view showing somewhat schematically and on a smaller scale, portions of various of the rollers of the apparatus of Fig. 1, together with a preferred driving arrangement therefor;

Fig. 3 is a side elevational view showing a portion of the apparatus of Fig. 1 considerably enlarged and in further detail;

Fig. 4 is another elevational view of the apparatus of Fig. 3 and taken at right angles to the view of Fig. 3;

Fig. 5 is a top view of the apparatus of Fig. 3;

Fig. 6 is a side elevational view similar to that shown in Fig. 1 but illustrating a modified form of the apparatus as shown in Fig. 1; and

Fig. 7 is a top plan view, on a somewhat smaller scale, showing somewhat schematically the driving train of the apparatus of Fig. 6.

In order that the description of the mechanism hereinafter disclosed, and its purposes may be more clearly understood, some of the important features of the preferred mercerization process to be carried out thereby will first be explained.

In accordance with such process, which is more fully described in my above-mentioned patent, the material to be treated which may comprise a substantially continuous web of vegetable fiber fabric, is first thoroughly and quickly mechanically impregnated with lye of mercerizing strength, such impregnation being effected before any substantial swelling of the fiber takes place. Thereupon the fabric as it proceeds is allowed to become homogeneously swelled under conditions which permit shrinkage mainly in the direction of the yarn along which the predominant luster or sheen is to be obtained. Thereafter and while the fiber is in substantially its maximum swollen condition, the fabric is strongly overstretched by tensioning the same in said direction which is to mainly impart the sheen, such stretching being insufficient to cause breaking thereof or tearing of the fabric. Meanwhile the fabric is also strongly stretched in the other direction. Then while the goods are retained with these stretched dimensions, the lye is removed, whereupon the goods may be tenterd and finished in the customary manner.

For purposes of ready reference in the following description of the apparatus, the stages of

treatment provided for by the apparatus may be summarized as:

- A—Mechanical impregnation.
- B—Swelling and shrinking.
- C—Stretching—lengthwise and crosswise.
- D—Fixing.
- E—Washing.

Referring now to the apparatus shown in Fig. 1, two webs of fabric to be treated, as at 10 and 11, may be continuously drawn into the right hand end of the equipment as shown, and after treatment these webs in mercerized condition pass out at the left hand end of the equipment together as indicated at 12. Fabric web guides of any suitable well-known type are indicated at 13 and 14, from which the webs pass over guiding rollers as at 15 for combining the webs (if two webs are to be treated at the same time). The webs then may pass over a plurality of axially curved spreading rollers as at 16 which serve to permit the fabric to proceed without folds. Rollers of such type per se are well known and will hereinafter be referred to as "bent" spreading rollers. From the rollers 16 the fabric webs pass over a roller 17 located in a trough 18 containing the mercerization liquid with which the fabric is to be impregnated. The fabric may then be passed upwardly and between squeezing rollers 19, 20, the roller 19 for example being of hard rubber and the roller 20 of soft rubber. Between the roller 17 and the rollers 19, 20, there occurs a rapid thorough wetting of the goods with the mercerization liquid. The squeezing rollers 19, 20 bring about an intensive mechanical impregnation of the fabric with the liquid before any substantial swelling of the fiber takes place. These squeezing rollers should preferably have a gap pressure of about 3.5 kilograms per centimeter and may preferably be driven with a surface speed higher than that of the succeeding rollers 21 and 23—24 hereinafter next described. This degree of difference in speed may be desirably varied in accordance with the particular fabric being treated. Apparatus made in accordance with this embodiment has been successfully operated at a speed difference of the order of about 1% between the rollers 19—20 and the succeeding driven rollers 21. Mechanism for maintaining the gap pressure at rollers 19, 20 is shown in outline at 21a, and being of a known type, need not be described in further detail.

If desired, the mechanical impregnation (stage A) may also be effected by suitable known vacuum impregnating equipment instead of using the squeezing rollers. From the squeezing rollers, the fabric passes down into the trough 18 again and around each of a series of rollers 21 and 22. The rollers 21 may be uniformly driven while rollers 22 may each rest on a pair of the rollers 21 as shown. Upon the rollers 21 and 22, a homogeneous and thorough swelling of the fiber of the fabric takes place. At the same time there may occur here in part at least the desired shrinkage, and this may be regulated by adjusting the surface speed of the squeezing rollers 19 and 20 so that it will be slightly greater than for the rollers 21 as above specified.

Instead of the particular type of roller assembly shown at 21 and 22, other known equipment may be used which will permit the desired swelling and shrinking at this point, as for example fabric shrinking bath equipment made up of simple guide rollers within the trough; as will be more fully referred to in conjunction with the

modified embodiment of the invention to be hereinafter described.

A pair of powerful squeezing rollers is provided as at 23, 24 comprising for example a lower soft rubber roller and an upper iron roller. Between the roller assembly 21, 22 and the squeezing rollers 23, 24, there may be provided a tension testing device 25a of a suitable well-known type, so as to enable the operator to determine and control the tension conditions as above referred to during the swelling of the goods.

The squeezing rollers 23, 24 are preferably driven separately from the prior and subsequent rollers, or are so driven that the speed thereof may be adjusted independently of the others. A speed difference of the order of about 3% to 5% between the rollers 19—20 and 23—24 has been successfully employed in apparatus according to this embodiment. The rollers 23, 24 are pressed together, for example hydraulically by known means, for applying a pressure in the neighborhood of 30 kilograms per centimeter and sufficient to prevent slippage of the fabric when subjected to powerful stretching starting at these rollers. The swelling and shrinking stage B extends from the point of tangency of the rollers 19—20 to the point of tangency of the rollers 23—24. Above the rollers 23, 24 a tension testing device 25, similar to 25a, may be located. This device comprises a roller 26 preferably mounted on ball bearings and over which the fabric is carried, this roller being supported on a suitable lever arm or arms 27 which in turn are pivotally mounted as at 28, this pivotal mounting preferably being also provided with ball bearings. The lever or levers 27 at the other side of the pivot 28 may be extended to carry a counterweight as at 29 and are connected to a spring balance as at 30. With such a device the tensions may be easily measured so as to permit the desired control of the fabric treatment. Instead of such a measuring device, other known tension devices may be used, for example a weighted pendulum roller or the like. The tension testing device 25 is followed by guide rollers as at 31, 32 and then by an assembly of rollers 33 for stretching the fabric transversely and also co-operating with the squeezing rollers 23, 24 for longitudinally stretching the fabric to the desired extent as compared with the transverse stretching. Accordingly, stage C, where the fabric is stretched, both in width and length, extends from the point of tangency of the rollers 23—24 through the assembly of rollers 33 to the output side thereof.

Reference will now be had to Figs. 3 to 5 inclusive, showing the roller assembly 33 in further detail. This assembly comprises, for example, four of the "bent" type of spreading rollers as at 34 to 37 inclusive. These rollers may have, for example, a radius of curvature of 2000 mm. (curvature of their axes) and a diameter of about 130 mm. and are preferably covered with rubber hose as indicated at 38 in Fig. 5. The rollers 35 and 37 are mounted with bearings of a suitable type known per se, in fixed position on frame 38, whereas the bearings for spreading rollers 34 and 36 are mounted upon a movable and adjustable sub-frame 39. The sub-frame 39 is adjustable in a horizontal direction by four threaded spindles as at 40, so that the angles of the loops of fabric formed in passing over the spreading rollers, and accordingly the spreading effect, may be adjusted. That is, the lengths of the arcs of contact between the fabric and each of the spreader rollers is thereby made adjustable. By such an

adjustment the transverse stretching of the fabric may be made either less than or great than the longitudinal stretching, so that the greatest stretching effect may be made along the direction of the yarns which are to impart the predominant sheen in the finished mercerized fabric. Also if desired, of course, these rollers may be so adjusted that the fabric will be stretched to approximately the same degree longitudinally and transversely as is desirable with some fabrics where the mercerization sheen is made substantially the same along the warp and the weft. This adjustment may be quickly varied during operation of the machine to meet varying conditions with different fabrics, etc., and without changing the form or curvature of the spreading rollers.

The positions of the threaded spindles 40 may be quickly and uniformly adjusted as by turning a hand wheel 41 mounted on a shaft 42 carrying bevel gears at 43 and 44 and a sprocket 45. The sprocket 45 is connected by a chain 46 with another sprocket 47 mounted on another shaft 48 similar to the shaft 42 and carrying additional bevel gears as at 49 and 50. Each of the spindles 40 carries a bevel gear as at 40' adapted to be engaged respectively by the bevel gears 43, 44, 49, 50, and the operation of which will be readily apparent from the drawings, Figs. 3 to 5.

The next stage of the apparatus (following the stretching stage C) is the fixing stage D, where provision is made for removing, in large measure, the treating caustic while at the same time maintaining the fabric dimensions of width and length as previously determined in stage C. In the present embodiment of Fig. 1 a plurality of "bent" rollers 51 is employed; although as will be understood by those skilled in the art other suitable and well-known means, such as cylindrical extenders or the like, may be employed for this purpose—it being understood, however, that in this stage no stretching of the fabric is effected, but on the contrary the previously determined width and length are maintained. The rollers 51 may be of cast iron of a radius of curvature of about 2550 mm. and of a diameter of about 150 mm. This assembly preferably inclines downwardly and the last few of this group of rollers dip into a trough 52 for containing liquid for removing the mercerization lye. This trough is provided with a connection as at 53 for admitting steam to maintain the washing liquid in the trough in heated condition. Above the first of the rollers 51 is positioned a number of spray nozzles as at 54. These nozzles are supplied with liquid pumped from the trough 52 as for example by a centrifugal pump 55 connected with the nozzle through a suitable filtering device 56.

While the spreading rollers of the assembly 33 need not be driven, certain of the rollers of the group 51 are preferably driven uniformly, for example, the first eight rollers of this group, and with a surface speed adjustable independently of the surface speed of the rollers 23, 24, whereby the desired stretching effects are accomplished between the latter rollers and the driven rollers of the group 51. The roller assembly 51 is so made that the fabric as previously stretched will be maintained with its dimensions substantially constant during the removal of the lye.

The lye removing trough 52 is followed by a lye remover assembly 60 preferably operating

on the counter current principle and of any suitable known type adapted for removing the residues of dilute lye which may have remained on the fabric after being sprayed and after passing through trough 52. The device 60 comprises a series of rollers and chambers arranged as shown or as otherwise known in the art for the purpose, and hence need not be described in further detail except that it is noted that the first three upper rollers as at 61, for example, are preferably driven.

The lye remover 60 may be followed by further nozzles as at 62 at which the fabric is washed and these may be followed by a pair of squeezing rollers as at 63, one of hard rubber and the other of soft rubber. The rollers 63 may be followed by washers and delivery rollers and further well-known finishing equipment if desired.

Referring now to Fig. 2, one form of the possible driving arrangements for the various rollers in the above-described equipment will now be described, although it will be understood that various suitable alternative arrangements may be used. The entire apparatus may be driven from a motor 70 which in turn is connected through speed reduction gearing 71, to a shaft 72 from which the driving power may be allocated to those portions of the apparatus, each with driving speeds relatively adjustable during operation, i. e., (a) the Foulard comprising the rollers 19—20 is driven by shaft 73 through a variable speed device indicated as 74 and the shaft 73 also driving the rollers 21 through suitable sprocket and chain connections as at 75, thus permitting the adjustment between the surface speed of rollers 19—20 and rollers 21 above referred to, (b) the Foulard comprised in the squeezing rollers 23, 24 driven by shaft 76 through gears as at 77, and (c) the driven rollers of the roller assembly 51, together with the washer rollers 61 and squeezing rollers 63 which are driven from shaft 78 through gearing as at 79, sprocket and chain connections as at 80, and gears as at 81, 81'. In addition the subsequent washing equipment (if any is used), and discharge rollers following the rollers 63 may be driven as by a pulley 82 on shaft 78. It will be noted that the shafts 73 and 76 as shown may be interconnected by a variable drive connection as at 83, so that the above-mentioned group (a) may be driven from the shaft 76 which drives the rollers 23, 24, but that the speed of the group (a) however is adjustable in respect to the rollers 23, 24 of (b). The shaft 76 may be driven from the shafts 72 through suitable belts, gears and pulleys as shown at 84, 85. At the other end of the machine the equipment may be driven through suitable belts and pulleys as at 86 connected to a variable speed drive 87 for driving the shaft 78 at a speed adjustable in respect to the rollers of the preceding parts of the apparatus assembly.

The various parts of the apparatus are preferably so arranged and driven at speeds such that the goods pass from the roller 17 to the rollers 23, 24 in about 15 to 25 seconds, and so that the goods pass from the rollers 23, 24 to the first roller of the assembly 51 in about 10 to 15 seconds. Apparatus operated within these timing periods has satisfactorily carried out the process described in my said copending application, but it is to be understood that these time periods are given by way of illustration and not by way of limitation.

Suitable measuring devices may be applied to the fabric as at 90, 91, for engaging the fabric respectively at a point before it enters the apparatus and at a point after it leaves the apparatus. These devices may be suitably interconnected by a means known to those skilled in the art for constantly indicating to the operator the percentage gain or loss in the yardage of the fabric during its passage through the apparatus, so that the operator may adjust the stretching equipment accordingly, to produce the desired results in the finished fabric, either according to the process described in the above-mentioned copending application or otherwise.

Modification

Referring more particularly to Figs. 6 and 7, another embodiment of the invention will be described as a modification of that disclosed in Figs. 1 and 2. For ready comparison of the respective embodiments, and to facilitate an understanding of the modified structure, parts and elements thereof identical with or corresponding to respective parts and elements of the embodiment of Figs. 1 and 2 will, so far as practical, be given corresponding numeral characters with a prime suffix (''). Where the corresponding parts of the two embodiments are identical, a detailed description will not be repeated.

From the input end (right hand of Fig. 6) through the squeezing rollers 19'-20', the structure is identical with that previously described with reference to Fig. 1. Instead of the arrangement of the rollers 21-22 as shown in Fig. 1, the present embodiment utilizes simple or idle rollers 21'-22' cooperatively associated with the tank 18', in accordance with the alternative structure, previously referred to at page 2.

This arrangement facilitates shrinkage and permits a shorter length of tank 18' for the same period of time of fabric swelling and shrinkage.

From the rollers 21'-22' the web of fabric passes between a pair of power driven squeezing rollers 23'-24' identical to the previously described rollers 23-24. The surface speed of these rollers is less than that of rollers 19'-20', preferably in the neighborhood of 5% or more, to permit of the desired swelling and shrinkage in the fabric travel from rollers 19'-20' to rollers 23'-24' (i. e. during stage B); and in this embodiment the speed of travel during stage B progressively decreases from input to output due to the progressive increase in swelling and shrinkage. After passing between rollers 23'-24' the fabric passes into stage C, where it passes over roller 26' of a tension testing device 25', similar in construction and position to the corresponding device 25 of Fig. 1, and thence over guide rollers 31' and 32' to a stretching unit 33'. The stretching unit 33' is constructed and functions in the same manner as the corresponding unit 33 of Fig. 1; and since the details of construction of unit 33 are fully illustrated in Figs. 3, 4 and 5, a further detailed description is deemed unnecessary, except to state that in the present embodiment the unit 33' as shown comprises twice as many rollers as does the corresponding unit 33 of Figs. 1-5, inclusive.

From the stretching stage the fabric passes into the fixing stage D comprising a group of rollers 51' of which the first two rollers 92 are positive driven powerful squeezing rollers which may be of similar structure as the rollers 23'-24' and serve to positively grip and force-

fully pull the fabric through the stretching stage C. The surface speed of the rollers 92 is separately adjustable from that of the rollers 23'-24' and 19'-20' and is adjusted to effect a higher speed of fabric feed from the stretching unit 33' than the speed of the fabric as delivered to the unit 33', for the purpose of effecting the desired longitudinal and transverse stretching of the fabric as heretofore described in connection with the apparatus of Fig. 1. The remaining rollers of the group 51' are arranged in an upper and a lower series. The lower series is driven at the same surface speed as that of rollers 92, and the rollers of the upper series are supported by the lower rollers; with the fabric passing alternately around successive lower and upper rollers in the manner previously described in connection with the rollers 21-22 of Fig. 1. Suitable spray nozzle means 24' is provided for delivering fluid from the tank 52' to the fabric passing through the fixing stage in a manner similar to that previously described relative to the apparatus of Fig. 1; and a suitable steam inlet conduit 53' is provided as and for the same purpose as the corresponding inlet 53 of Fig. 1.

The fabric passes from the rollers 51' of the fixing stage D to the rollers 61' within a tank 60' of the washing stage E and then out between a measuring means 91' as in the previously described and illustrated embodiment; and since these parts are constructed, arranged and function in exactly the same manner as the corresponding parts of Fig. 1 further description is unnecessary.

From the foregoing it will be understood that from the time the fabric is engaged between the pair of rollers 92 and during its continuous passage through stages D and E until it passes out of the apparatus, its speed is substantially uniform and continuously maintained at a higher rate than the speed of the fabric delivered by the rollers 23'-24' into stage C. The difference in these speeds is determined and fixed in accordance with the degree of fabric stretch desired to be effected in stage C.

A suitable power train for driving the respective groups of driven rollers is illustrated in Fig. 7, and will be briefly described. A suitable source of power, such as an electric motor 70', is connected through a speed reduction means 71' to a shaft 72' from which the driving power may be allocated to three portions of the apparatus, each with driving speeds relatively adjustable during operation, i. e. (a) the rollers 19'-20' driven by shaft 73' of the variable speed device 83', (b) the rollers 23'-24' driven by shaft 76' through gears such as 77', and (c) the driven rollers of the group 51', the driven rollers 61' and 63' which are all driven from shaft 78' of the variable speed drive device 87'. The pair of rollers 92 is preferably driven by direct gear connection with gears such as 93 of the rollers 92 and the lower series of driven rollers 51' is driven from shaft 78' by suitable gear, sprocket and chain drive such as 94. The rollers 61' and 63' are driven through suitable sprocket and chain drives such as 95. Accordingly, the respective relative speeds of the portions (a), (b) and (c) may be suitably varied separately in the desired manner as will now be clearly understood.

The above-described apparatus when used to treat piece goods of good quality, makes it possible during the mercerization to increase one

dimension of the fabric up to from 6 to 8% greater than before treatment. And even after such mercerized fabric is carefully and fully Sanforized, the increased dimension as obtained in the commercial practice of the invention, amounts to from 1% to nearly 4%, depending upon the character of the fabric being treated. This increased dimension may also be obtained without greater loss in the other dimension as compared with the prior mercerization practice. At the same time the mercerization luster may be improved several times over as compared with the former available process, and the finished Sanforized fabric is stabilized with the increased yardage to a remarkable degree against shrinkage even on repeated washing. On the other hand, with the former mercerization practice a substantial loss in yardage occurs amounting generally to several percent.

While the invention has been described in detail with respect to particular preferred examples, it will be understood by those skilled in the art after understanding the invention that various changes and further modifications may be made without departing from the spirit and scope of the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for mercerizing fabric piece goods, comprising a series of devices for acting in close succession on a continuously moving strip of the fabric and including, means for first effecting a thorough penetration of the fiber with mercerization fluid, two series of spaced apart freely mounted idle rollers providing a substantially long path of fabric travel, means for applying mercerizing fluid to said fabric substantially throughout said path of travel, said guide rollers and said fluid applying means being so constructed and arranged that said fabric is permitted a substantially uniform rate of continuous swelling and shrinkage during said path of travel, a pair of rotating squeezing rollers adjacent the last roller of said series of idle rollers and between which the fabric is engaged without substantial slippage after said path of travel through said swelling and shrinkage field, a pair of assemblies of "bent" idle spreading rollers over which the fabric is thereafter passed as a succession of loops, means for moving the fabric through the latter rollers at a higher surface speed than that of said squeezing rollers so as to cause substantial transverse stretching of the fabric as well as longitudinal stretching in cooperation with said squeezing rollers, and means positioned beyond said stretching means for then washing said fluid from the fabric, including mechanism for meanwhile carrying the fabric and substantially retaining the dimensions of same as thus stretched, until after said fluid is removed.

2. Apparatus for stretching fabric which is being continuously mercerized and advanced longitudinally, comprising a pair of rotating squeezing rollers between which the fabric is engaged without substantial slippage, a pair of assemblies of "bent" idle spreading rollers over which the fabric is then passed as a succession of loops, means between said squeezing rollers and said spreading rollers to gauge the longitudinal tension of the fabric, a further group of rollers beyond said spreading rollers and adjacent to the output side thereof and means for driving said

further group of rollers at speeds adjustable in respect to the squeezing rollers, for carrying the fabric from the spreading rollers at a greater surface speed than at the squeezing rollers, said squeezing rollers, said idle spreading rollers and said further group of adjustable speed rollers being so constructed and arranged that the fabric is stretched lengthwise and crosswise and the crosswise stretching may be substantially varied without variation in the lengthwise fabric tension, and means for washing the mercerization fluid from the fabric at said further group of rollers, said latter rollers being so shaped and driven as to substantially retain the dimensions of the fabric as thus stretched.

3. Apparatus for stretching fabric which is being continuously mercerized and advanced longitudinally, comprising a pair of rotating squeezing rollers between which the fabric is engaged without substantial slippage, a pair of assemblies of "bent" idle spreading rollers over which the fabric is then passed as a succession of loops, means comprising further rollers for carrying the fabric from the spreading rollers at a greater surface speed than at the squeezing rollers and whereby the spreading rollers cause substantial transverse stretching of the fabric as well as permitting longitudinal stretching by said adjustable spreading rollers in cooperation with said squeezing rollers, said further rollers being so constructed and arranged as to maintain the longitudinal and transverse dimensions of said fabric substantially constant from a point adjacent said spreading rollers and until removal of the mercerization liquid and means at said further rollers for first spraying the fabric and then immersing the same to remove the mercerization liquid.

4. Apparatus for stretching a web of fabric which is being continuously mercerized and advanced longitudinally and for then carrying the fabric with its stretched dimensions substantially maintained until after the substantial removal of mercerizing liquid, comprising means for subjecting said fabric to mercerization liquid and effecting substantially maximum swelling thereby, a plurality of "bent" idle spreading rollers around portions of the surface of each of which in succession the fabric is carried while in substantially maximum swelled condition, whereby the fabric forms a succession of loops, means for mounting each alternate roller in spaced relationship with respect to the shortest path between the rollers just preceding and succeeding, means for adjusting such mounting means to vary such spaced relationship, whereby the extent of the contact of the fabric with the roller surfaces is varied, thereby varying the extent of transverse stretching of the fabric, means for feeding the fabric to said rollers at a predetermined speed, means for feeding the fabric from the rollers at greater speed than the said speed of delivery of the fabric to said rollers to thereby pull the fabric over the said rollers under longitudinal stretching tension, the construction and arrangement of the parts being such that the longitudinal tension may be varied without varying the crosswise stretching, a plurality of rollers positioned beyond said first rollers for receiving the fabric in stretched condition as it leaves said first rollers and so constructed and arranged as to maintain substantially constant the dimensions of the fabric while thereon and means for washing mercerization liquid from said fabric after passage through said spreading rollers and during pas-

sage through said dimension-maintaining means.

5. Apparatus for mercerizing fabric piece goods, comprising a series of devices for acting in close succession on a continuously moving strip of the fabric and including, means for effecting a thorough impregnation of the fabric with mercerization fluid, a pair of power driven squeezing rollers operable to feed the fabric at a predetermined speed less than that at said impregnating means and so constructed and arranged as to grip and hold said fabric against slippage while being fed therethrough, means intermediate said impregnating means and pair of rollers for supporting and guiding said fabric during a swelling period and so constructed and arranged as to permit progressive shrinkage at a substantially uniform rate, power driven feeding means spaced beyond said pair of rollers and operable at a predetermined surface speed substantially greater than that of said rollers so as to place the fabric under relatively great longitudinal tension, roller means intermediate said pair of rollers and power driven feeding means so constructed and arranged as to impart to the fabric passing therethrough a predetermined substantial transverse tension, and dimension maintaining means beyond and immediately adjacent said transverse stretching means and so constructed and arranged as to hold said fabric substantially in its stretched condition while conveying it at substantially uniform speed during removal of the mercerizing agent.

6. In a device of the character described, the combination of means for briefly subjecting the fabric to a mercerizing fluid, a pair of squeezing rollers between which the fabric is squeezed to effect mechanical impregnation immediately after said brief period of subjection, two spaced-apart series of rollers each comprising a plurality of idle rollers about which the fabric is passed from said squeezing rollers, means for subjecting fabric passing over said idle rollers to mercerizing fluid, said series of rollers and fluid subjecting means being so constructed and arranged that a substantially long path of travel is provided and said mercerizing fluid is maintained in contact with said fabric substantially throughout said path of travel whereby said fabric is provided with a swelling and shrinking field following said mechanical impregnation, a second pair of squeezing rollers between which said fabric passes from said swelling and shrinking field and by which said fabric is held against substantial slippage, said first and second pairs of squeezing rollers being driven at predetermined speeds to permit substantially maximum swelling and shrinkage of said fabric intermediate said pairs of rollers, a tension measuring device dis-

posed adjacent the output side of said second pair of rollers, means adjacent to the output side of said tension measuring device for effecting lateral and longitudinal stretching of said fabric and so disposed with respect to said second pair of squeezing rolls and swelling and shrinking field as to act upon said fabric at substantially maximum swelling thereof, dimension-maintaining means adjacent to the output side of said stretching means constructed and arranged to receive said fabric before substantial washing thereof and to maintain said fabric in substantially the same dimensional condition as it is delivered from said stretching means, and means for removing a substantial portion of said mercerizing fluid from said fabric while it is being carried on said dimension-maintaining means to thereby fix said fabric.

7. In a device of the character described, the combination of means for briefly subjecting the fabric to a mercerizing fluid, a pair of squeezing rollers between which the fabric is squeezed to effect mechanical impregnation immediately after said brief period of subjection, means to which the fabric is passed from said squeezing rollers constructed and arranged for then conducting the fabric in the presence of said fluid for a relatively long path of travel whereby said fabric is provided with a swelling and shrinking field following said mechanical impregnation, a second pair of squeezing rollers between which said fabric passes from said swelling and shrinking field and by which said fabric is held against substantial slippage, said first and second pairs of squeezing rollers being driven at predetermined speeds to permit substantially maximum swelling and shrinkage of said fabric intermediate said pairs of rollers, a tension measuring device disposed adjacent the output side of said second pair of rollers, means adjacent to the output side of said tension measuring device for effecting lateral and longitudinal stretching of said fabric and so disposed with respect to said second pair of squeezing rolls and swelling and shrinking field as to act upon said fabric at substantially maximum swelling thereof, dimension-maintaining means adjacent to the output side of said stretching means constructed and arranged to act upon said fabric before substantial washing thereof so as to maintain said fabric in substantially the same dimensional condition as it is delivered from said stretching means, and means for removing a substantial portion of said mercerizing fluid from said fabric while it is being carried on said dimension-maintaining means to thereby fix said fabric.

ERNST WEISS.