Feb. 22, 1966 F. CATALLO ETAL 3,235,933

METHOD FOR COMPACTING FABRIC

Filed Sept. 14, 1962

FIG. 1

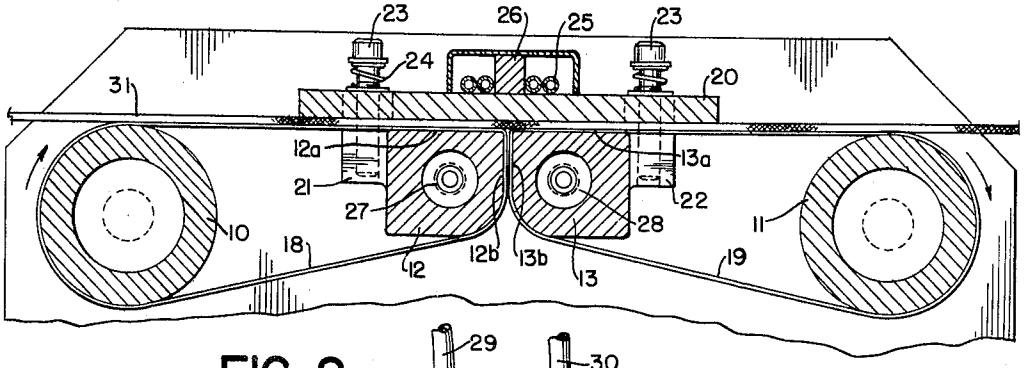
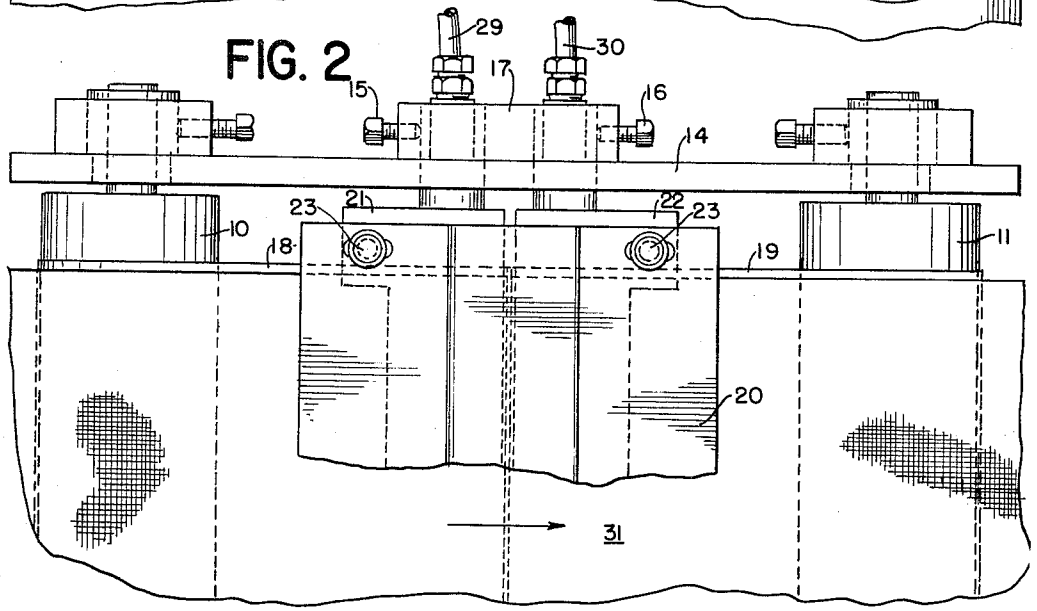


FIG. 2



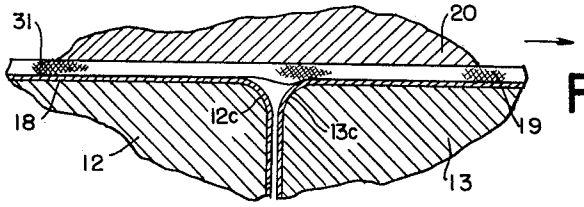


FIG. 3

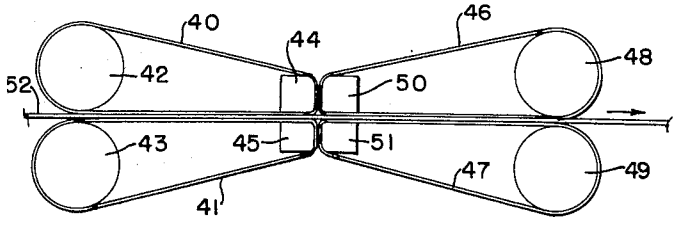


FIG. 4

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METHOD FOR COMPACTING FABRIC

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5 Claims. (Cl. 26—18.6)

The present invention relates to the treatment of fabric, and more particularly to an improved method and means for treating fabric by compacting the fabric lengthwise, to preshrink or otherwise condition the material. The invention is particularly suited for the preshrinking or compacting of tubular knit fabric, but is useful for treating fabric in other ways, and for treating web material of various types, including web material not strictly falling within the definition of fabric.

This invention is related to other inventions described and claimed in our copending applications Ser. No. 638,154, filed February 4, 1957, Ser. No. 707,814, filed January 8, 1958, and Ser. No. 707,803, filed January 8, 1958, now United States Patents No. 3,015,145, No. 3,083,435, and No. 3,015,146, respectively. In this respect, the present invention involves the treatment of web material by feeding the material at a first speed toward a treating zone of limited size, and carrying the material away from the treating zone at a reduced speed. In the zone, the material is compacted or otherwise treated in a desired manner, determined by the relative speeds of feeding and removing and the dimensions of the treating zone.

According to our prior inventions, web material is fed to a treating zone by means of a feeding roll and is carried away from the zone by a retarding roll travelling at a lower peripheral speed. A nip, formed by the feeding and retarding rolls, defines one end of the treating zone—the exit end—while the entrance end of the zone is formed by a blade-like member spaced a short distance in advance of the nip. The present invention is similar in its fundamental theory to our prior inventions, but differs therefrom in certain substantial respects, particularly with regard to the manner in which the web material is carried toward and away from the treating zone and in the manner in which the treating zone is formed.

Thus, in accordance with the present invention, web material is conveyed to and away from the treating zone by means of travelling belts which grip the material across its width, advantageously over a substantial lengthwise extent. The belts may be arranged to grip one side only of the web material, in which case pressure means may be provided for urging the material into gripping contact with the belts. Alternatively, pairs of belts may be provided, with both belts of a pair travelling at the same speed, so that the material may be gripped on both surfaces, between a pair of belts, and carried to and away from the treating zone. The alternative arrangement may be used to particular advantage in connection with the treatment of tubular knitted material, for example, which is conventionally treated in flat, doubled form.

In accordance with one of the important features of the invention, the fabric conveying belts are disposed along the conveying path up to a point immediately adjacent the treating zone. The belts then extend sharply away from the conveying path, advantageously at about right angles thereto. Thus, the point at which the feeding belt disengages the fabric may be very close to the point at which the fabric first engages the removing or retarding belt. The treating zone may be formed at least in part by the belts themselves. When only two belts are used, a pressure plate advantageously spans the feeding and retarding belts and provides a smooth, flat surface along which the web material may move from one belt to the other. The belts are advantageously very thin, usually having a thickness less than that of the material treated, so that the belts may readily be caused to travel about a sharp, right angular corner. The small space defined by the spanning pressure plate and the adjacent corners of the belt paths forms the treating zone, in which the material is relatively unconfined in its thickness direction, accommodating compacting, pleating or other treatment of the material in the desired manner.

In the alternate form of the invention, the belts are arranged in symmetrical pairs and one set of feeding and retarding belts takes the place of the pressure plate used in the above-described form of the invention. In the alternative arrangement, the treating zone is defined by the corner areas of the four belts, which are disposed symmetrically about the treating area.

Advantageously, the feeding and retarding belts are driven by rollers positioned remotely from the treating zone and the belts are passed about stationary supports adjacent the zone, which have right angularly related surfaces about which the belts pass. The right angle corners are slightly rounded to avoid excessive wear on the belts. The guiding surfaces of the supports may be disposed at acute angles, for example, if desired. However, right angularly related surfaces are usually more advantageous, as they result in less wear on the belts.

For a better understanding of the invention, reference should be made to the following detailed description and to the accompanying drawing, in which:

FIG. 1 is a longitudinal, cross-sectional view of a simplified form of the apparatus of the invention utilizing a single feeding belt and a single retarding belt, with a pressure plate spanning the two belts;

FIG. 2 is a fragmentary, top plan view of the apparatus of FIG. 1;

FIG. 3 is a greatly enlarged, fragmentary view of the apparatus of FIG. 1, showing details of the treating zone; and

FIG. 4 is a simplified representation of an alternative form of the new apparatus, utilizing pairs of feeding and retarding belts.

Referring now to the drawing, and initially to FIGS. 1–3 thereof, the reference numerals **10**, **11** designate spaced rollers which are engaged by appropriate drive means (not specifically illustrated) and arranged to be driven at different speeds. The roller **10**, which may be considered the feeding roller is arranged to be driven at a speed higher than the roller **11**, which may be considered the retarding roller. Advantageously, both rollers are driven from a single drive source, and adjustable means is provided in the drive system for at least one of the rollers, whereby the relative speeds of the rollers may be adjusted. Any suitable mechanism may be utilized for this purpose, and reference may be made to the previously identified applications for illustrative examples thereof.

Between the rollers **10**, **11** are support members **12**, **13**, which are mounted in normally fixed relation by spaced frame plates **14**, with suitable means **15–17** being provided for effecting limited adjustment. In accordance with the invention, the supports **12**, **13** have upper surfaces **12***a*, **13***a* which are tangent to the upper surfaces of the rollers **10**, **11**, respectively. Advantageously, the parts are so arranged that a single plane is defined by the rollers **10**, **11** and the surfaces **12***a*, **13***a*, substantially as shown in FIG. 1.

The supports **12**, **13** are also provided with vertical surfaces **12***b*, **13***b* disposed substantially at right angles to

the surfaces 12*a*, 13*a* and merging into generally rounded surfaces adjacent the bottoms of the supports. In accordance with the invention, feeding and retarding belts 18, 19 are trained about the rollers 10, 11 and the respective supports 12, 13 associated therewith. The arrangement is such that the belts are driven by the rollers 10, 11 at speeds determined by the rotation of the rollers and through paths determined in part by the surfaces 12*a*, 12*b* and 13*a*, 13*b* of the supports. The belts 18, 19, are advantageously as thin as practicable, so that extraordinary stresses are not imparted thereto as the belts travel through angular paths formed by the supports 12, 13.

As shown best in FIG. 3, the adjacent upper corners 12*c*, 13*c* of the supports 12, 13 are rounded very slightly to facilitate the travel of the belts 18, 19 about the fixed supports. Generally speaking, the radii of the corners 12*c*, 13*c* should be quite small, usually not substantially greater than that necessary to avoid excessive wear on the belts.

Disposed above the feeding and retarding belts 18, 19 is a pressure plate 20, which extends across the full width of the belts and slightly beyond the edges thereof. The plate 20 spans the recess between the supports 12, 13 and extends longitudinally a substantial distance over the tops of the supports. In the illustrated apparatus, the pressure plate 20 extends longitudinally beyond both of the supports 12, 13 and is secured to lugs 21, 22 at the edges of the supports, by means of bolts 23 and springs 24. With proper adjustment of the bolts 23, the springs 24 urge the plate 20 downwardly, to apply pressure in desired, predetermined amounts.

One or all of the support members 12, 13 and the pressure plate 20 are provided with heating means and, advantageously, each of these members is provided separately with heating means, so that uniform, controllable heat is supplied to the treating area. In the illustrated apparatus, the pressure plate 20 is provided with an electrical heating element 25, portions of which are disposed on opposite sides of a reinforcing rib 26. The electrical element 25 is thermostatically controlled by any means suitable for the purpose. The supports 12, 13 of the illustrated apparatus are provided with internal chambers 27, 28, which are supplied with steam from lines 29, 30. Advantageously, the rollers 10, 11 are also heated, usually by steam, although it may be less important to heat the rollers than the areas surrounding the treating zone.

In the operation of the apparatus of FIGS. 1–3, web material 31, which may be tubular knit fabric, for example, is fed onto the upper surface of the feeding belt 18, which is driven at a predetermined speed. The belt 18 feeds the web material between the pressure plate 20 and the support 12, the belt 18 having a substantial grip on the material by reason of the pressure applied between the plate 20 and the support 12. The web material 31 is fed to and across the small gap formed between the supports 12, 13, at which point the material is gripped between the pressure plate 20 and the retarding belt 19. In accordance with the invention, the retarding belt 19 is travelling at a speed somewhat slower than the belt 18, so that the web material is abruptly decelerated from the higher to the lower speed. This, of course, occurs uniformly across the width of the material, since the material is gripped across its entire width by the belts 18, 19.

Advantageously, the pressure plate 20 is so adjusted with respect to the supports 12, 13 that little, if any, slippage occurs between the web material 31 and the respective feeding and retarding belts 18, 19. Accordingly, deceleration of the moving web material from the feeding to the retarding speed takes place in the short interval or space in which the web material is unconfined laterally in travelling from one belt to the other. This area, in which the material is decelerated, may be referred to as the treating zone.

As explained in somewhat more detail in our before identified, copending applications, the web material may be compacted in the treating zone, by causing the fibers to be shortened lengthwise, and, for this purpose, the length of the treating zone, measured longitudinally of the fabric, is advantageously such that no buckling of the fabric or fibers occurs, substantially as described in the United States Patents Nos. 2,765,513 and 2,765,514 to Richard R. Walton. On the other hand, it may be desirable, in certain instances, to effect a crimping or pleating of the material, in which case the longitudinal dimension of the treating zone is desirably of such magnitude, in relation to the relative speeds of the feeding and retarding belts 18, 19, that the material is caused to bunch up and form folds or pleats. In either case, the treatment of the fabric is given a substantial degree of permanency by means of the heated surfaces surrounding the treating zone, between which the material is gripped under pressure. In this respect, there is usually, if not always, a certain amount of residual moisture in the fabric, so that the fabric is, in effect, steamed and set during the treatment.

Of course, it will be understood that web material other than "fabric" may be treated by the described apparatus and in accordance with the described method to achieve various desirable results, such as creping, pleating, etc.

A modified form of the new apparatus is illustrated in FIG. 4. In the modified apparatus, the feeding and retarding belts are arranged in pairs. Thus, feeding belts 40, 41 are trained about driven feeding rollers 42, 43 and fixed supports 44, 45. Likewise, retarding belts 46, 47 are trained about driven retarding rollers 48, 49 and about fixed supports 50, 51. The lower set of feeding and retarding belts, and the elements related thereto, may be substantially the same as those described in connection with the apparatus of FIGS. 1–3. The upper set of belts and elements is advantageously symmetrical to the lower set, although it will be understood that the various components need not be of identical size, as illustrated. In the modified apparatus, the feeding belts 40, 41 are driven at equal speeds, and grip the web material 52 on its opposite surfaces. The material, thus gripped across its entire width, is fed to a treating zone formed by the small open space defined by the innermost corners of the supports 44, 45 and 50, 51. The material passing through the treating zone is engaged on its opposite surfaces by the retarding belts 46, 47, travelling at a slower speed, and is controllably conveyed away from the zone.

Fundamentally, the treatment of the fabric in the modified apparatus of FIG. 4 is substantially the same as the treatment of the material in the apparatus of FIGS. 1–3. However, the modified apparatus may be advantageous in certain instances, as it assures greater uniformity of treatment on the opposite surfaces of the web material. Such an advantage may be particularly desirable in connection with the treatment of tubular knit material.

The new apparatus and method enables web material to be treated in an improved manner and results in a treated material having improved and novel characteristics. The apparatus is of a generally simplified nature, capable of economical manufacture, yet provides for superior control of the material during the treatment thereof, so that highly uniform and advantageous treating characteristics are realized.

It should be understood, however, that the specific forms of the invention herein illustrated and described are intended to be representative only, as certain changes may be made therein without departing from the clear teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

We claim:

1. The method of treating web material to reduce its length which comprises gripping the material across its width by a moving belt, advancing the gripped material

at a first speed toward a treating zone, slidably supporting and guiding the belt across its width and over an edge in the immediate region of the treating zone to abruptly disengage the belt from the web material and cause the material to travel through the treating zone, and abruptly gripping the material across its width by a second belt moving at a speed slower than the first belt, said second belt being slidably guided across its width and over an edge in the region of said treating zone to abruptly engage and grip the web material at the exit side of said treating zone, said treating zone being defined on at least one side of the web material solely by said belts, said web material being shortened in length as a function of the relative speeds of the first and second belts.

2. The method of claim 1, further characterized by heating the web material adjacent the treating zone.

3. The method of claim 1, further characterized by gripping and advancing the material toward the treating zone and removing the same therefrom by pairs of belts acting upon opposite surfaces of the material, said treating zone being defined on both sides of said web material by said belts.

4. The method of claim 1, further characterized by holding the material in pressure contact with the belts on opposite sides of the treating zone.

5. The method of claim 1, further characterized by guiding the material to travel substantially in a single plane while gripped by the belts and passing through the treating zone.

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