June 5, 1945. A. LYEM 2,377,434

TEXTILE MATERIALS

Filed May 15, 1941

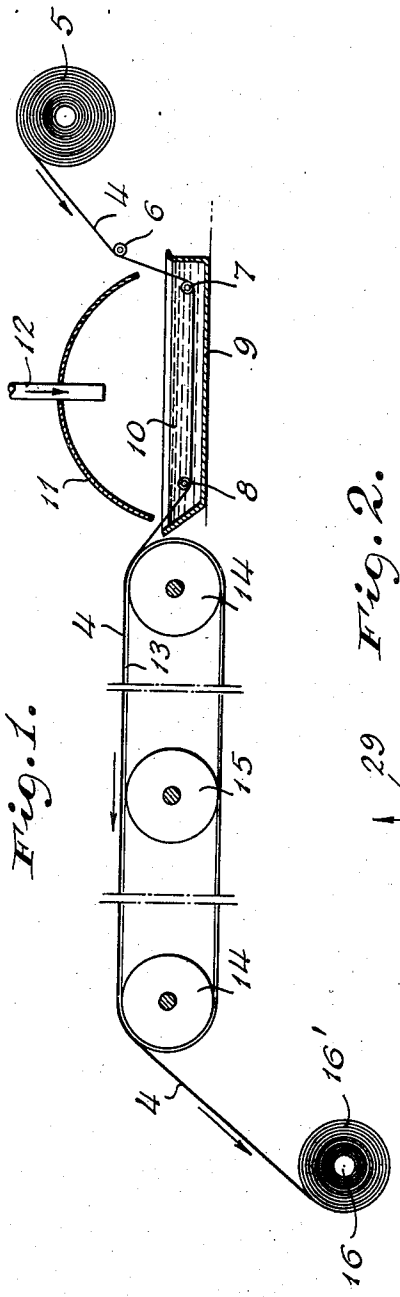


Fig. 1.

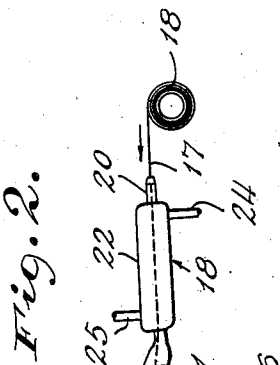


Fig. 2.

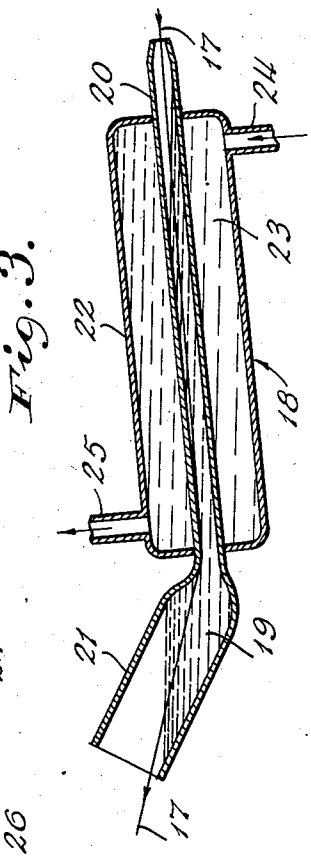
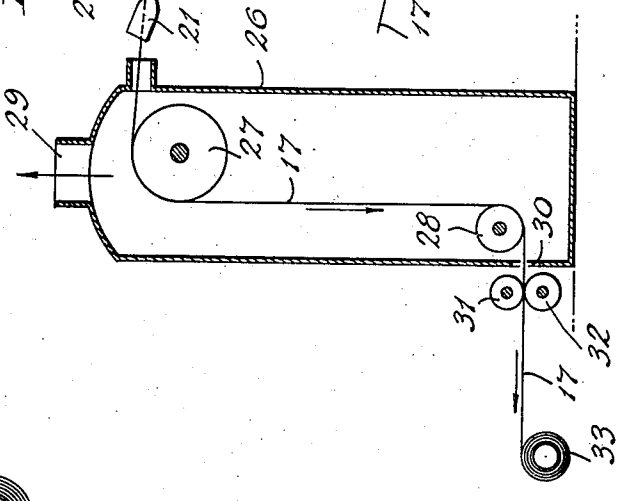


Fig. 3.



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TEXTILE MATERIAL

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4 Claims. (Cl. 8—131)

This invention relates to textile materials in the form of yarns, filaments, threads, ribbons, fabrics and the like, and more particularly to such materials having a basis of an organic derivative of cellulose and possessing improved serimetric properties.

An object of my invention is the treatment of materials in the form of yarns, filaments, threads, ribbons, fabrics and the like having a basis of an organic derivative of cellulose so as to improve their tenacity and elongation characteristics.

Another object of my invention is the provision of means whereby said materials may be treated as a continuous process in a relatively simple and economical manner.

Other objects of my invention will appear from the following detailed description and the accompanying drawing.

In many textile applications it is particularly desirable that yarns, filaments, threads and like products possess a certain degree of extension or elongation so that they may be stretched somewhat without any danger of their breaking. Textile products made of organic derivatives of cellulose such as, for example, cellulose acetate, normally possess such textile properties to a satisfactory and desirable degree. However, there are many applications where elongation and tenacity characteristics greater than those normally possessed by cellulose acetate are essential and therefore any improvement in their elongation and tenacity characteristics serves greatly to extend their usefulness.

I have now discovered that when yarns, filaments, threads, ribbons, fabrics and the like having a basis of an organic derivative of cellulose are subjected in a continuous process to the action of a volatile non-aqueous medium comprising acetaldehyde, the materials so treated are caused to shrink. As a result of this treatment the tenacity and particularly the elongation characteristics of said treated materials are notably enhanced, and, due to the fact that the non-aqueous media comprising acetaldehyde which are applied thereto are of a volatile nature, said media may be applied to the materials in a continuous manner under controlled evaporative conditions and thus any danger of injuring the filamentary character of said materials due to excessive action thereon by the acetaldehyde media is wholly eliminated. Not only may be serimetric properties of the usual dry-spun yarns, filaments and threads having a basis of an organic derivative of cellulose be improved by this treatment, but especially good results are obtained when yarns, filaments and threads of an organic derivative of cellulose which have been stretched are subjected to my novel shrinking treatment.

The concentration of acetaldehyde which may be employed in the volatile non-aqueous liquid media employed in treating the organic derivative of cellulose materials may be varied over a considerable range depending upon the result desired in the final product. Since acetaldehyde is a fairly active shrinking agent when applied to textile materials having a basis of an organic derivative of cellulose, it is preferable that the activity of the solutions be modified and this may be accomplished in a number of ways. One way in which this modification in activity may be accomplished is by diluting said acetaldehyde solutions with an inert organic diluent, i. e. one which is mutually soluble with the acetaldehyde but which has little or no solvent or swelling action on the organic derivative of cellulose textile materials which are being treated. Such inert diluents may be, for example, xylene, benzene, toluene, carbon tetrachloride, and kerosene. While any of these diluents may be used to modify the activity of the acetaldehyde shinking solutions in amounts ranging from 25 to 75% based on the volume of acetaldehyde in the solution, I preferably employ xylene as the diluent. The use of xylene in substantially equal parts by volume with respect to the acetaldehyde gives excellent results. Where a more limited shrinking action is desired, greater amounts of diluent may be employed. Not only may a variation in activity be obtained by variation in the concentration of the solution, but such results may likewise be achieved, if shorter immersion times or a decrease in the operating temperatures be resorted to. Thus, the particular operating conditions may be varied over a wide range depending upon the ultimate result desired. Maintaining the temperature of the treating liquid at from 0° to 20° C., and employing contact or immersion times of 1 second to 2 minutes gives satisfactory results.

Not only does my invention encompass the particular liquid media which are employed to enhance the tenacity and elongation characteristics of the said organic derivative of cellulose textile materials, but it likewise includes within its purview, particular means whereby said liquid media may be applied as a continuous process with precise control of time and temperature, as well as precise control over the coordinated evaporative conditions by means of which the volatile,

non-aqueous shrinking media may be rapidly removed from said materials.

In order further to illustrate this aspect of my invention, reference may be had to the accompanying drawing wherein there is shown by way of example, suitable apparatus for carrying out my novel process, by means of which the aforementioned improved textile materials may be prepared economically and expeditiously. Like reference numerals indicate like parts throughout the several views of the drawing.

In the drawing:

Fig. 1 is a side elevational view of apparatus for the continuous treatment of fabrics,

Fig. 2 is a side elevational view of apparatus for the continuous treatment of yarns, and

Fig. 3 is a detailed view in section of the means for containing the liquid media when treating yarns.

Referring now to the drawing, and particularly to Fig. 1, there is shown a fabric 4 being drawn from a roll of fabric 5 and moving in the direction indicated. The fabric 4 is passed over a guide roller 6 and beneath guide rollers 7 and 8 which are positioned by suitable means (not shown) in a trough 9 containing the desired treating liquid 10. The trough 9 is provided with a hood 11 which is fitted closely to the surface so that any evaporation of the liquid from the trough is minimized. Passing through hood 11 is a pipe 12 by means of which the liquid in trough 9 may be replenished as the level falls due to the liquid being carried away from the moving fabric. The liquid-laden fabric 4 is drawn from trough 9 and is supported on an endless belt 13 which may be driven at any predetermined speed by a pair of driven rollers 14 and is supported in the center thereof by a rotatable roller 15. The run of the belt 13 may be of any desired length but should be sufficiently long so that substantially complete evaporation of the shrinking agent will have occurred under the conditions of air temperature and circulation surrounding the belt by the time the fabric has been carried to the take-up roll or device. Any inert liquid of higher boiling point remaining on the fabric after the shrinking agent has evaporated therefrom may be removed by causing air at a somewhat higher temperature, i. e. at about 100–150° C., to circulate about the fabric, as by passing the fabric through a horizontal drying cabinet of the net or blanket type. The treated fabric, as it leaves the belt 13, is delivered to and taken up by the beam 16 driven at a suitable rate of speed as a roll 16' of finished fabric. By this arrangement a fabric may be treated in a continuous manner. In lieu of winding the fabric into a roll as it leaves belt 13, the fabric may be passed to some subsequent finishing treatment or it may be passed to a dyeing operation when a colored fabric is desired.

In Fig. 2 and Fig. 3 there is shown a form of apparatus by means of which a yarn may be subjected to a continuous shrinking treatment. A yarn 17 is drawn from a suitable yarn package 18 in the direction shown and is passed through a vessel generally indicated by 18' which contains a treating liquid 19. Vessel 18' comprises a center tube 20 flared at one end to form a reservoir-like well 21 adapted to hold a substantial amount of the treating liquid. Tube 20 is provided with a jacket 22 integral therewith, through which a heating or cooling liquid 23 may be circulated, as shown, by means of an intake port 24 and a discharge port 25. It will be understood, of course, that the direction in which the liquid 23 is caused to flow may be reversed as desired. After being suitably impregnated with the treating liquid the yarn is passed into a chamber 26 and over guide rollers 27 and 28. The treated yarn is drawn from the guide roller 28 in the chamber 26 through an opening 30 near the bottom thereof and after passing between rotatable guide rollers 31 and 32 the yarn is taken up in the form of a package 33. Air is circulated through chamber 26 and the air, laden with the vapors of the treating liquid, is removed from chamber 26 through a suitable opening 29 at the top thereof, whence they may be led to any recovery system. Thus circulation of air through the chamber 26 facilitates the evaporation of the treating liquid and permits rapid drying of the treated yarn so that same can be wound in package form immediately on leaving the chamber.

It can thus be seen that I have provided very efficient and economical means for treating yarns, threads, ribbons, fabrics and like textile materials having a basis of an organic derivative of cellulose with liquid media in a continuous manner for the purpose of improving the tenacity and elongation characteristics of said textile materials.

In order further to illustrate my invention, but without being limited thereto, the following examples are given:

Example I

A stretched, dry-spun cellulose acetate yarn of 45 denier, 1.5 turns per inch and having 80 filaments is passed through a solution of equal parts by volume of acetaldehyde and xylene isomers maintained at 15° C. The yarn is passed through this solution at a speed of 100 yards per minute and is then passed into a chamber wherein the liquid on the yarn is removed by evaporation. Upon leaving the chamber the yarn is collected on spools, bobbins and the like without any further treatment. When the treated yarn is tested it is found that the tenacity has increased 25% while the elongation has increased over 39%.

Example II

When a dry-spun cellulose acetate yarn of 150 denier, 0.3 turn per inch and having 40 filaments is treated in the same manner with a solution of the same composition, it is found that the elongation has increased 15%.

Example III

A cellulose acetate fabric of a ninon weave is treated by passing the fabric in the open width through a trough containing 45 parts by volume of acetaldehyde and 55 parts by volume of xylene. The fabric is passed through the trough at such a speed that it is immersed for 40 seconds whereupon it is carried from the trough and the liquid suitably evaporated therefrom. When strips cut from such treated fabric are tested, both along the warp as well as along the filling, it is found that the elongation along the warp has increased almost 25% while the elongation along the filling has increased almost 12% due to this treatment.

Example IV

A cellulose acetate fabric of taffeta weave is treated by passing the fabric in open width through a trough containing 50 parts by volume of acetaldehyde and 50 parts by volume of xylene. The fabric is passed through the trough so that it is immersed for 20 seconds and the liquid is

then removed by evaporation. When strips cut from this treated material are tested, the elongation along the warp is found to have increased over 38% and that along the filling over 10%.

While my invention has been particularly described in connection with the treatment of cellulose acetate textile materials, other organic esters of cellulose, as well as ethers of cellulose, may be employed. Examples of other cellulose esters are cellulose propionate, cellulose butyrate, and mixed esters such as cellulose acetate-propionate and cellulose acetate-butyrate, while examples of cellulose ethers are ethyl cellulose and benzyl cellulose.

It is to be understood that the foregoing detailed description is merely given by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. A continuous process for the treatment of filaments, threads, yarns, ribbons, fabrics and like materials having a basis of an organic derivative of cellulose for improving the serimetric properties thereof, which comprises continuously passing said materials through a solution, consisting of 50 parts by volume of acetaldehyde and 50 parts by volume of xylene, at such a speed that said materials are in contact with said solution for from 1 second to 2 minutes, and substantially immediately removing said solution from said materials by passing said materials through an evaporative atmosphere.

2. A continuous process for the treatment of filaments, threads, yarns, ribbons, fabrics and like materials having a basis of cellulose acetate for improving the serimetric properties thereof, which comprises continuously passing said materials through a solution, consisting of 50 parts by volume of acetaldehyde and 50 parts by volume of xylene, at such a speed that said materials are in contact with said solution for from 1 second to 2 minutes, and substantially immediately removing said solution from said materials by passing said materials through an evaporative atmosphere.

3. A continuous process for shrinking textile materials having a basis of an organic derivative of cellulose for improving the serimetric properties thereof, which comprises continuously passing said textile materials along a controlled path through a non-aqueous shrinking medium consisting of acetaldehyde and xylene, at such a speed that said textile materials are in contact with said shrinking medium from 1 second to 2 minutes, and substantially immediately removing said shrinking medium from said textile materials by passing said textile materials through an evaporative atmosphere.

4. A continuous process for shrinking textile materials having a basis of cellulose acetate for improving the serimetric properties thereof, which comprises continuously passing said textile materials along a controlled path through a non-aqueous shrinking medium consisting of acetaldehyde and xylene, at such a speed that said textile materials are in contact with said shrinking medium from 1 second to 2 minutes, and substantially immediately removing said shrinking medium from said textile materials by passing said textile materials through an evaporative atmosphere.

ARTHUR LYEM.