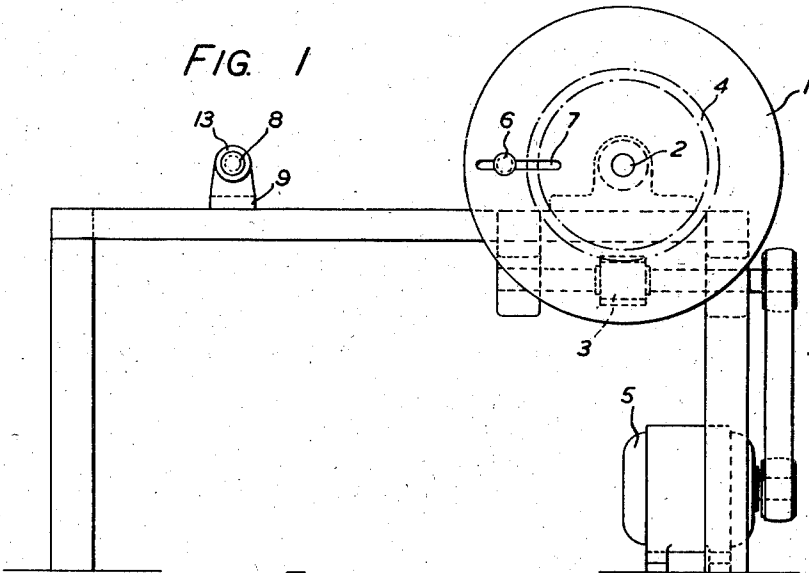
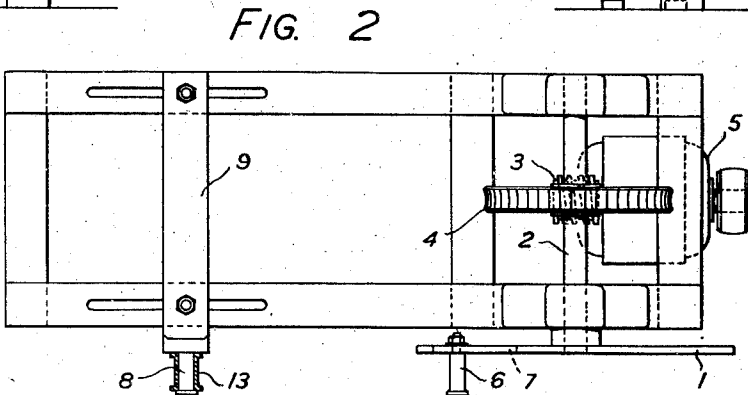
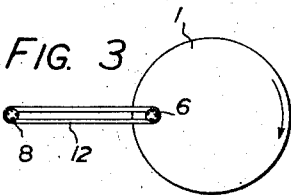
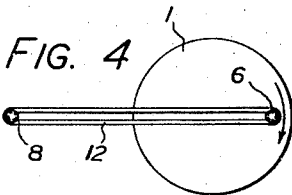
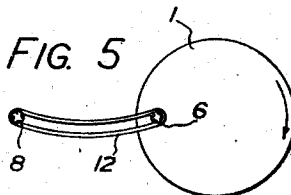
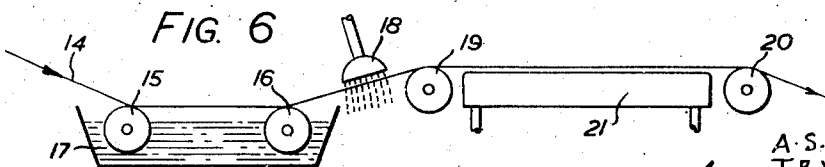


Sept. 22, 1942.

A. S. BELL ET AL
TREATMENT OF YARN
Filed Nov. 13, 1940

2,296,329



A. S. BELL
J. R. WYLDE
INVENTORS
P. Melton & W. W. Wylde
ATTORNEYS

UNITED STATES PATENT OFFICE

2,296,329

TREATMENT OF YARN

Angus Smith Bell and Joseph Rowland Wylde,
Spondon, near Derby, England, assignors to
Celanese Corporation of America, a corpora-
tion of Delaware

Application November 13, 1940, Serial No. 365,434
In Great Britain December 20, 1939

12 Claims. (Cl. 28—59)

This invention relates to yarns of an elastic and voluminous character and to the manufacture thereof.

According to the invention a yarn consisting of a mixture of wool fibres and artificial staple fibres having a cellulosic basis is given a moderate amount of stretch in a wet state, and is then dried under conditions that permit release of the strain set up in the fibres by the stretching operation. Yarns treated in this way have improved voluminosity and softness of handle and possess an elasticity that is lacking in the untreated yarns, the improvement being particularly noticeable in the case of heavier yarns and yarns with a low degree of twist. The appearance of the yarns is also improved. As an example of the moderate extension that may be given in the stretching operation, 15–25% or so has been found to give very satisfactory results and, in the subsequent drying, yarns so stretched may be permitted to return to substantially their original length or to within say 1–5% in excess of that length.

As examples of artificial staple fibres that may be mixed with the wool fibres may be mentioned fibres of cellulose acetate or other organic derivative of cellulose, fibres of cellulose acetate or other cellulose ester that have been wholly or partially regenerated to cellulose by saponification, and viscose and cuprammonium cellulose fibres. Mixtures in which the artificial component is cellulose acetate or cellulose otherwise esterified or etherified are particularly suitable for producing resilient yarns having a superior handle, and yield better results than fibres of simple cellulosic character. The artificial fibrous component of the yarn may consist of mixtures of the various kinds of cellulosic fibres mentioned above.

The stretching operation may be carried out with the material wet by water alone. There may, however, be included a shrinking agent in the wetting out liquid or alternatively or in addition a shrinking agent may be applied after the yarn has been stretched to the desired extension, either while the yarn is fully stretched or with the yarn free to shrink.

The drying step during which the recovery of length is effected is carried out under reduced tension or with the yarns entirely free from tension. The drying may be used to eliminate the shrinking agent by evaporation or the material may be washed before drying, if necessary.

According to one method of applying the stretch, the yarn is prepared in hank form and

stretched by mechanism similar to that employed in mercerizing. According to another method, the stretch is applied to a running thread, which may advantageously be wound in hank form to enable the final tensionless drying to be readily effected.

The initial twist influences the reaction of the yarns to the treatment. Low or medium twist in singles yarns or low or medium doubling twist in folded yarns are more favourable than high twists.

The following wetting liquids have been found particularly suitable for the treatment of yarns containing a mixture of cellulose acetate and wool fibres:

35/65 to 40/60 acetone water.	25% calcium thiocyanate in water.
Aqueous solutions of methyl ethyl ketone and glycol derivatives.	30% (by weight) nitric acid in water. (Nitric acid of 1.14–1.3 S. G.)
8/82/10 ethyl acetate/alcohol/water.	Alcohol/water at 40° C. 75/25.
50/50 methylene chloride benzene.	25/25/50 acetone/ethanol/water.
20/80 ammonium thiocyanate/water.	34/66 acetic acid/water.
55/45 chloroform/benzene.	75 parts of 40% formaldehyde in water.
2% phenol in water.	25 parts of ethyl or methyl alcohol.
50/50 dioxan/water.	60/40 ethylene dichloride/benzene
40% formaldehyde in water.	25/75 methylene chloride/alcohol.
10% acetaldehyde 90% water by vol.	40/60 acetone/alcohol.
10%–50% diacol 90%–50% water.	50/50 ethylene methylene ether/benzene.

The liquids may be employed in heated condition and may, moreover, contain agents to promote or inhibit the delustring of the cellulose acetate material under treatment.

The yarns to be treated may be intended for a variety of purposes, e. g. hand- or machine-knitting and weaving. A cellulose acetate/wool yarn suitable for hand-knitting may be composed of four ends of 12's cotton counts of cellulose acetate/wool fibres in the proportions of 75/25, each end having 9.5 turns per inch Z-twist, the ends being doubled in pairs with 7.5 turns per inch S-twist and the two pairs finally doubled with three turns per inch Z-twist. This yarn may be extended to approximately 26% in the wet stretching operation.

A yarn suitable for both hand- and machine-knitting is composed of two 12's cotton count ends,

as in the previous example, each with 9.5 turns per inch Z-twist and doubled together with 7.5 turns per inch S-twist. The extension in the wet stretching operation should be approximately 22%.

A yarn suitable for machine-knitting is composed of two 24's cotton counts of cellulose acetate/wool fibres in the proportion of 75/25, each with 13 turns per inch Z-twist, doubled with 11 turns per inch S-twist. Approximately 20% extension should be imparted in the wet stretching operation.

One yarn suitable for weaving comprises two 32's cotton counts cellulose acetate and wool fibres in the proportions of 75/25, each with 14 turns per inch Z-twist doubled with 12 turns per inch S-twist. This should be extended approximately 18% in the wet stretching operation. Another weaving yarn comprises a singles 12's cotton count of cellulose acetate and wool fibres of the proportions 75/25, twisted to 9.5 turns per inch and wet stretched to approximately 22% extension.

Cellulose acetate/wool yarns as just described, have a high degree of voluminosity which renders them particularly suitable as knitting and hosiery yarns. Moreover, for weaving, the increased elasticity enables the production of fabrics which may be more satisfactorily finished.

The accompanying drawing shows diagrammatically two forms of apparatus suitable for carrying out the invention. In the drawing

Figs. 1 and 2 are side elevation and plan of one form of apparatus;

Figs. 3, 4 and 5 illustrate the amount of stretching that can be effected by the apparatus; and

Fig. 6 is a side elevation of the other form of apparatus.

Referring to Figs. 1 and 2, a disc 1 is carried on a horizontal shaft 2 adapted to be slowly rotated through worm gearing 3, 4 by the motor 5. A pin 6 projects from the face of the disc 1, and is adjustable along the radial slot 7. A pin 8 is fixed to a slide 9 adjustable along slots 10 in the frame 11 carrying the shaft 2.

With the pin 6 in the position shown in Fig. 3 and with the pin 8 suitably adjusted to the length of a hank 12 of mixed wool and cellulosic fibres, the hank—wetted out with a suitable liquid—is slipped over the pins, and the disc is slowly rotated to the position shown in Fig. 4. The hank is thus stretched by an amount depending on the operating radius of the pin 6.

Further rotation of the disc 1 brings the pin 6 to its original position and the stretching tension is removed from the hank 12. The "permanent" stretch imparted can be seen in Fig. 5. The pins 6, 8 may with advantage carry freely rotatable reels, one of which is shown at 13 in Fig. 2. When the hank is subsequently dried (if necessary after intermediate washing), as, for example, in a tensionless manner in a pole drier, it may contract to substantially its original length.

Referring to Fig. 6, a mixed fibre yarn is shown under treatment in a "bobbin-to-bobbin" operation. The running yarn 14 passes round rollers 15, 16 dipping into a bath 17, the roller 16 running at a speed of say 15-25% in excess of that of the roller 15 to stretch the yarn. The stretched yarn is washed by the spray 18, and then passes round rollers 19, 20, the latter of which runs at a lower speed than the former to permit the yarn to contract while it is dried by the hot-plate 21.

Having described our invention, what we desire to secure by Letters Patent is:

1. Process for the manufacture of staple fibre yarns of an elastic and voluminous character, said process comprising wetting a yarn consisting of a mixture of wool fibres and artificial staple fibres having a cellulosic basis, stretching the wet yarn by about 15-25%, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

2. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting a yarn consisting of a mixture of wool fibers and artificial staple fibers of an organic derivative of cellulose, stretching the wet yarn by about 15-25%, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

3. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting a yarn consisting of a mixture of 25% of wool fibers and 75% of artificial staple fibers of cellulose acetate, stretching the wet yarn by about 15-25% and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

4. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting a yarn consisting of a mixture of wool fibers and artificial staple fibers of regenerated cellulose, stretching the wet yarn by about 15-25%, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

5. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting with a shrinking agent a yarn consisting of a mixture of wool fibers and artificial staple fibers having a cellulosic basis, stretching the wet yarn by about 15-25%, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

6. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting a yarn consisting of a mixture of wool fibers and artificial staple fibers having a cellulosic basis, stretching the wet yarn by about 15-25%, applying a shrinking agent to the stretched yarn and then drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

7. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting with a shrinking agent a yarn consisting of a mixture of wool fibers and artificial staple fibers having a cellulosic basis, stretching the wet yarn by about 15-25%, applying further shrinking agent to the stretched yarn and then drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original

length and release of the strain set up in the stretching operation.

8. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting with a shrinking agent a yarn consisting of a mixture of 25% of wool fibers and 75% of artificial staple fibers of cellulose acetate, stretching the wet yarn by about 15-25%, applying further shrinking agent to the stretched yarn and then drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

9. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting a yarn consisting of a mixture of wool fibers and artificial staple fibers having a cellulosic basis, stretching the wet yarn by about 15-25% while said yarn is in hank form, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

10. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting a running yarn consisting of a mixture of wool fibers and artificial staple fibers having a cellulosic basis, stretching the wet yarn by about 15-25% while

it is running, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

11. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting with a shrinking agent a hank of yarn consisting of a mixture of 25% of wool fibers and 75% of artificial staple fibers of cellulose acetate, stretching the wet yarn by about 15-25% while it is in hank form, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

12. Process for the manufacture of staple fiber yarns of an elastic and voluminous character, said process comprising wetting with a shrinking agent a running yarn consisting of a mixture of 25% of wool fibers and 75% of artificial staple fibers of cellulose acetate, stretching the wet yarn by about 15-25% while it is running, applying further shrinking agent to the stretched yarn, and drying the stretched yarn under conditions that permit shrinkage of the yarn to within from 1 to 5% in excess of its original length and release of the strain set up in the stretching operation.

ANGUS SMITH BELL,
JOSEPH ROWLAND WYLDE.