May 7, 1940. D. FINLAYSON ET AL 2,199,429

TEXTILE MATERIAL

Filed Aug. 20, 1937

FIG. 1

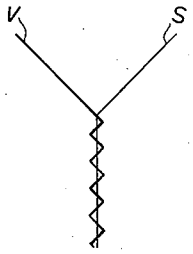


FIG. 2

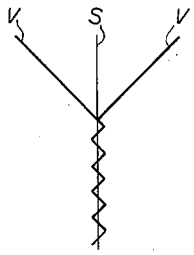


FIG. 3

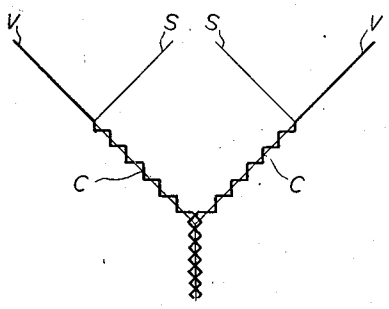


FIG. 4

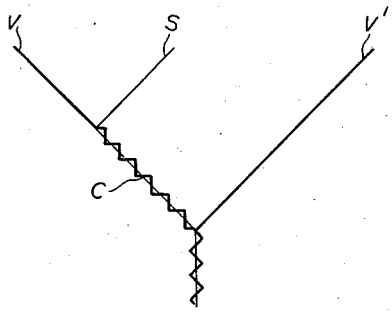
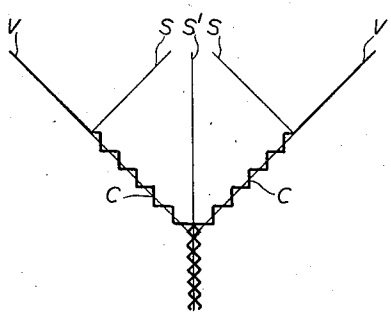


FIG. 5



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TEXTILE MATERIAL

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21 Claims. (Cl. 57—140)

This invention relates to improvements in textile materials and is more particularly concerned with new composite yarns and with fabrics or other materials made of or containing such yarns.

It is well known that woollen yarns are considerably more voluminous in character than cotton yarns and this is probably due at least in part to the fact that the fibres of cotton are considerably straighter than woollen fibres and are comparatively short in length so that it is necessary to insert a substantial amount of twist in a cotton yarn in order to obtain a coherent product, which reduces the voluminosity of such yarn. Moreover, wool has a much greater elasticity both in the dry and wet state than has cotton.

For some purposes the voluminous and elastic character of woollen yarn presents considerable advantages and a great deal of research has been directed in recent years to the production of artificial yarns which have the voluminous character of woollen yarns. The results obtained, however, have not been entirely satisfactory since the products do not compare favourably with wool as regards their properties of voluminosity, elasticity and non-crushability. For this reason many so-called artificial wools hitherto marketed have contained substantial proportions of natural wood, e. g. 50–75% of natural wool.

It has now been discovered that products which have a high degree of voluminosity and elasticity may be produced by associating a bundle, or yarn having at most only a low degree of twist, of artificial filaments (as hereinafter referred to) with a yarn which in the composite product obtained is capable of being shrunk without at the same time effecting any substantial shrinkage of the said yarn or bundle of artificial filaments. The yarn which is capable of being shrunk is hereinafter referred to as the shrinkable yarn. The yarn or bundle of artificial filaments associated with the shrinkable yarn according to the present invention is preferably such that the artificial filaments composing it have been crinkled but it may be such that the artificial filaments composing it are capable of being crinkled after their association with the shrinkable yarn. The production of composite yarns which comprise a yarn of crinkled cellulose acetate filaments which in the composite yarn has at most only a low degree of twist, doubled with a high twist yarn which in the composite yarn has a sufficiently high degree of twist that it possesses the ability to shrink on treatment with hot aqueous liquors, forms the subject matter of our co-pending application S. No. 160,066 of even date.

It is important, in order to obtain the best results in the present invention, that the yarn or bundle of crinkled artificial filaments should be present in preponderating proportions in the final product. Preferably, therefore, the shrinkable yarn should constitute as low a proportion as 30%, 20%, or even less of the total denier of the composite product.

The yarn or bundle of artificial filaments employed according to the present invention and which, in the final product, is in a crinkled condition, is hereinafter referred to as the "voluminous" component of the composite product. The voluminous component may comprise filaments of any suitable artificial material, for example organic derivatives of cellulose, regenerated cellulose, e. g. viscose, cuprammonium and nitrocellulose artificial silks, or partially or completely saponified cellulose acetate or other cellulose ester artificial silk. Or again, the voluminous component may have a basis of cellulosic material but have been subjected to a process of surface esterification or etherification, or may have a basis of an organic derivative of cellulose and have been subjected to a process of esterification, (e. g. as described in British Patents Nos. 448,816 and 448,817). The artificial filaments contained in the voluminous component may have been subjected to a stretching process or a shrinking process prior to their association with the shrinkable yarn in accordance with this invention. Any stretching operation should, of course, be carried out prior to imparting any crinkle to the filaments.

The shrinkable yarn may be made of any of the materials specified above. It is important, however, that the shrinkable yarn should differ in character from the voluminous component so that on treatment with shrinking agents only such shrinkable yarn shrinks, the voluminous component remaining substantially unaffected. This result may be attained by employing, as the shrinkable yarn, yarn which has a basis of a different material from the voluminous component and/or which, by reason of its construction, is especially adapted to be shrunk, e. g. highly twisted crêpe yarn. Thus, for example, there may be associated with a voluminous component having a basis of one derivative of cellulose a shrinkable yarn which has a basis of another derivative of cellulose, of regenerated cellulose, of cellulose acetate which has been subjected to partial or complete saponification, or

of cotton, silk or wool and such yarns may be twisted to a degree considerably short of crêpe twist.

Where the shrinkable yarn is a highly twisted crêpe yarn it is not necessary that such yarn should be of different material from the voluminous component since the ordinary aqueous scouring treatments which effect substantial shrinkage of crêpe yarns have substantially no shrinking effect on the voluminous components. The use of crêpe yarns, therefore, presents the advantage that it is possible by means of them to produce composite yarns of uniform chemical character. Another way of obtaining composite yarns which have a uniform chemical character is to employ a voluminous component which is naturally sensitive to shrinking agents and an ordinary yarn of the same character and to coat the voluminous component with a reserve, e. g. a gum, wax, or starch, prior to associating such yarns together, so that on subsequent treatment with a shrinking agent the shrinking agent is prevented by the reserve from acting on the voluminous component. Another process is to associate with a voluminous component containing substantially unstretched artificial filaments a yarn of the same material which has been stretched to a substantial extent. In general, stretched yarns are more sensitive to shrinking agents than unstretched yarns so that it is possible by controlling the conditions to effect substantial shrinkage of the stretched yarn without any substantial effect on the voluminous component. Or, again, a voluminous component which contains filaments which have been shrunk may be associated with an unshrunk yarn of the same material so that on treatment with a shrinking agent the shrinking effect is restricted almost entirely to the unshrunk yarn.

It will be appreciated, however, that where the shrinkable yarn is a crêpe yarn it is not necessarily made of the same material as the voluminous component. Thus very satisfactory results may be obtained by associating a regenerated cellulose voluminous component with highly twisted natural silk crêpe yarn. Where the shrinkable yarns employed are highly twisted crêpe yarns which have a basis of cellulose acetate or other organic derivatives of cellulose they are preferably produced by processes in which twist is inserted while the yarn is under the influence of steam or hot water. For such processes reference is made to U. S. Patents Nos. 2,089,191, 2,088,628 and 2,088,587.

Crinkle may be imparted to the filaments of the voluminous component by any suitable process, for example by means of crimping rollers, the crimp imparted by such rollers preferably being set immediately after or during the crimping operation, e. g. by treatment with steam. Another method is by twisting, setting and untwisting the yarn as a whole, (here again the setting may be brought about by treatment with steam), and in connection with processes of this type reference is made to U. S. Patents Nos. 2,089,198 and 2,089,199 and British Patent No. 464,981. These processes are only applicable to the crinkling of the artificial filaments prior to their association with the shrinkable yarn.

Some artificial filaments, e. g. cellulose acetate filaments of flat or nearly flat cross-section, are sensitive to the action of hot water and may be crinkled by treating them, substantially without tension, with hot aqueous liquors, for example hot dilute soap solutions. Similarly crinkling may be effected by applying hot aqueous treatments to flat filaments of organic derivatives of cellulose containing paradichlorbenzene or other plasticising agent for the cellulose derivative (as described in British Patent No. 459,781). It will be appreciated that processes of this type, which rely on treatment with hot aqueous liquors, are applicable to the crinkling of the filaments after they have been associated with the shrinkable yarn. The crinkle may be fixed in the material, for example by the process described in British Patent No. 455,021.

The filaments in the voluminous component may be continuous, as is normal in the production of artificial silk, or may be discontinuous, provided that the length of the staple in the product is not so short as to necessitate a relatively high degree of twist to produce a coherent product. A staple length of 5–8 or 10 inches or more may be used, but preferably the staple is as long as possible, e. g. of the order of 18 inches.

For reasons which are set out below it is especially advantageous to employ yarn of high tenacity as the shrinkable yarn, for example cellulose acetate yarn which has been stretched considerably so as to impart to it a high tenacity, or the product obtained by partial or complete saponification of such yarn. By employing a yarn of considerable strength as the shrinkable yarn it is possible to associate with it relatively large quantities of the voluminous component and thus increase the total voluminosity of the product while conserving the necessary strength for the product considered as a whole.

The association of the voluminous component with the shrinkable yarn is preferably effected by a light doubling twist. The doubling twist must not be so high as to reduce substantially the voluminosity. As a result of the doubling operation the shrinkable yarn either receives twist or has some twist removed from it, depending on the relative directions of the twist in the shrinkable yarn and of the doubling twist. For this reason the twist in the shrinkable yarn before the doubling operation should be either in excess of or short of that desired in the ultimate product. Where the shrinkable yarn is a high twist crêpe yarn it is preferable to insert the doubling twist in the same direction as the original twist in the shrinkable yarn so that at no stage has the shrinkable yarn a twist higher than that in the desired product. By this means the strength of the shrinkable yarn is conserved. For example where an ultimate twist of 55 turns per inch in the shrinkable yarn of the composite product is desired it is better to insert a twist of 50 turns per inch and then increase this to 55 by a doubling twist of 5 turns per inch in the same direction than to start with an original twist of 60 turns per inch and to decrease this to 55 by a doubling twist of 5 turns per inch in the reverse direction.

As stated above it is of the greatest importance, in order to obtain the best results, that the voluminous component should be present in the composite products of the invention in preponderating proportion. The high proportion of voluminous component relative to shrinkable yarn may be achieved, for example, by associating a voluminous component of relatively high denier with a shrinkable yarn of relatively low denier, the voluminous component and the shrinkable yarn being fed at the same speed to the doubling device. Or, alternatively, and this seems to be preferable from the point of view

of the voluminosity of the product, the voluminous component may be fed to the doubling device at a higher speed than the shrinkable yarn, for example at a speed 5, 10, 50 or even 100% or more faster than that of the shrinkable yarn. In this way the voluminous component appears in the composite product as if it were more or less spiralled round the shrinkable yarn, with the result that the latter may be more or less embedded in the composite product. As an example of the relative proportions of voluminous component to shrinkable yarn of a final total denier of 150–200 in the composite product the shrinkable yarn may have a denier of the order of 30–50. With such low proportions of shrinkable yarn it is advantageous, as indicated above, that the shrinkable yarn should be of relatively high tenacity.

Numerous combinations of shrinkable and voluminous components falling within the scope of the invention are shown in the accompanying drawing.

Fig. 1 shows a single shrinkable yarn S doubled with a single voluminous component V. Two or more voluminous components may be doubled with a single shrinkable yarn, Fig. 2 showing two voluminous components V doubled with a single shrinkable yarn S. Again, as illustrated by Fig. 3, two or more composite yarns C, each containing one or more voluminous components V doubled with a shrinkable yarn S may be doubled together to make a product of greater total denier.

Fig. 4 shows a composite yarn C further doubled with an additional voluminous component V^1. Fig. 5 shows two composite yarns C, containing voluminous and shrinkable components V, S doubled with each other and simultaneously with an additional shrinkable yarn S^1. In each doubling operation the speed of feeding the different yarns to the doubling device may be controlled in the manner already described so as to yield a product of high voluminosity.

Preferably the composite yarns are subjected to treatment in order to shrink the shrinkable yarn contained therein before associating the composite yarn in a fabric. Where the shrinkable yarn is a highly twisted crêpe yarn the shrinking may be effected by the ordinary treatments with aqueous scouring liquids and in such a case treatment with, for example, a hot aqueous soap solution may serve both to shrink the crêpe yarn and to crinkle the voluminous component. In other cases the choice of shrinking agent will depend on the character of the yarn to be shrunk. For shrinking yarns having a basis of regenerated cellulose there may be employed, for example, sulphuric or hydrochloric acid, zinc chloride, thiocyanates, e. g. calcium thiocyanates, and other powerful swelling agents for cellulose, whilst for shrinking yarns having a basis of cellulose acetate or other organic derivatives of cellulose agents such as nitric acid or the thiocyanates referred to may be employed. However, these latter yarns are preferably shrunk with the aid of organic shrinking agents, e. g. acetone, and especially methylene chloride or similar latent solvents (see U. S. Patent No. 2,658,422). The treatment of the composite yarns with shrinking agents may be carried out prior to, or subsequent to, the conversion of the yarn into fabric form.

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

1. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled artificial filaments which in the composite yarn has at most only a low degree of twist doubled with an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled artificial filaments, the said yarn of crinkled artificial filaments being present in substantially greater proportion than the said shrinkable yarn.

2. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled artificial filaments which in the composite product has at most only a low degree of twist, doubled with an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled artificial filaments, the said yarn of crinkled artificial filaments being of substantially greater denier than the said shrinkable yarn.

3. A composite yarn resembling a wool yarn, which comprises a length of a yarn of crinkled artificial filaments which in the composite yarn has at most only a low degree of twist doubled with a smaller length of an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled artificial filaments, the said yarn of crinkled artificial filaments being present in substantially greater proportion than the said shrinkable yarn.

4. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled regenerated cellulose filaments which in the composite product has at most only a low degree of twist, doubled with an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled regenerated cellulose filaments, the said yarn of crinkled regenerated cellulose filaments being present in substantially greater proportion than the said shrinkable yarn.

5. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled organic derivative of cellulose filaments which in the composite product has at most only a low degree of twist doubled with an artificial yarn of less than crêpe twist which is capable of being shrunk by chemical means relatively to the said yarn of organic derivative of cellulose filaments, the said yarn of organic derivative of cellulose filaments being present in substantially greater proportion than the said shrinkable yarn.

6. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled cellulose acetate filaments which in the composite product has at most only a low degree of twist doubled with an artificial yarn of less than crêpe twist which is capable of being shrunk by chemical means relatively to the said yarn of cellulose acetate filaments, the said yarn of cellulose acetate filaments being present in substantially greater proportion than the said shrinkable yarn.

7. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled regenerated cellulose filaments which in the composite product has at most only a low degree of twist doubled with an artificial yarn which is capable of being shrunk relatively to the said yarn of regenerated cellulose filaments and which constitutes at most 30% of the total denier of the composite yarn.

8. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled regenerated cellulose filaments which in the composite product has at most only a low degree of twist doubled with an artificial yarn which has a tensile strength of at least two grams per denier and which is capable of being shrunk relatively to the said yarn of regenerated cellulose filaments, the said yarn of regenerated cellulose filaments

being present in substantially greater proportion than the said shrinkable yarn.

9. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled regenerated cellulose filaments which in the composite product has at most only a low degree of twist doubled with an artificial yarn which in the composite yarn has a degree of twist such that it possesses the ability to shrink on treatment with hot aqueous liquors, the said yarn of regenerated cellulose filaments being present in substantially greater proportion than the said high twist yarn.

10. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled filaments of a derivative of cellulose which is a homologue of cellulose acetate, doubled with an artificial yarn which in the composite product has a degree of twist such that it possesses the ability to shrink on treatment with hot aqueous liquors, the said yarn of crinkled filaments having in the composite product at most only a low degree of twist and being present in substantially greater proportion than the said high twist yarn.

11. A composite yarn resembling a wool yarn, which comprises a yarn of crinkled regenerated cellulose filaments which in the composite yarn has at most only a low degree of twist doubled with an artificial crêpe shrunk high twist yarn, the said yarn of crinkled regenerated cellulose filaments being present in substantially greater proportion than the shrunk yarn.

12. A composite yarn resembling a wool yarn which comprises a yarn of crinkled cellulose acetate filaments which in the composite yarn has at most only a low degree of twist, doubled with an artificial chemically shrunk yarn of less than crêpe twist, the said yarn of crinkled cellulose acetate filaments being present in substantially greater proportion than the shrunk yarn.

13. Process for the production of composite yarns resembling wool yarns, which comprises associating together at least two yarns, one of which is a yarn of crinkled artificial filaments and one of which is an artificial yarn which is capable of being shrunk relatively to the said yarn of artificial filaments, the said yarn of crinkled artificial filaments being present in the final product in substantially greater proportion than the said shrinkable yarn having at most only a low degree of twist.

14. Process for the production of composite yarns resembling wool yarns, which comprises doubling together at least two yarns, one of which is a yarn of crinkled artificial filaments and one of which is an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled artificial filaments, the said yarn of crinkled artificial filaments being of substantially greater denier than the said shrinkable yarn and possessing in the final product at most only a low degree of twist and thereafter subjecting the composite yarn to an operation whereby the shrinkable yarn is shrunk.

15. Process for the production of composite yarns resembling wool yarns, which comprises feeding to a doubling device a yarn of crinkled artificial filaments and an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled artificial filaments, the said yarn of crinkled filaments being fed to the doubling device at a speed greater than the said shrinkable yarn and possessing in the final product at most only a low degree of twist and thereafter subjecting the composite yarn to an operation whereby the shrinkable yarn is shrunk.

16. Process for the production of composite yarns resembling wool yarns, which comprises doubling together at least two yarns, one of which is a crinkled yarn of regenerated cellulose filaments and one of which is an artificial yarn capable of being shrunk relatively to the said yarn of regenerated cellulose filaments, the yarn of crinkled regenerated cellulose filaments having in the final product at most only a low degree of twist and being present in substantially greater proportion than the said shrinkable yarn and thereafter subjecting the composite yarn to an operation whereby the shrinkable yarn is shrunk.

17. Process for the production of composite yarns resembling wool yarns, which comprises doubling together at least two yarns, one of which is a yarn of crinkled regenerated cellulose filaments and one of which is an artificial high twist yarn, the said yarn of crinkled regenerated cellulose filaments being present in substantially greater proportion than the said high twist yarn and having in the final product at most only a low degree of twist, and the said high twist yarn having in the final product a degree of twist such that it possesses the ability to shrink on treatment with hot aqueous liquors.

18. Process for the production of composite yarns resembling wool yarns, which comprises doubling together at least two yarns, one of which is a yarn of crinkled regenerated cellulose filaments and one of which is an artificial yarn which is capable of being shrunk relatively to the said yarn of crinkled regenerated cellulose filaments, the said yarn of crinkled regenerated cellulose filaments being present in the final product in substantially greater proportion than the said shrinkable yarn and having in the final product at most only a low degree of twist, and thereafter subjecting the composite yarn to an operation whereby the said shrinkable yarn is shrunk.

19. Process for the production of composite yarns resembling wool yarns, which comprises doubling together at least two yarns, one of which is a yarn of crinkled cellulose acetate filaments and one of which is an artificial yarn of less than crêpe twist which is capable of being shrunk by chemical means relatively to the said yarn of crinkled cellulose acetate filaments, the said yarn of crinkled cellulose acetate filaments being present in the final product in substantially greater proportion than the said shrinkable yarn and having in the final product at most only a low degree of twist and thereafter subjecting the composite yarn to an operation whereby the shrinkable yarn is shrunk.

20. Process for the production of composite yarns resembling wool yarns, which comprises associating together at least two yarns, one of which is a yarn of crinkled artificial filaments and one of which is a yarn which is capable of being shrunk relatively to the said yarn of artificial filaments, the said yarn of crinkled artificial filaments being present in the final product in substantially greater proportion than the said shrinkable yarn and having at most only a low degree of twist and thereafter subjecting the composite yarn to an operation whereby the shrinkable yarn is shrunk.

21. Process for the production of composite yarns resembling wool yarns, which comprises doubling together at least two yarns, one of which is a yarn of crinkled regenerated cellulose

filaments and one of which is a high twist yarn, the said yarn of crinkled regenerated cellulose filaments being present in substantially greater proportion than the said high twist yarn and having in the final product at most only a low degree of twist, and the said high twist yarn having in the final product a degree of twist such that it possesses the ability to shrink on treatment with hot aqueous liquors and thereafter subjecting the composite yarn to an operation whereby the shrinkable yarn is shrunk.

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