

UNITED STATES PATENT OFFICE

2,174,573

PRODUCTION OF CRIMPED CELLULOSE
DERIVATIVE YARNSDonald Finlayson, Spondon, near Derby, Eng-
land, assignor to Celanese Corporation of
America, a corporation of DelawareNo Drawing. Application April 7, 1937, Serial
No. 135,490. In Great Britain May 1, 1936

9 Claims. (Cl. 57—157)

This invention relates to improvements in fila-
ments, yarns, fibres and the like and is more par-
ticularly concerned with the production of yarns
exhibiting characteristics commonly associated
with natural fibres and especially wool.

In prior U. S. Patents Nos. 2,089,198 and 2,089,-
199 and British Patent No. 464,981 I have de-
scribed processes for imparting crimp to yarn by
setting twist in the yarn while it is travelling, and
subsequently removing twist from the yarn. The
twist to be inserted in the yarn may be a false
twist, and the twist may be set in the yarn either
while it is travelling in the course of the operation
in which the twist is imparted or in the course of
the operation in which the twist is removed. The
specifications all describe the application of the
process to the treatment of yarns consisting of
continuous filaments or yarns consisting of staple
fibre which in the case of artificial material may
either be produced by cutting up continuous fila-
ments and subsequently spinning the cut fibre into
a yarn or may be produced by direct conversion
from a continuous filament yarn, for example by
the processes of U. S. Patents Nos. 2,077,078 and
2,077,079. Further, it is stated in the said speci-
fications that the filaments (including fibres) con-
tained in the basic yarn may be of a lustrous
character or may be delustred as by subjecting
cellulose acetate or other cellulose derivative ma-
terials to hot aqueous liquors or liquors containing
thiocyanates or solvents for the cellulose deriva-
tive, so as to resemble more closely the finer quali-
ties of natural staple fibres. By subjecting such
a yarn to the crimping process of the prior U. S.
Patents Nos. 2,089,198 and 2,089,199 and British
Patent No. 464,981 a product is produced which
has a subdued lustre, is crimped to some extent by
the delustring treatment, and is further crimped
by the twisting, setting and untwisting process.
Before or after the twisting, setting and untwist-
ing, the yarn may, according to the processes of
the prior specifications, be converted into a staple
fibre yarn, as already indicated.

I have now found that a superior product, par-
ticularly as regards the crimp, may be obtained by
twisting cellulose derivative yarns, setting the
twist, untwisting, and subsequently treating with
hot aqueous media and particularly hot aqueous
liquors. It appears that by applying the treat-
ment with a hot aqueous medium after the twist-
ing, setting and untwisting operation, a higher
degree of crimp is imparted than is the case when
the treatment with the hot aqueous medium is
applied before the twisting, setting and untwisting
operation.

The yarn to be treated in accordance with the
combined process of the present invention may be
a continuous filament yarn or it may be a staple
fibre yarn formed by any suitable process, for
example by cutting continuous filaments to staple
lengths and subsequently spinning into a yarn, or
it may be a yarn produced by direct conversion of
a continuous filament yarn into a yarn containing
staple fibre, as by the processes of U. S. Patents
Nos. 2,077,078 and 2,077,079. Alternatively a con-
tinuous filament yarn may be twisted, set and
untwisted and, either before or after the subse-
quent treatment with hot aqueous liquors, con-
verted into a staple fibre yarn, as for example by
the processes previously mentioned. When at an
intermediate stage in the conversion to a staple
fibre yarn the material exists in the form of staple
fibres, the treatment with a hot aqueous medium
may be applied to the materials in this form and
before spinning into a yarn.

The material constituting the yarn may be cel-
lulose acetate or any other organic derivative of
cellulose, for example cellulose formate, propion-
ate or butyrate, or other organic esters or mixed
esters of cellulose, or ethyl or benzyl cellulose or
other cellulose ethers or mixed ethers of cellulose,
or mixed ether-esters of cellulose. Where the
material is at some stage converted into a staple
fibre yarn, it may be mixed with fibres of mate-
rials other than cellulose derivatives, for example
regenerated cellulose, natural silk, wool, cotton or
the like, the other fibre being either lustrous or
non-lustrous as desired.

As a result of the treatment according to the
present invention, the cellulose derivative mate-
rials have a subdued lustre. If the lustre is re-
quired to be reduced still more, the process may be
combined with a special delustring treatment, for
example by incorporating white pigments into the
materials either during the spinning process for
producing the original filaments, i. e. by incor-
porating the pigment in the spinning solution, or
as an aftertreatment applied to the materials,
such aftertreatment being applied at any conven-
ient stage.

While the present invention contemplates the
treatment by the combined process of twisting,
setting and untwisting, and subsequent treat-
ment in hot aqueous liquor of cellulose derivative
yarns of any character, especially valuable re-
sults may be obtained by treating yarns contain-
ing filaments or fibres of flat cross-section. The
filaments or fibres constituting the yarn may be
wholly flat in cross-section or may contain a
substantial proportion of flats (as opposed to the

bulbous type of cross-section), for example more than 50% and preferably more than 70 or 80% of flats. It is found that the hot aqueous treatment imparts a better crimp to such materials than materials consisting wholly of filaments or fibres having a bulbous cross-section. The filaments or fibres of flat cross-section may be produced by any convenient method. One method is to spin a cellulose derivative solution containing the cellulose derivative in a concentration lower than the minimum required to produce bulbous cross-section. In particular, in the case of a solution of cellulose acetate in acetone, a concentration of 24% or lower, down to say 20%, and especially a concentration about 22-23½% produces a good variety of filament for the purpose of the present invention.

The operation of twisting the yarns, setting the twist and untwisting may be effected according to any of the processes described in prior U. S. Patents Nos. 2,089,198 and 2,089,199 and British Patent No. 464,981, referred to above.

While the treatment with a hot aqueous medium may simply consist of a treatment in wet steam, it is preferred to employ a boiling or almost boiling aqueous liquor. Such a liquor may contain a wetting agent, as for example a water-soluble soap or a sulphonated oil, for instance Monopol soap or Turkey red oil, or other sulphonated higher aliphatic compound, for instance a sulphonated higher fatty acid or a sulphonated higher fatty alcohol, or true sulphonic acids of the higher members of the aliphatic series. The treatment may, for example, be a treatment at the boil for ½ hour to 1½ hours in water containing a small proportion, for example up to 1 gram per litre, of wetting agent. Preferably, after such treatment the material is given a final wash-off, for instance in ordinary water which may be warm or hot. Such a washing-off may be repeated several times.

The treatment with a hot aqueous liquor may be operated so as to exercise a control over the lustre of the final product. A treatment of a cellulose acetate material with a boiling solution as described above produces a substantial reduction in lustre. A similar treatment with boiling water produces a much smaller reduction in lustre but still results in a product of substantially reduced lustre. If desired, salts or sugars may be added to the aqueous liquor, for example in a concentration up to 10 or 20% so as to reduce the loss in lustre occasioned by the hot aqueous treatment. Thus, for example, I may dissolve up to 10% of sodium chloride or up to 20% of sodium sulphate in the liquor and obtain a product which has a very good lustre and, at the same time, is well crinkled or crimped. For further information relating to these salts or sugars which have the effect of protecting the lustre of the material, reference is made to U. S. Patents Nos. 1,765,581 and 1,808,061. If desired the treatment with a hot aqueous medium may take place under pressure so as to enable temperatures higher than 100° C. to be used.

It is preferable in order to obtain a yarn of very woolly characteristics to finish with a doubled yarn having a light doubling twist which is reverse in direction to any twist in the constituent yarns. The twist, if any, in the constituent yarns should also be light. It is further very advantageous to have the product in this form before applying the treatment with the hot aqueous medium. This form of product may result directly from a twisting, setting and untwisting

step. For example, two or three yarns having either no twist or each having a light degree of twist in the same direction may be twisted together with a relatively high degree of twist, the twist set, as for example by means of steam, and the doubled yarn then untwisted so as to leave in the final yarn a light doubling twist, reverse in direction to any original twist in the constituent yarns. Where, as is preferred, the twisting, setting and untwisting operation comprises the insertion of false twist, the production of a doubled yarn of the character referred to will take place in a separate operation, and may either precede or follow the twisting, setting and untwisting operation.

Generally, by a light twist is meant a twist of not more than 5 turns per inch. A doubled yarn of the character referred to may be built up, for example, by taking a number of single yarns, each having say 0 or up to 1 or 2 turns per inch, and doubling them together with a doubling twist of 2 turns per inch in the reverse direction to any initial twist in the singles. Again, where a product of very heavy denier is required, two doubling operations may be employed. Thus, a number of single yarns each having 1 turn per inch or less may be doubled together with a doubling twist of 1 turn per inch in the same direction, and a number of yarns so doubled together with a doubling twist of 2 turns per inch reverse in direction.

Similarly, where the process includes the step of converting the product to a yarn containing staple fibre, a doubled yarn having the above characteristics may be obtained directly during such conversion step. For example, a number of continuous filament yarns having no twist or a light twist in one direction may be converted into yarns containing staple fibre by the process of U. S. Patent No. 2,077,079, and a number of such yarns travelling from this direct conversion process doubled together with a light twist, reverse in direction to any original twist in the yarn.

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

1. Process for the production of improved crimped yarns, which comprises subjecting yarns which have a basis of organic derivatives of cellulose to the operations of twisting, setting the twist and untwisting, and thereafter subjecting the material of the yarns to treatment in a bath of hot aqueous liquid whereby a higher degree of crimp is imparted thereto.

2. Process for the production of improved crimped yarns, which comprises converting continuous filament yarns which have a basis of organic derivatives of cellulose into staple fibre yarns, subjecting the staple fibre yarns to the operations of twisting, setting the twist and untwisting, and thereafter subjecting the staple fibre yarns to treatment in a bath of hot aqueous liquid whereby a higher degree of crimp is imparted thereto.

3. Process for the production of improved crimped yarns, which comprises subjecting yarns which have a basis of organic derivatives of cellulose to the operations of twisting, setting the twist and untwisting, and thereafter converting such yarns into staple fibre yarns and subjecting the staple fibre yarns to treatment in a bath of hot aqueous liquid whereby a higher degree of crimp is imparted thereto.

4. Process for the production of improved crimped yarns, which comprises converting continuous filament yarns which have a basis of or-

ganic derivatives of cellulose into staple fibre yarns by cutting the filaments of such yarns without destroying the continuity of the yarns as a whole, subjecting the staple fibre yarns so produced to the operations of twisting, setting the twist and untwisting, and thereafter subjecting the staple fibre yarns to treatment in a bath of hot aqueous liquid whereby a higher degree of crimp is imparted thereto.

5. Process for the production of improved crimped yarns, which comprises subjecting yarns which have a basis of organic derivatives of cellulose to the operations of twisting, setting the twist and untwisting, cutting the yarns into staple fibres, and thereafter subjecting the staple fibres to treatment in a bath of hot aqueous liquid whereby a higher degree of crimp is imparted thereto and converting such staple fibres into yarn.

6. Process for the production of improved crimped yarns, which comprises subjecting a plurality of yarns which have a basis of organic derivatives of cellulose and at most a low twist to the operations of doubling, setting the doubling twist and untwisting to an extent which leaves a small doubling twist in the yarns reverse in direction to the initial twist in the yarns, and thereafter subjecting the products to treatment in a bath of hot aqueous liquid whereby a higher degree of crimp is imparted thereto.

7. Process for the production of improved crimped yarns, which comprises subjecting yarns which have a basis of organic derivatives of cellulose to the operations of twisting, setting the twist and untwisting, and thereafter subjecting the material of the yarns to treatment in a bath of aqueous liquid maintained at a temperature of the order of the boiling temperature of the liquid whereby a higher degree of crimp is imparted thereto.

8. Process for the production of improved crimped yarns, which comprises subjecting yarns which have a basis of organic derivatives of cellulose to the operations of twisting, setting the twist and untwisting, and thereafter subjecting the material of the yarns to treatment in a bath of hot aqueous liquid containing a salt whereby a higher degree of crimp is imparted thereto.

9. Process for the production of improved crimped yarns, which comprises subjecting yarns which have a basis of organic derivatives of cellulose to the operations of twisting, setting the twist and untwisting, and thereafter subjecting the material of the yarns to treatment in a bath of hot aqueous liquid containing a sugar whereby a higher degree of crimp is imparted thereto.

DONALD FINLAYSON.