

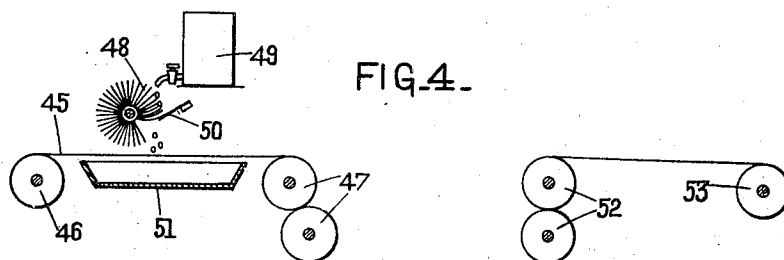
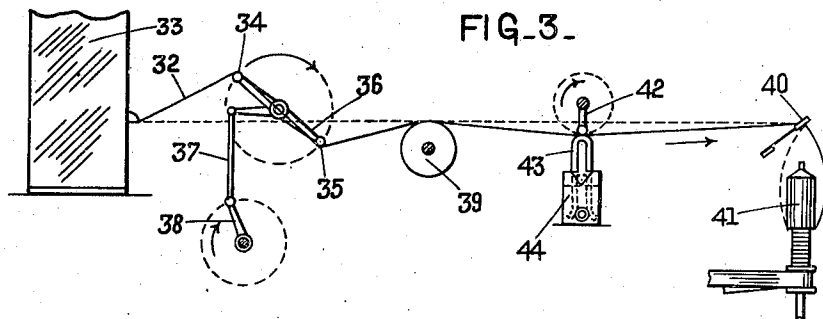
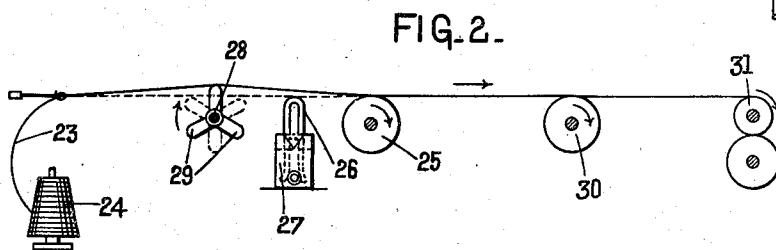
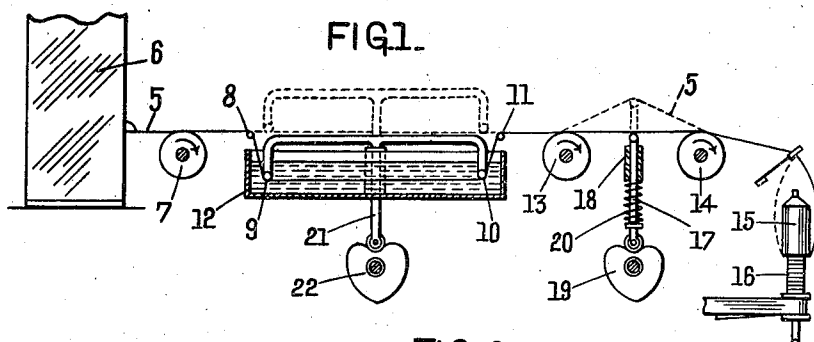
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2,064,279

ARTIFICIAL TEXTILE MATERIAL

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ARTIFICIAL TEXTILE MATERIAL

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This invention relates to textile yarns or threads consisting of or containing continuous artificial filaments having a more or less frequent variation in denier of regular or irregular degree and/or extent, and to their manufacture.

Patent No. 1,898,085 describes a method of production of such filaments by drawing the filaments at varying linear speeds in the course of their production by either the dry or evaporative method or the wet or coagulation method.

Numerous methods are described in the prior specification for variably stretching or drawing the filaments to impart the desired alternating or periodically recurring irregularities, the methods falling roughly into two classes.

According to the first of these methods, the filaments are received by a roller moving with a variable peripheral speed, or otherwise formed or adapted to draw the filaments at varying linear rates so that a correspondingly variable stretch is imparted to the filaments while they are in a soft or plastic state during setting. The filaments may be wound on the variable speed roller or the like or may pass therefrom for collection in any suitable way with or without twisting.

The second of the methods above referred to consists in drawing the filaments at varying linear speeds by periodically lengthening the path followed by them on their way to a winding or twisting and winding device, the rate at which the length of path is followed determining the variation in denier produced on the filaments.

The object of the present invention is to provide further methods of producing filaments, yarns, or threads (hereafter referred to as "filaments") having variable denier similar to those produced according to the prior specification above referred to, but instead of applying variable stretch to the filaments which are still soft or plastic in the course of their production, operates on filaments which have already acquired a set condition. Broadly, the invention consists in bringing set filaments to a sufficiently soft or plastic state to enable them to be stretched, and applying a stretching force to reduce the denier of the filaments at intervals along their length.

Various methods may be employed for carrying out the process according to the present invention. According to one method, the whole length of the filaments is softened and the filaments are then submitted to an intermittent stretching force which may be applied, for example, by any of the methods described in

Patent No. 1,898,085. According to a further method, the filaments are softened at intervals along their length, that is, at points required to be reduced in denier, and are then subjected to a stretching force which may be either constant in degree and operate to reduce the denier of the filaments in accordance with the degree to which they have been softened, or may be intermittent in character as in the previous method, in which latter case the intermittent stretching force may be synchronized to coincide in its incidence with the softened portions of the filaments, or may be out of phase therewith in order to modify the resultant reduction in denier.

The intermittent softening may be effected by a positive application of the softening medium to the required parts of the filaments, this method being particularly suitable when the softening media have a fairly rapid action. There may, however, be applied to the filaments a reserve or resist adapted to protect the filaments from the softening medium, so that the filaments can be passed through the medium while only their unprotected parts are softened. This method is advantageous when softening media of a slower character are employed, though it may be used with advantage with more powerful media. Similarly protective clips may be fixed to the filaments for the same purpose. A reserve or resist or clips as just described may be applied as a protective means at any desired intervals and are useful in enabling a shorter spacing to be obtained between the reductions of denier than is possible merely by the use of an intermittent stretching force.

The filaments may be softened continuously with the operation in which they are stretched, or may be first subjected to the softening influence and then carried through a stretching apparatus. Any suitable softeners may be employed, for example, in the case of filaments of cellulose acetate or other organic derivatives of cellulose, solvents or softeners for the cellulose derivative such as aqueous acetone or aqueous dioxane, acetic acid or glycerine. In the case of glycerine, a fairly prolonged softening treatment at a temperature of about 160° C. is necessary. Volatile softeners may be allowed to evaporate from the filaments after the treatment, and others may be scoured or washed off the filaments or otherwise removed. Reserves or resists suitable for protecting the filaments against the action of the various softening materials are medium viscosity mineral oil in the case of acetone or dioxane, paraffin wax in the

case of acetic acid, and temperature resistant varnishes in the case of glycerine. The reserves or resists are removed at any convenient stage after the treatment, either before or after the filaments are made into fabrics or articles. Clips may be used with any of these softening media.

When fairly long spacings are required between the reductions in denier, it is preferable to soften the filaments at required intervals only and not over the whole length, in order to reduce the amount of softener required. Thus, the filaments may be caused to pass between two rollers above the surface of a bath of softening liquid, and caused to move at desired intervals through the bath by means of guide rods or rollers which are disposed across the path of the filaments into the bath by a suitable cam operated or other gear. After leaving the second roller, the filaments pass round a further roller and a reciprocating or oscillating rod, bar or the like is caused to move across the filaments to lengthen and shorten alternately the path followed by them. This variation in the length of path results in a stretching of the softened filaments, and may either be synchronized exactly with the softening, or may be out of phase therewith, or take place at a different frequency, so that the reduction in denier takes place to a different extent and/or over different lengths of the filaments. The filaments are wound in any convenient manner, for example, by a friction-driven bobbin, it being preferred to allow the filaments sufficient run after the stretching for them to harden and lose any stickiness imparted in the softening treatment.

The variations in denier may take place in a regular manner along the length of the filaments, not only as to the lengths of reduced and unreduced deniers, but also as to the actual reduction in denier, or any one or more of these factors may be irregular in character. Thus the applying means for the softening material or the means for imparting intermittent stretch, where such is used, may operate in a regular or irregular manner.

For example, the applying means for the softening material may comprise one or more reciprocating or oscillating members driven by cams, cranks, eccentrics, or other devices so as to come into contact with the filaments in a regular or irregular manner and to make regular or irregular lengths of contact therewith, the members being supplied with or picking up the softening material to transfer it to the filaments in sufficient quantity to bring about the required softening. Alternatively, or in addition, the reciprocating or oscillating members may serve to displace the filaments so as to cause them to move into or out of contact with means such as a wick or pad supplied with the softening material.

Means such as those just described are particularly suitable for giving a long or fairly long spacing between the softened portions. For shorter spacing, one or more rotatable devices may be used, these devices having one or more arms adapted to contact with the filaments to apply softening material or to displace them into or out of contact with means supplied with softening material. The rotary device or devices may be regularly or irregularly driven, and in the case of multi-armed devices, the arms may have the same or different lengths and may be regularly or irregularly disposed round the devices. Similar means may be used for applying a reserve or resist.

A further method of producing the irregularities in the filaments is to apply the softening material by splashing, so that all semblance of mechanical regularity is eliminated. Similarly, a reserve or resist may be splashed on to the filaments.

The filaments to be treated may be of regular denier, or the invention may be applied to filaments already having irregular denier, for example those produced according to the methods described in Patent No. 1,898,085. For example, such irregular denier filaments may receive an intermittent application of softening material, either coinciding with the reduced parts of the filaments, or in any other regular or irregular sequence along their length, after which the filaments are subjected to stretching intermittently or otherwise. Or the filaments may receive a regular or irregular application of reserve or resist, after which they are softened and stretched as described above. By applying such reserve or resist to the unreduced parts of such irregular filaments, the irregularities in denier may be considerably increased, thus enhancing the effect obtainable by the use of the filaments in subsequent textile operations.

The operations described above may be carried out in bobbin-to-bobbin or other winding operations carried out on the filaments, or may be performed continuously with their production by the dry or evaporative method. For example, in the case of the production of irregular denier yarns according to Patent No. 1,898,085 further irregularities or increased irregularities may be imparted to the filaments as a continuous operation.

The filaments to be treated according to the invention may contain substances adapted to facilitate softening and stretching, for example filaments of cellulose acetate or other derivatives of cellulose may contain one or more plastifiers such as triacetine, diacetine, diethyl phthalate, dibutyl tartrate, and tricresyl phosphate e. g. 10% of tricresyl phosphate, for this purpose.

The invention may be applied to the production of irregular denier in artificial filaments of any character whatsoever by the use of appropriate softeners, and is particularly applicable to the production of irregular denier filaments of cellulose acetate or other organic derivatives of cellulose, such as organic cellulose esters, e. g. cellulose formate, propionate, or butyrate, or cellulose ethers, e. g. methyl, ethyl or benzyl cellulose. Filaments of cellulosic artificial silk, such as viscose, nitrocellulose, and cuprammonium silk, may likewise be treated by the use of appropriate softening materials such as Schweitzer's reagent, zinc chloride solution, and sulphuric acid, any residuum of which may afterwards be removed.

The filaments of variable denier may be twisted into threads with low, medium or high degrees of twist, alone or together with other filaments, yarns, or threads of the same or different material. Though the maximum variation in denier is obtained in threads of filaments having the same variations in coincident positions along their lengths, filaments having different arrangements and degrees of variations may be incorporated in a single thread. The filaments or threads of variable denier may be used as warp or weft or both in woven fabrics or introduced to give any desired patterned, striped, or other effect in woven, knitted, or other fabrics or articles.

The figures of the accompanying drawing show in side elevation several forms of apparatus for carrying out the invention.

In Fig. 1, filaments are drawn as a thread 5 from a spinning cell 6 by means of a feed roller 7 and are led by means of guides, 8, 9, 10, 11 through a trough 12 containing a softening liquid. After leaving the guide 11 the thread 5 passes in turn round rollers 13, 14, and then proceeds to a cap-spinning device 15 where it is twisted and wound onto a bobbin 16. Between the rollers 13, 14 is mounted a vertical rod 17 sliding in guides 18 and caused to move up and down by means of a cam 19. A spring 20 provides for the downward movement of the rod 17. The upper end of the rod 17 engages the thread 5 between the rollers 13, 14, and on its upward movement deflects the thread as shown by the dotted lines. This deflection causes parts of the threads softened by passage through the liquid in the trough 12 to be stretched to a degree dependent upon the amount of deflection, and at a frequency corresponding to the rate of operation of the cam 19.

The second roller 14 is driven at a higher speed than the roller 13 so as to take up the slack produced by the stretching of the thread. In order to guard against slip, the thread may be taken more than once round the rollers 13, 14.

In order to reduce the consumption of softening liquid the thread 5 may be depressed into the liquid at intervals only so that it is softened at corresponding intervals along its length. For this purpose the guides 9, 10 may be mounted on a rod 21 supported similarly to the rod 17 and actuated by a cam 22 having the desired amplitude and operating at any desired frequency, which is preferably such that the stretching action of the cam 19 falls only on the softened part of the threads. Instead of the threads being drawn direct from the spinning cell, a bobbin, hank or other package may be used for supplying the thread.

Fig. 2 shows another arrangement in which a thread 23 is drawn from a package 24 by means of a feed roller 25. Ordinarily the thread would pass in contact with a wick 26 dipping into a container 27 filled with softening liquid. A device 28 is, however, provided which operates to lift the thread at intervals out of contact with the wick 26 so that the softening liquid is only applied to parts of the thread. The device 28 operates at any desired speed in order to produce the required intervals of softening, and is preferably provided with a plurality of thread-engaging arms 29, which arms may be regularly or irregularly spaced to produce corresponding regular or irregular lifting of the thread.

The intermittently softened thread passes from the roller 25 to a stretching roller 30 moving at an appropriately higher speed so that the softened portions of the thread are stretched, the stretching, of course, falling mainly on such softened portions.

After stretching the filaments pass to a take-up bobbin 31. The run of the thread between the roller 30 and the bobbin 31 may be sufficient to provide for the evaporation of volatile softening liquids from the thread. If desired, however, drying or washing means may be provided in order to remove surplus softening liquid after stretching. Instead of the threads 23 being taken from the bobbin 24, they may be led direct from a spinning cell as described with reference to Fig. 1.

In Fig. 3, a thread 32 is taken from a spinning cell 33 and is led over and under two bars 34, 35 mounted on the ends of a rocking lever 36 actuated by means of a link 37 connected to a crank 38. After leaving the rod 35 the thread passes to a roller 39 which draws it from the cell 33 and the action of the rods 34, 35 operates to stretch the thread intermittently as described in U. S. application S. No. 389,412 to produce an intermittent variation in denier. The thread then passes to the balloon guide 40 of the cap-spinning device 41.

A rotating crank device 42 operates to press the thread intermittently on to a wick 43 supplied with a reserve liquid, such as a mineral oil, paraffin wax, or a varnish, from a container 44. The crank 42 thus applies to the variable denier thread an intermittent coating of the reserve at any desired intervals depending on the frequency of the crank 42 as compared with that of the rods 34, 35. The thread thus treated with the reserve may then be softened, for example as described with reference to Fig. 1 above, and stretched, the softening taking place only on the unreserved parts of the thread so that a further intermittent reduction in denier is superimposed on that already imparted by the rods 34, 35. The crank device 42 may be arranged to apply the reserve only to the portions of the thread of larger denier, thus leaving the portions of lower denier to be exposed to the action of the softening liquid. Thus on subsequent stretching the portions already of low denier are still further reduced in denier.

The operating cams or cranks described in connection with Figs. 1-3 produce a more or less regular or periodic treatment of the threads. In order to secure a more random treatment, the apparatus shown in Fig. 4 may be employed. In this apparatus a thread 45 is drawn from a bobbin or other package 46 by means of rollers 47, and in its passage to such rollers the thread moves beneath a brush 48 on to which softening liquid is dripped from a container 49. The brush is deflected by means of a blade 50 so as to cause the softening liquid to be splashed irregularly on to the thread. Surplus liquid is caught in a tray 51 under the thread. The thread is thus softened at frequent irregular intervals, and is thus capable of being stretched irregularly by means of further rollers 52 to which they proceed after leaving the rollers 47. The irregularly stretched thread is wound up on to a bobbin or other package 53. Such an apparatus is capable of treating a large number of threads simultaneously. For example 46 and 53 may be beams capable of receiving several hundreds of threads, each of which is irregularly softened by means of the brush 48.

What we claim and desire to secure by Letters Patent is:—

1. Process for the production of artificial filaments, yarns, or threads which comprises applying a softening agent and tension to a set filament, yarn, or thread in such a manner that the combined action of the softening agent and tension falls locally thereon to bring about an intermittent variation in the denier of the material.

2. Process for the production of artificial filaments, yarns, or threads which comprises applying a softening agent intermittently along the length of a set filament, yarn, or thread, and applying tension thereto so as to stretch the softened material at such intervals, thereby

bringing about a corresponding intermittent variation in the denier of the material.

3. Process for the production of artificial filaments, yarns, or threads which comprises applying a softening agent to a set filament, yarn, or thread, and applying tension intermittently thereto in order to stretch the material at intervals along its length, thereby bringing about a corresponding intermittent variation in the denier of the material.

4. Process for the production of artificial filaments, yarns, or threads which comprises applying a softening agent to a set filament, yarn, or thread, and applying tension thereto, both the application of the softening agent and the application of the tension being intermittent, and thereby effecting a stretching of the material with a frequency and to an extent which are functions of the frequency and extent of the softening and tensioning.

5. Process for the production of artificial filaments, yarns or threads, comprising softening a set filament, yarn or thread of an organic derivative of cellulose at intervals along its length, and reducing its denier at intervals along its length by stretching the softened filament, yarn or thread intermittently in such a manner that the incidence of the intermittent stretching force is out of synchronism with the incidence of the softened portions of the filament, yarn or thread.

6. Process for the production of artificial filaments, yarns or threads, comprising softening a set filament, yarn or thread of cellulose acetate at intervals along its length and reducing its denier at intervals along its length by stretching the softened filament, yarn or thread intermittently in such a manner that the incidence of the intermittent stretching force is out of synchronism with the incidence of the softened portions of the filament, yarn or thread.

7. Process for the production of artificial filaments, yarns, or threads which comprises applying a softening agent and tension to a set filament, yarn, or thread of cellulose acetate in such a manner that the combined action of the softening agent and tension falls locally thereon to bring about an intermittent variation in the denier of the material.

8. Process for the production of filaments, yarns or threads of cellulose acetate which comprises extruding a cellulose acetate solution in the form of filaments through a plurality of orifices into a setting medium, and continuously with such extrusion applying a softening agent and tension to the set filaments in such a manner that the combined action of the softening agent and tension falls locally thereon to bring about an intermittent variation in the denier of the filaments.

9. Process for the production of artificial filaments, yarns or threads which comprises softening

ing a set filament, yarn or thread of cellulose acetate of irregular denier, and applying tension thereto so that the action of the tension of the softened material brings about a further modification in the denier of the material.

10. Process for the production of artificial filaments, yarns or threads which comprises applying at intervals along the length of a set filament, yarn, or thread of an organic derivative of cellulose a liquid having a softening action on the cellulose derivative, and applying tension thereto in order to stretch the material at the softened portions, thereby effecting a corresponding variation in the denier of the material.

11. Process for the production of artificial filaments, yarns or threads which comprises softening a set filament, yarn or thread of cellulose acetate with the assistance of heat, and applying tension thereto in such a manner as to stretch the softened material at intervals along its length, thereby bringing about an intermittent variation in the denier of the material.

12. Process for the production of artificial filaments, yarns, or threads, comprising applying a resist to selected portions of a set filament, yarn or thread, subjecting the remainder of the filament, yarn or thread to the action of a softening medium, and applying stretch to the filament, yarn or thread to reduce its denier at the softened intervals.

13. Process for the production of artificial filaments, yarns or threads, comprising applying a resist to selected portions of a set filament, yarn or thread of an organic derivative of cellulose, subjecting the remainder of the filament, yarn or thread to the action of a softening medium, and applying stretch to the filament, yarn or thread in such a manner as to reduce its denier at the softened intervals.

14. Process for the production of artificial filaments, yarns or threads, comprising applying a resist to selected portions of a set filament, yarn or thread of cellulose acetate, subjecting the remainder of the filament, yarn or thread to the action of a softening medium, and applying stretch to the filament, yarn or thread in such a manner as to reduce its denier at the softened intervals.

15. Process for the production of artificial filaments, yarns or threads, comprising applying a resist to selected portions of a set filament, yarn or thread of cellulose acetate, subjecting the remainder of the filament, yarn or thread to the action of a softening medium, and applying stretch to the filament, yarn or thread in such a manner as to reduce its denier at the softened intervals, continuously with the production of said filament, yarn or thread by the dry or evaporative method.

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