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PRODUCTION OF TEXTILE OR OTHER MATERIALS

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FIG. 2.

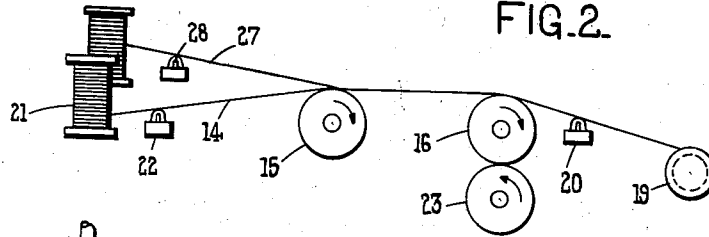
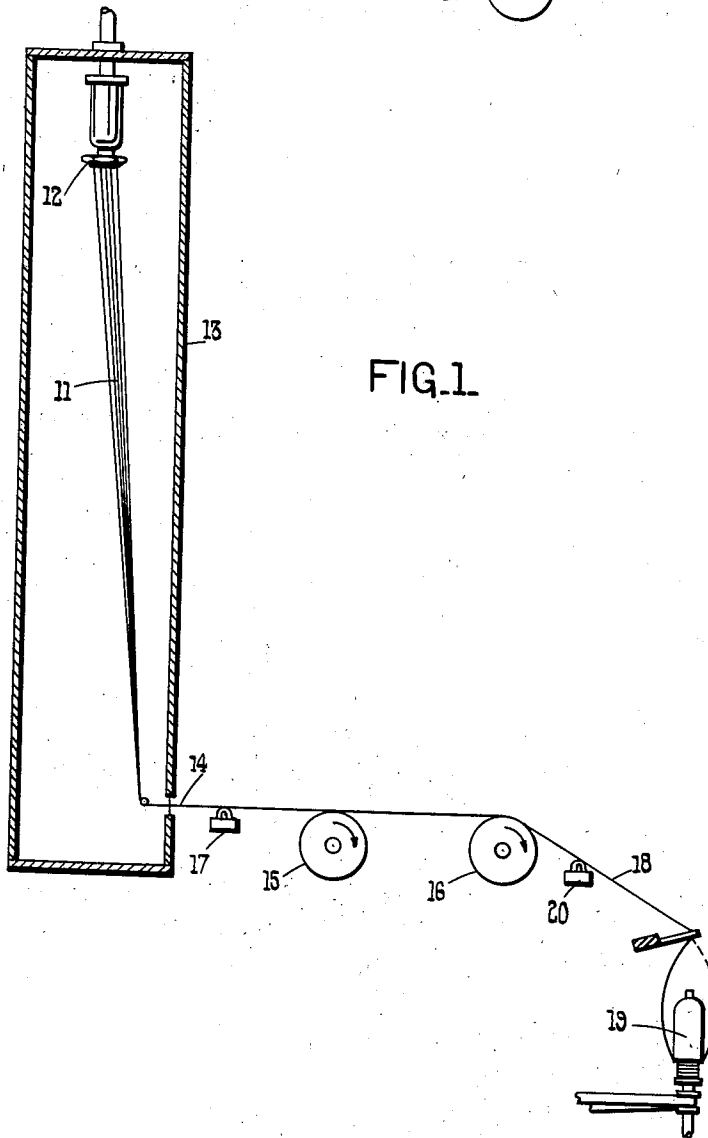


FIG. 1.



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PRODUCTION OF TEXTILE OR OTHER MATERIALS

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3 Claims. (Cl. 18—54)

This invention relates to the union of a number of artificial filaments of smaller cross-section into unitary filaments of larger cross-section.

According to the invention a number of associated artificial filaments which are in a soft or sticky condition are subjected to stretching, with the result that the filaments adhere together to form a unitary filament of large cross-section. The unitary filament has a full-round cross-section, with a smooth or comparatively smooth surface. It may, however, be flattened, crinkled, or embossed by subjection to pressure, for example in the manner described in U. S. application S. No. 406,356 dated November 11, 1929.

The sticky condition necessary to enable the filaments to adhere under the action of the stretch may be brought about in any suitable way. For example, a liquid having a solvent, softening, or swelling action on the substance of the filaments may be applied to the filaments in limited quantity, and preferably in the form of an extremely thin film, by means of a wick, or a rod, roller, or the like surface moistened with the liquid as described in U. S. application S. No. 393,287 dated September 17, 1929. Likewise, the liquid may be applied as a spray or in vapour form, or the filaments may be led through a bath of the liquid.

The solvent may be applied intermittently along the length of the filaments, for example, in the manner described in U. S. Patent No. 1,909,192, with the result that on the application of the stretch intermittent lengths of the filaments are united together, while the remainder of the filaments retain their original independent character.

The operations mentioned above may take place continuously with the production of the filaments, or subsequently thereto.

A further method which may be adopted in carrying out the invention is to apply the stretch to the filaments at such a stage in their production that they are still soft or sticky by reason of a content of residual solvent. Thus, in the manufacture of filaments of cellulose acetate or other organic derivatives of cellulose by the dry or evaporative method, the filaments may be caused to unite into a unitary filament after they have left the spinning cell by making use of the combined effect of stretching and the small quantity of residual solvent still contained in the filaments, provided that the filaments are stretched over a sufficiently long run. The effect of the residual solvent in this connection may be increased by including in the spinning

solution a material such as for example vinyl acetate, which has a tendency to remain in the filaments for a longer period than the volatile solvent, e. g. acetone, used in the spinning solution, and to keep them in a tacky condition for a longer period.

A still further method consists in applying heat to filaments of a thermoplastic character, such as cellulose acetate, to soften them sufficiently to form a unitary filament under the action of the applied stretch. Heat may also be used to assist in the union of the filaments in any of the methods according to the invention which rely on the softening of the filaments by materials applied to or contained in the filaments.

It is to be noted that unitary filaments produced without stretch, as for example by the methods described in U. S. application S. No. 393,287 dated September 17, 1929, may be of a relatively bulky character probably on account of enclosed air spaces, and irregularities due to the retention to some degree of the form of the individual primary filaments. The nature of the cross-section of the product of the present invention will depend in this respect upon the degree of stretch applied to the filaments, and the degree of softness or stickiness, greater stretch, and/or greater stickiness, whether due to residual solvent or to the application of further solvent and/or heat, resulting in a product having a smoother surface and a more solid cross-section. By controlling the factors of stretch and softness or stickiness, a product having any desired cross-section within a large range may be produced. An intermittently coalesced product, consisting of alternating lengths of unitary filament and filamentary thread may be produced if desired by the intermittent application of either of the above softening agencies, or, if sufficient stretch be employed, a product consisting of alternate lengths of smooth, round unitary filament, and bulky, irregular unitary filament may be obtained.

The nature of the product may be modified by further treatment and the addition of other materials to the filaments of which the product is made. Thus, there may be incorporated with the product, dyes, or other effect materials, or metallic or other strands or wires. Or again, a product having a low or reduced lustre may be produced by suitable delustring treatments. Any or all of these effects may be produced along the whole length of the product or intermittently along portions of the length thereof.

Several ways of carrying out the invention will

now be described by way of example with reference to the accompanying drawing, principally with respect to the production of unitary filaments of cellulose acetate or other organic derivatives of cellulose continuously with their production by the dry or evaporative method, but it is to be understood that the following description is in no way limitative.

Fig. 1 shows a method of carrying out the invention continuously with the production of filaments by the dry or evaporative method.

Fig. 2 shows a method of carrying out the invention in the course of a bobbin-to-bobbin winding operation.

Referring to Fig. 1, a bundle of filaments 11 is extruded from a jet or nozzle 12 downwardly into a current of evaporative medium passing through a spinning cell or chamber 13, the major portion of the volatile solvent employed in the spinning solution being evaporated from the filaments before they leave the cell. The filaments associated in the form of a thread 14 are drawn from the cell by a feed roller 15 and proceed to a further roller 16 whose peripheral speed is greater than that of the feed roller 15 so that the thread 14 is stretched to a slight extent. Before or after passing round the feed roller 15 (or first stretching roller) the filaments may be moistened by passage over a wick 17 with acetone or other suitable solvent, or softening or swelling agent. Examples of suitable solvents are low boiling solvents such as acetone (commercially pure, or mixed with water) ethylene dichloride and ethyl or methyl alcohol, dichlorethylene and ethyl or methyl alcohol etc., high boiling solvents or plastifiers such as diacetin, triacetin, ethyl lactate, diacetone alcohol (alone or mixed with water or alcohol) dibutyl tartrate or tricresyl phosphate, and mixtures thereof. The use of high boiling solvents or plastifiers imparts increased pliability to the product. Under the stretch applied between the two rollers 15, 16 the filaments in the thread 14 which have been rendered sticky by the solvent or the like adhere to each other to form a single larger filament 18, which proceeds to a winding device 19, and is collected thereon.

Before or, more advantageously, after passing round the second stretching roller 16 the unitary filament 18 may be moistened with any suitable lubricant by means of a wick as shown at 20, the application of which material removes any residual stickiness which might cause the filament 18 to adhere on the package formed in the winding apparatus 19.

The operation above described may be carried out otherwise than continuously with the production of the filaments, for example, during a bobbin-to-bobbin, or other winding operation, as shown in Fig. 2, wherein the filaments, associated in the form of a thread 14 are taken from a bobbin 21 and passed over a wick 22, or like device to render them sticky or tacky. After passing over the wick, the filaments are led successively round two rollers 15, 16, of which the second, 16, rotates slightly faster than the first. The filaments coalesce under stretch to form a unitary filament 18, which passes over a lubricating wick 20, and proceeds to a winding device 19, by which it is collected in the form of a package. If desired, a flattened product may be obtained by the use of the roller 23, which is adapted to be pressed against the under side of the roller 16. The roller 23 may if desired, be

embossed or wavy to produce an embossed or crinkled product.

Means are shown in Fig. 2 for incorporating additional material in the unitary product. The additional material 27 is associated with the filaments 14 prior to stretching, such materials being preferably brought into a sticky or tacky condition by means of a solvent or softening material applied by a wick 28. If the same softening or solvent material is effective to both of the threads 14, 27 the wick 22 may be used for both.

The solvent or softener may be applied to the filaments in any suitable way, as in the form of a spray or vapour or by passing the filaments over wicks, as shown in the drawing, or rollers, rods, or other devices moistened with the requisite quantity of the solvent or the like. Similar methods may be adopted for the application of the lubricant, a wick being particularly suitable for this purpose.

Instead of applying a solvent or the like to make the filaments sticky, adhesion of the filaments may be effected by stretching the thread of associated filaments while they are still not completely set. By the addition of suitable substances, such as for example, vinyl acetate, to the spinning solutions of cellulose acetate or other organic derivatives of cellulose, the filaments may be maintained sticky for a longer period when this method of producing the unitary filaments is adopted.

It is even possible to utilize the small quantity of solvent remaining in the filaments spun from the usual solutions of the cellulose derivative in volatile solvents such as acetone after they emerge from the spinning cell to cause the filaments to unite, provided that a sufficiently long run say, 4 to 6 feet is given to the filaments between the feed roller and the stretching roller.

If heat is to be applied to the filaments to render them sticky, either alone, or in conjunction with any of the methods indicated above, the filaments may be led round a heated roller (which may be the feed roller) or through a heated chamber before or during the application of the stretch.

After union of the filaments, further stretch may be imparted after another application of heat, or solvent or the like, or both, in order to improve the qualities of the filament and in particular to give it a smoother surface.

It will be understood that the degree of stretch necessary to effect the adhesion of the filaments is small, and that the denier of the unitary filament produced can be controlled by choosing such size or number of primary filaments as will give a unitary filament of the desired denier under the conditions adopted.

In order to produce a flattened, intermittently flattened, or crinkled or embossed product, the unitary filament produced in the manner indicated above may be led through nipping rollers, having appropriately formed surfaces, while they are still in a somewhat soft or sticky condition. Conveniently, the nipping rollers may be used to apply to the filaments the stretch by which they are caused to unite.

Composite threads containing two or more filaments of a continuous or intermittent unitary character or one or more such filaments together with one or more primary filaments may be formed by separately forming the unitary filaments and associating the several filaments prior to winding. If desired, a bundle of filaments proceeding from a spinning cell may be divided into groups, one or more of which may be formed into

the unitary filaments before reassociation of the several filaments of the bundle.

In effecting the union of the small filaments into a single thread or into one consisting of 5 lengths of unitary filaments alternating with lengths of individual filaments, it is advantageous to employ a thread of filaments which have been twisted together, the applied stretch then pulling the twisted filaments into intimate contact with 10 each other and causing them to unite very firmly together.

Colour effects may be produced on the unitary filaments by applying suitable dyestuffs at any suitable stage of the process of manufacture; 15 that is, prior to the application of stretch simultaneously therewith, or after the filaments have coalesced under tension to form the finished product. Where a coalescing solvent is applied and the dyestuff is applied prior or subsequently to 20 application thereof, the said dyestuff should preferably be applied in the form of a solution in organic solvents, as described in U. S. application S. No. 284,673 dated June 11th, 1928. The dyestuff may be applied prior to the application of 25 the coalescing liquid, by means of wicks, rollers, and the like in a continuous manner to produce uniform colour, or intermittently to form differential colour effects. A further convenient mode of application of the dye is in solution in 30 the coalescing solvent. Other modes of applying the dyestuff may also be used; for example the finished product may be dyed in hanks or in the form of other packages by any suitable known dyeing methods.

35 Products which are delustred or opaque may be produced in accordance with the invention, and this effect may be obtained continuously along the length of the product or intermittently as desired. In the case of cellulose acetate or other 40 organic derivatives of cellulose the delustred or opaque effect may be produced by subjecting the product to the action of water or other aqueous media, alcohol, steam or other delustring agency after coalescence. Another mode of obtaining 45 this effect is to apply a soluble metal salt (such as a salt of barium, strontium or calcium) to the yarns or filaments (of whatever kind) about to be coalesced, either in the coalescing liquid or by separate application and then after coalescing to 50 subject the product to a chemical treating bath that precipitates the metal in the form of an insoluble compound (such as sulphate, carbonate, or phosphate).

Ornamental effects of the nature of differential 55 color effects or differential lustre may be produced by associating other yarns having different delustering or dyeing properties, or yarns which have been dyed or delustred in a different manner, with the material to be coalesced. Ex- 60 amples of such yarns are those made of natural silk, wool and cotton, and (if the filaments to be coalesced are of cellulose acetate or other organic

derivatives of cellulose) viscose or other reconstituted cellulose yarns and vice versa. Metal- 5 lized effects may be produced by associating with the material fine flat metal bands, such as are used in making tinsel, or metallized threads or 10 yarns, prior to coalescing. If desired, a bronze or aluminium powder or like material may be incorporated in the product at any suitable stage of manufacture to produce metallic or other ef- 15 fects. In the case of yarns or strands of additional materials which are not in a sticky or tacky condition, it is preferred that they should be incorporated during stretching, or towards the end of the stretching process, since the ap- 20 plication of stretch to such materials might be liable to cause them to break, or to restrain the process so that stretching cannot be carried out on the sticky filaments themselves.

The invention is not of course limited to the 25 production of unitary filaments from filaments of cellulose acetate or other organic derivatives of cellulose but may be applied to artificial filaments of the reconstituted cellulose type which are in a suitable sticky condition for adhesion 30 under the application of stretch. Further, filaments of both types, when sticky or tacky may be used together for the purpose of the invention.

After the production of the unitary filaments or the composite threads containing them, they 35 may be collected by any suitable reeling or winding, or twisting and winding operation.

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

1. Process for the production from a number of 35 artificial filaments of a single filament of larger cross-section, said process comprising heating a number of filaments of a thermoplastic derivative of cellulose while they are associated 40 together, and stretching said filaments while they are in a soft condition so as to cause them to merge permanently together to form a single filament of larger cross-section.

2. Process for the production from a number of 45 artificial filaments of a single filament of larger cross-section, said process comprising heating a number of filaments of cellulose acetate while they are associated together, and stretching said 50 filaments while they are in a soft condition so as to cause them to merge permanently together to form a single filament of larger cross-section.

3. Process for the production from a number of 55 artificial filaments of a single filament of larger cross-section, said process comprising extruding a spinning solution of cellulose acetate in the form of a number of filaments, said solution containing vinyl acetate, associating said filaments 60 while they are in a soft condition and stretching them so as to cause them to merge permanently together to form a single filament of larger cross-section.

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