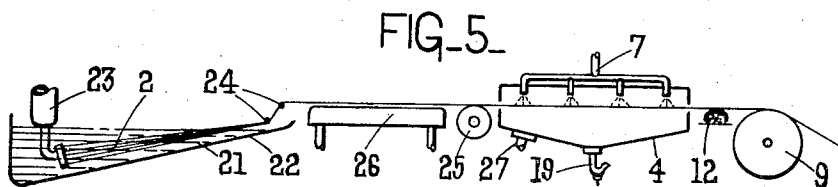
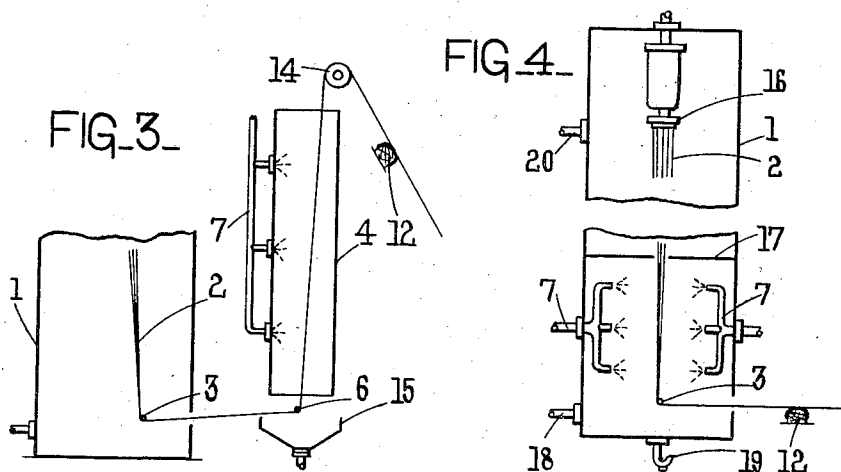
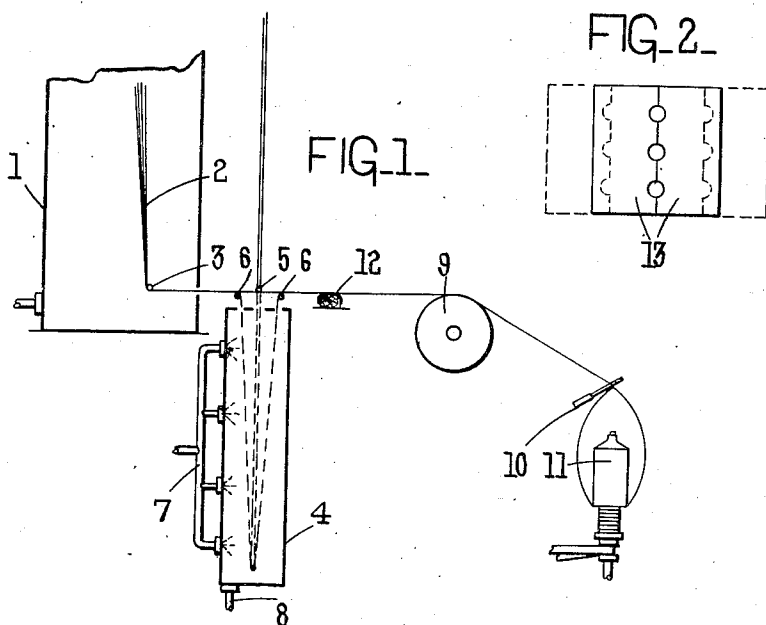


June 16, 1936.

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TREATMENT AND MANUFACTURE OF ARTIFICIAL
YARNS, THREADS, FILAMENTS AND THE LIKE
Filed Oct. 13, 1932

2,044,136



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UNITED STATES PATENT OFFICE

2,044,136

TREATMENT AND MANUFACTURE OF ARTIFICIAL YARNS, THREADS, FILAMENTS, AND THE LIKE

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Application October 13, 1932, Serial No. 637,585
In Great Britain November 7, 1931

7 Claims. (Cl. 18—54)

This invention relates to the manufacture and treatment of artificial yarns, threads, filaments and the like or materials containing the same of cellulose acetate or other cellulose esters or ethers.

In the manufacture of filaments and like products of cellulose esters or ethers by the dry or evaporative method, it is well known that the major portion of the solvent contained in the spinning solution is evaporated during the passage of the filaments through the spinning cell or chamber, but that a residue of the solvent remains in the filaments. Similarly, in the case of wet spinning, when the coagulating bath contains a solvent or when the spinning solution contains a solvent not readily soluble in the coagulating bath, the resulting filaments generally contain a proportion of solvent.

The present invention relates to means whereby residual solvent can be taken out of the filaments or at least the proportion thereof reduced considerably. According to the present invention, the materials are treated with steam, preferably immediately after they leave the spinning cell in the case of treating dry-spun products. The steam should not be applied under such conditions that delustering of the filaments or other products takes place where such delustering is not desired. In order to prevent the delustering, the humidity of the steam may be suitably adjusted. Preferably the steam employed is substantially dry. The steaming treatment may be comparatively short and in any case will not be sufficiently long to render the filaments or other products resistant to delustering on treatment with hot aqueous media.

The steaming treatment may be applied to the materials in any suitable form but is preferably applied to the individual filaments or associated filaments while they are travelling from point to point. In order to achieve the principal advantages which may be obtained by the present invention, it is necessary that the steaming treatment should be applied to the filaments or other products comparatively soon after the spinning operation.

I find that not only is the solvent content of the filaments reduced so that there is comparatively little liability of the filaments to change in properties on being stored, but in addition, the steam appears to effect a conditioning of the filaments or yarns or other products so as to render them more amenable to textile operations, and particularly knitting, weaving, twisting, winding, pining and so forth. Moreover, a still further

advantage is that the filaments or like products are better able to withstand a comparatively high twist, such as is essential in the manufacture of threads for weaving into crêpe fabrics. As described in U. S. application S. No. 523,930 filed 19th March, 1931, in the manufacture of crêpe fabrics it is highly desirable to apply the twist in two or more separate stages. The steaming treatment of the present invention appears to render the thread which has been subjected to the first stage of twisting more solid, so that it can more easily be subjected to the further stage or stages of twisting in such a way that the said further stage or stages of twisting are wholly or largely productive of snarls when the crêpe threads are subsequently woven into the required crêpe fabrics and given the crêping treatment. This is important, since the amount of twist which is subsequently converted into a snarl determines the extent to which the crêpe figure is produced.

In addition to all the foregoing advantages, the present invention has the additional advantage that it increases the covering power of the filaments and other products. This is especially advantageous when the filaments or like products are being spun by the dry spinning method at high speed, for example 200–300 or more metres per minute. These high spinning speeds have been regularly practised in the past few years, and it is found that, as compared with the artificial silk spun under similar spinning conditions, using the old spinning speeds of 100 metres per minute or thereabouts, the yarn produced exhibits somewhat less covering power. It will therefore be appreciated that from this point of view alone, the present invention is important. Moreover it is found that by treating the filaments, yarns, etc. according to the present invention packages thereof exhibit less tendency to loosen or tighten after winding.

As stated above, it is desirable to apply the steaming treatment to the filaments or other products as soon as possible after the spinning operation. I find it most advantageous to apply the steaming treatment continuously with the manufacture of the products, and in the case of dry spinning, just before or immediately or shortly after the filaments leave the spinning cells or chambers. Thus, for example, the steaming treatment may be applied to the filaments during their passage from the spinning cells or chambers to a winding device, for example a hanking machine or a drum winding apparatus or a cap or ring spinning machine. This may be quite con-

veniently effected on the standard spinning metiers by providing one, two, three or other small number of jets, so that steam is projected on to the travelling filaments between the spinning cell or chamber and the customary feed roller or between the feed roller and the winding or winding and twisting device. I find it convenient to employ three or four steam jets for each set of travelling filaments and to position the jets at intervals of an inch to two inches along the path of the filaments.

According to a modification of the invention the steaming treatment may be carried out in the cell itself or in a compartment forming a part of the cell. Thus filaments extruded from a spinning jet in a dry spinning cell may be caused to travel for a sufficient distance in the portion of the cell containing the main evaporative atmosphere so that the solvent is substantially removed, and then during the later stages of their travel they may pass through an atmosphere containing steam to remove remaining solvent. Preferably the portion of the cell in which the filaments or the like are treated with steam is substantially separated from the remainder of the cell by a partition, which may be adjustable to facilitate starting up, so as to maintain the atmosphere in the main evaporative portion of the cell substantially free from steam. This object may be assisted by causing the current of evaporative medium to move in the direction of travel of the filaments and either withdrawing it near the end of the portion of the cell in which evaporation is carried out or allowing it to pass through the partition into the chamber where steaming is effected and withdrawing it by the same outlet as the steam.

The steam to be employed for the purpose of the present invention is, as stated above, preferably dry steam. It may be at any suitable temperature, for example at a temperature of about 90° to 110° C. or may be superheated to higher temperatures, as for example 140 to 150° C.

If desired, the steaming treatment according to the present invention may be conducted in a closed or substantially closed chamber, more especially where it is desired to recover the solvents driven off from the filaments or other products. Thus, for example, the products during their passage past the steam jets, or while being treated with steam, may be substantially enclosed in a suitable chamber fitted with a suction device leading to a solvent recovery apparatus. Conveniently a spinning metier may be fitted with a tall narrow trough-like arrangement which may be thermally lagged and may carry at its upper end smooth rods or small rollers or pulleys to prevent damage to the filaments. Steam may be injected into the bottom of the trough-like vessel or at any suitable height, and the suction of the draw-off device may be adjusted so as to prevent any substantial escape of steam from the upper open end of the vessel. If desired, the upper end of the vessel may be substantially closed, for example, by means of a cover which contains holes through which the filaments and a fork or similar device pass, and such cover may be formed in two parts to allow of the introduction of the filaments into the vessel at the commencement of the steaming operation. Conveniently the filaments proceeding from a dry spinning metier may first be carried directly to the feed roller and thence to a winding device. A fork arrangement may engage the filaments between the metier and the feed roller so as to draw them

down into the trough-like vessel where they are treated with steam. The prongs of the fork may themselves be smooth rods or a pulley or like arrangement may be provided to reduce friction. When running at a customary dry spinning speed of 200-300 metres per minute, it is convenient to have a trough of about 3-4 feet in depth so as to provide a run of 6-8 feet for the filaments in the steam.

Various forms of apparatus which may be employed according to the present invention are shown in the accompanying drawing but it is to be clearly understood that they are given solely by way of illustration and do not limit the invention in any way. In the drawing

Fig. 1 is a side view of one form of apparatus for carrying out the invention;

Fig. 2 is a detailed view of a cover for the vessel 4 of Fig. 1;

Figs. 3 and 4 are side views of alternative forms of apparatus suitable for carrying out the invention;

Fig. 5 is a side view of a form of apparatus suitable for carrying out the invention in conjunction with a wet spinning process.

Figure 1 shows a form of apparatus in which a bundle of filaments 2 formed in a dry spinning cell 1 pass round a guide 3 and out through a letter-box over suitable guides or pulleys 6 positioned above a vessel 4 in which steaming is carried out. Suitable dimensions for this vessel are about 3 ft. in length by 4 inches diameter. The top of the vessel may be open or it may be closed by means of a slotted cover formed in two parts. Figure 2 shows a cover which may be used in this connection, the two portions 13 of which may either be hinged to the sides of the vessel or may slide upon it as desired. The dotted lines indicate the position of the parts when separated to admit the filaments into the steaming vessel. Steam is introduced into the vessel 4 through the pipes 7 and issues together with condensed water through the outlet 8 which may either discharge to the open air or, if desired to recover the solvent, may be connected by means of suitable pumps to a solvent recovery apparatus. When it is desired to subject the filaments to a steaming operation they are pushed down into the vessel 4 by means of a rod 5 the end of which may be merely a smooth surface or which may carry a pulley wheel or other device. On issuing from the vessel 4 the filaments pass over a wiper 12, round a feed roller 9, and through a guide 10 to a cap spinning apparatus 11.

Figure 3 shows a somewhat similar type of apparatus in which a bundle of filaments 2 formed in the dry spinning apparatus 1 passes round a guide 3 and out of the cell round a guide 6 and up through a steaming vessel 4 into which steam is introduced by means of the pipes 7. The bottom of the vessel 4 may be open and condensed steam may be collected in a receiver 15 which discharges in any suitable manner. On issuing from the vessel 4 the filaments pass over a guide or pulley 14 and a wiper 12, proceeding thence to a feed roller and being taken up in any suitable manner.

Figure 4 illustrates an apparatus in which steaming of the filaments is carried out in the spinning cell itself. A bundle of filaments 2 extruded from a spinning jet 16 passes down the cell 1 and through the opening in the partition 17, round a guide 3 and out of the cell over a wiper 12, from which it proceeds to a feed roller and thence to any suitable winding or winding

and twisting apparatus. Steam is introduced into the lower part of the cell through the pipes 7 and is withdrawn through the outlet 18 together with the evaporative medium introduced through the inlet 20. The mixture of steam and air or other evaporative medium passes through a solvent recovery apparatus and condensed water is collected in the steam trap 19.

The application of the invention of the present application to products obtained by wet spinning processes is illustrated in Figure 5. A bundle of filaments 2, extruded from a spinning jet 23 which is immersed in a suitable coagulating bath 21 contained in the vessel 22, passes round guides 24 and over a drying table 26 to a steaming chamber 4. If desired, a feed roller 25 may be inserted between the drying table and the steaming chamber. Steam is introduced into the chamber through the pipes 7 and issues through the outlet 27 which may communicate with a solvent recovery apparatus. Condensed steam is collected in the steam trap 19. After steaming the filaments pass over a wiper 12 and then round a feed roller 9, after which they are taken up on any suitable winding or twisting and winding device.

The invention is particularly important in relation to the manufacture and treatment of filaments and other products of cellulose acetate, but may equally well be applied to the treatment of filaments and like products of cellulose formate, cellulose propionate, cellulose butyrate, cellulose nitro-acetate or other esters or mixed esters of cellulose, ethyl, butyl or benzyl cellulose or other cellulose ethers or mixed ethers, or cellulose ether-esters, e. g. ethyl cellulose acetate and oxy-ethyl cellulose acetate.

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

1. Process for conditioning artificial filaments, threads, ribbons and like filamentary materials containing organic derivatives of cellulose, and which are in a substantially dry state, which comprises removing from said materials residual volatile solvent, dissolved therein, by the application of steam thereto.

2. Process for conditioning artificial filaments, threads, ribbons and like filamentary materials containing organic derivatives of cellulose, and which are in a substantially dry state, which comprises removing from said materials residual

volatile solvent, dissolved therein, by the application of steam thereto for a period insufficient to render the materials resistant to delustering.

3. Process for conditioning dry-spun artificial filaments, threads, ribbons and like filamentary materials containing cellulose acetate, and which are in a substantially dry state, which comprises removing from such materials residual volatile solvent, dissolved therein, by the application of steam thereto for a period insufficient to render the materials resistant to delustering.

4. Process for conditioning dry-spun artificial filaments, threads, ribbons and like filamentary materials containing cellulose acetate, and which are in a substantially dry state, which comprises removing from said materials residual volatile solvent, dissolved therein, by the application of steam thereto for a period insufficient to render the materials resistant to delustering, said application of steam being effected continuously with the production of the materials.

5. Process for conditioning artificial filaments, threads, ribbons and like filamentary materials containing organic derivatives of cellulose, and which are in a substantially dry state, which comprises removing from said materials residual volatile solvent, dissolved therein, by the application of dry steam thereto for a period insufficient to render the materials resistant to delustering.

6. Process for conditioning dry-spun artificial filaments, threads, ribbons and like filamentary materials containing organic derivatives of cellulose, and which are in a substantially dry state, which comprises removing from said materials residual volatile solvent, dissolved therein, by the application of dry steam thereto for a period insufficient to render the materials resistant to delustering, said application of steam being effected continuously with the production of the materials.

7. Process for conditioning dry-spun artificial filaments, threads, ribbons and like filamentary materials containing cellulose acetate, and which are in a substantially dry state, which comprises removing from said materials residual volatile solvent, dissolved therein, by the application of dry steam thereto for a period insufficient to render the materials resistant to delustering, said application of steam being effected continuously with the production of the materials.

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