Jan. 19, 1943. O. VON KOHORN ZU KORNEGG 2,308,576

METHOD FOR THE MANUFACTURE OF ARTIFICIAL FIBERS AND STAPLE FIBER YARNS

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Fig. I.

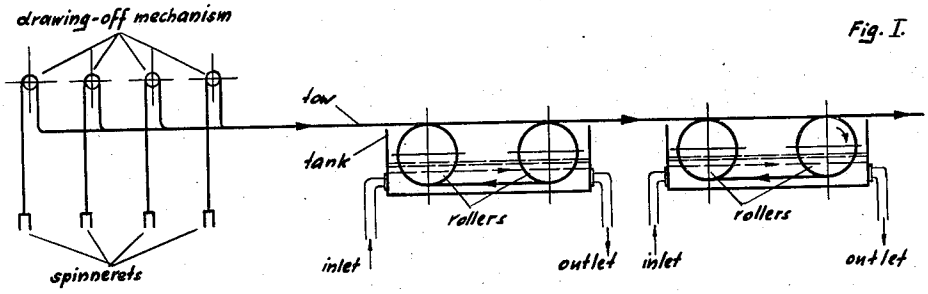


Fig. II.

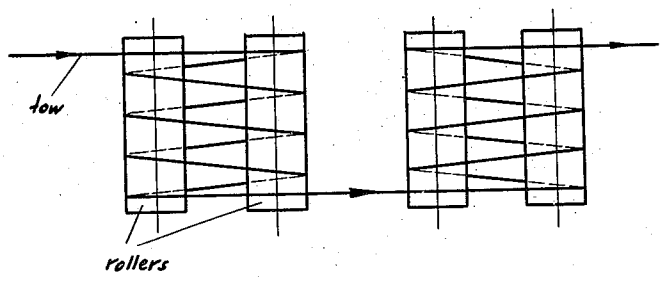


Fig. III.

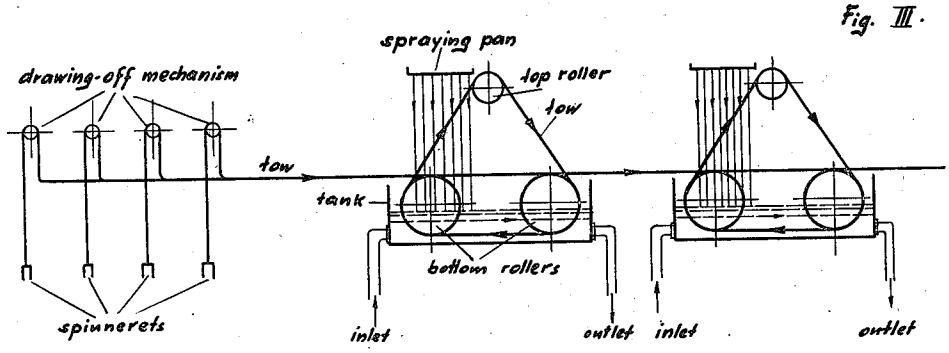
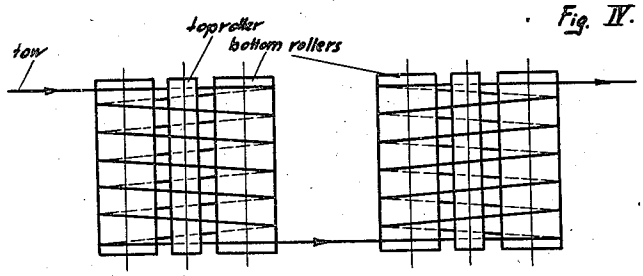


Fig. IV.



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Fig. V.

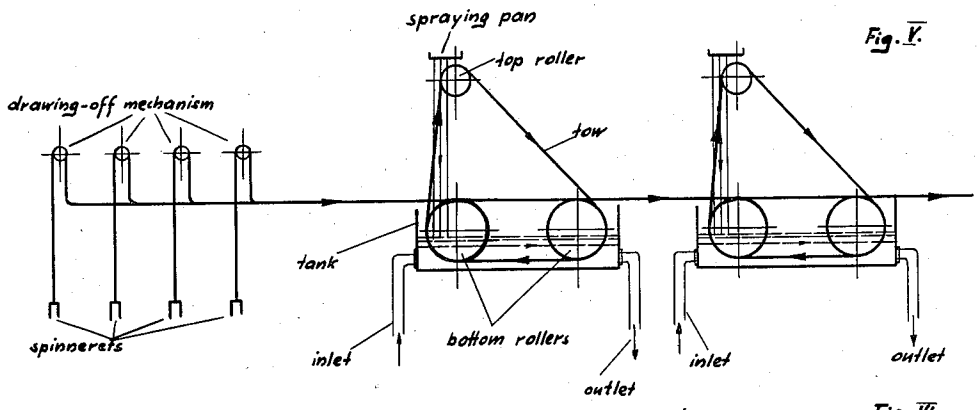


Fig. VI.

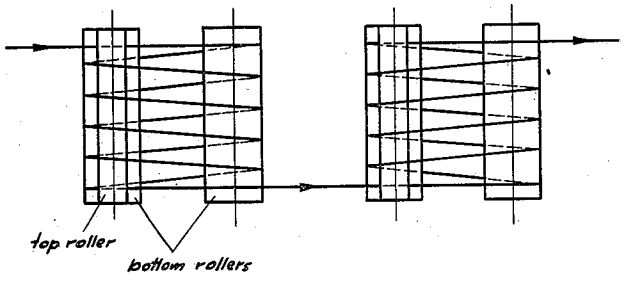


Fig. VII.

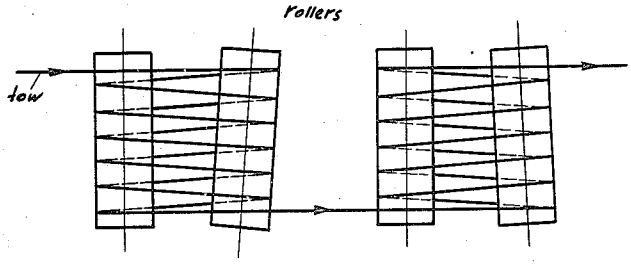
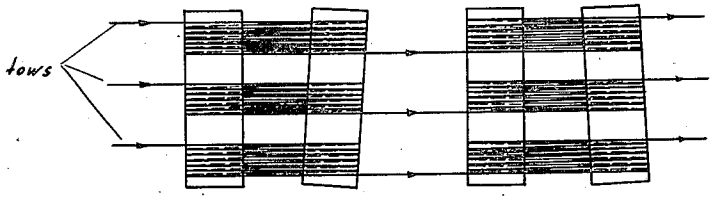


Fig. VIII.



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UNITED STATES PATENT OFFICE

2,308,576

METHOD FOR THE MANUFACTURE OF ARTIFICIAL FIBERS AND STAPLE FIBER YARNS

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Application March 27, 1941, Serial No. 385,446

4 Claims. (Cl. 18—54)

This invention relates to the manufacture of artificial threads and more particularly to the continuous spinning, after-treatment and finishing of staple fibers or staple fiber yarns. Without limiting my invention to the processes set forth herein, the method described is especially suitable for artificial threads produced by the viscose and cuprammonium methods.

As one example of my process, I shall describe the order and arrangement of machines and processes as used by me in the manufacture of viscose staple fibers and staple fiber yarns. I spin a plurality of threads on a spinning machine comprising the same number of spinnerets, by projecting viscose through these spinnerets into a coagulating bath, containing sulphuric acid and different salts. After collecting all these threads into one heavy tow or rope, I am confronted with the problem of after-treating, drying and converting the continuous filaments into staples or yarn. The treatment of such a thick rope, which may have a total denier of several hundred thousand, is naturally the more difficult, the thicker the rope and the larger the number of individual filaments forming such a rope.

Two methods have been suggested, of which one prefers to cut the rope into staples as soon as possible after the formation of the threads, with the after-treatment taking place on the cut staples.

The other method advocates the after-treatment of the continuous threads, and this latter method has the advantage of permitting the drying of the continuous threads, and then directly converting them into yarn. By referring to after-treatment in the case of viscose filaments, the treatment of the spun threads still containing acid with water, de-sulphurizing solutions, bleaching solutions, neutralizing solutions, oils, or other finishing agents, is meant. Also, the dyeing of the filaments may take place and is to be included in the term "after-treatment."

All these after-treating operations have to take place one after the other and the solutions have to be kept distinctly separate. In order to carry out the after-treatment completely and evenly, a certain time must be allowed for the chemicals to act on the threads, and therefore the threads must remain in contact with one particular kind of solution for a certain minimum length of time. In the case of continuously running threads, which are progressing at the rate of the spinning speed, I employ a number of cylinders or rollers, around which I wind the rope formed by the plurality of threads, and which are rotated at the same circumferential speed as the spinning speed.

In the drawings:

Fig. 1 is a diagrammatical view of a side elevation of the spinning and after-treating device shown partly in section.

Fig. 2 is a diagrammatical top plan view of the same after-treating device shown in Fig. 1.

Fig. 3 is a diagrammatical view of a side elevation of the spinning device and a different embodiment of the after-treating device, shown partly in section.

Fig. 4 is a diagrammatical top plan view of the after-treating device, shown in Fig. 3.

Fig. 5 is a diagrammatical view of the side elevation of the spinning device and a different embodiment of the after-treating device, shown partly in section.

Fig. 6 is a diagrammatical top plan view of the after-treating device shown in Fig. 5.

Fig. 7 is a diagrammatical top plan view of the after-treating device shown in Figs. 1 and 2, but with the rollers arranged in oblique position.

Fig. 8 is a diagrammatical top plan view of the after-treating device shown in Fig. 7, used for a plurality of tows.

I provide (as illustrated in the drawings) two rollers, arranged horizontally, around which the rope is wound spirally, taking a certain number of turns depending on the after-treating time required. If the spinning speed is, for example, 80 yards per minute, the circumferential speed, at which these rollers are driven, is also approximately 80 yards. This method also has the advantage of permitting me to apply a certain tension to the threads between the spinning and the after-treating machine. This arrangement of rollers permits me to accommodate a considerable yardage of rope on a small space, and to keep the rope moving at the same time.

As the collected threads enter the after-treating machine, immediately upon their formation, I even have the possibility of continuing the coagulating or precipitating action on the threads in the after-treating machine. It is known that, in order to regenerate cellulose from viscose, a certain time is required, and that even after the formation of the threads, these threads still are in a plastic condition and require additional time and/or additional treatment with coagulating solutions in order to obtain a completely regenerated cellulose filament.

This arrangement of processes gives me the opportunity of using a different type of coagulat-

ing bath in the after-treating machine from the one initially used in the spinning machine. This second coagulating bath may be of different chemical composition, concentration, density, temperature and so forth, and also allows me to apply a second bath more intensely in both chemical and physical respects, without damaging or impairing the quality of the filaments.

The following is an example of two different types of coagulating baths used by me in the spinning and after-treating machine. I project viscose into an initial coagulating bath containing 11% sulphuric acid, 23% sodium sulphate and 2% zinc sulphate. The bath has a density of approximately 1.3 and a temperature of approximately 45° centigrade. After collecting the filaments thus formed into a rope, having a total denier of 400,000, I conduct this rope around two rollers in the first section of the after-treating machine, winding them around these rollers spirally at least 12 times. Depending on the diameter and the center distance of these rollers, I obtain a certain treating time which in this particular case is between 1 and 2 minutes. The bath applied in this first after-treating section contains sulphuric acid and salts, and is kept at a temperature of less than 10 degrees centigrade. By using a second coagulating bath at such low temperatures, I obtain an increase in the strength of the filament. This second coagulating bath may have the same acid contents as the first bath, but I have found it preferable to use a bath containing a much higher percentage of sulphuric acid.

It is, of course, possible to use even a third coagulating bath if required, by using a set of two more rollers, arranged similarly in the second section of the after-treating machine.

In order to conduct the rope spirally around and along the axis of the rollers, I arrange the two rollers not in an exactly parallel position, but in a slightly oblique position, which gives the rope the tendency of travelling along the rollers in spiral form. In other words, while the rollers are arranged both horizontally and in the same plane, they converge towards their one end.

In each after-treating machine, I arrange at least one such treating section and, if necessary, two or more such sections. The number of these sections will depend on the time required by the rope to traverse the section, and on the total after-treating time required for a rope of a certain denier with a solution of a certain type.

In order to further reduce the space required for such a treatment of the continuous running rope, I have provided for the following arrangement of rollers. In each after-treating section, I provide an additional third roller above the other two rollers described hereinbefore. Also this roller is arranged horizontally and preferably located at a point equi-distant from the transverse centers of the two bottom rollers. I now have three rollers instead of two, around which to wind the tow spirally, which gives me an increased yardage of tow in each after-treating section and a longer after-treating time.

The two bottom rollers (as shown in the drawings) run partly submerged in the treating bath, so that the rope wound around the bottom rollers runs in this bath when passing between the two bottom rollers. I continually circulate this bath in order to always provide fresh solution.

In the case where I use a third top roller, I employ a spraying tray or pan above the top roller, which sprays the treating bath on the rope passing between the top and bottom rollers.

This arrangement of rollers permits a very efficient treatment of the rope according to the counter-current method and in two separate ways. For example, the rollers rotate in clockwise direction, as shown in the drawings. The rope will pass from the right lower roller to the left lower roller at the bottom of these rollers. In this case, I provide for the treating bath to enter the lower tank at the left and to flow in this lower tank from the left to the right, the outlet being at the bottom right-hand corner of the tank. Thus a fresh treating bath will always flow through this tank according to the counter-current system, with regard to the fiber tow moving in the opposite direction. It is well known that by using a bath on moving objects in the counter-current method, a much more intense action is obtained.

The above described arrangement of rollers enables me to subject the moving tow to a second counter-current treatment. I arrange the spraying tray above the top roller, which sprays the treating bath on the rope travelling from the bottom to the top roller. In view of the fact that the rope travels upward, and the treating bath downward, I obtain a second counter-current effect, which again intensifies the action of this bath on the filaments.

After thus carrying out the required after-treating operations, I either cut the continuous filaments into staples or I convert them directly into yarn, according to one of the known methods.

Even when desiring to cut the continuous threads as soon as possible after spinning, and to after-treat the cut staples, it is desirable to first remove the acid from the threads prior to cutting. The advantages of cutting the neutral tow rather than the acid one are obvious, especially with regard to the construction of the cutting machine and working comfort. In such a case, I simply use one or two of the above described after-treating sections.

If I desire to after-treat the continuous threads and then to obtain staples, I cut the continuous tow after it has passed the complete after-treatment.

In the case of direct conversion into yarn, I have to dry the threads which can be done on a similar roller arrangement, but enclosed in a casing. In such a case, I provide for squeeze rollers prior to the entry of the tow into the drier, in order to remove as much moisture as possible. I also provide similar squeeze rollers between the different after-treating sections in order to reduce the consumption of chemicals.

It is known and has, for instance, been described in my U. S. Patent No. 2,134,160, to after-treat continuously running threads by guiding them over rotating rollers.

The present invention particularly refers to the arrangement of rollers so as to obtain a maximum efficiency with regard to the action of the treating liquids on the filaments. As hereinbefore described, I obtain counter-current effects in two manners by circulating liquids in a direction opposite that to the movement of the thread.

In Fig. 1, a one-way counter-current effect is obtained by circulating liquid in the tanks shown from left to right. In Fig. 3, a two-way counter-current effect is shown by circulating liquid in the lower tanks shown from left to right and by spraying a solution on to the threads moving

upward. In Fig. 5, the top roller has been placed directly above the left bottom roller, rotating in clockwise direction. I thus obtain an absolute counter-current effect on the fibers moving upward.

In the process described by me, I can regulate the tension of the threads on the rollers by using rollers of different size or by rotating these rollers at different speeds. I thus can regulate the tension or slack of the rope in each individual section.

When using the type of machine described and illustrated in Fig. 5 of the drawings, I have found that I can also treat two or more continuous tows simultaneously. I do this by an imaginary division of the rollers into two or more sections along their width. I thus wind each of the two or more tows around a certain section of the rollers, say five times and then on to the next section. If, for instance, the rollers of a section have a total width of 8 ft. and if I wish to treat four independent tows simultaneously, I proceed as follows:

I allot a width of 2 ft. out of the total width of the roller to each of the four tows and I wind each tow around the rollers as many times as possible on the above mentioned width of 2 ft.

I thus use one machine with rollers of 8 ft. width as if I had four independent machines with rollers of 2 ft. width each.

I thus have the advantage that I can treat a plurality of tows with varying deniers, and so forth.

If I use one such after-treating machine in conjunction with one spinning machine of, say 100 spinning places, I can unite the threads spun on 25 spinning places each into one tow and after-treat the resulting four tows in the above described manner.

After completing the after-treatment, I either dry the four tows separately, in which case I can use different cutting lengths for each tow if desired, or I unite the four tows at the end of the after-treating machine (provided their denier is the same) and dry the resulting heavier tow.

This method gives me much greater flexibility than if only one tow can be treated on one machine.

It is desirable to have as large a production on one single machine as possible. On the other hand, in many cases it is also desirable to produce tows of not too large a total denier.

This latter case is applicable particularly to textile plants where such continuous tows are to be converted directly into yarns, spinnable slivers, or tops. While the whole machine might be capable of treating a total denier tow of 500,000 denier or more, it may be necessary to limit the total denier of such tows in many cases to 100,000 denier or less.

In the above described event, it would be very uneconomical to have a separate after-treating machine for each such 100,000 denier tow. My invention solves this problem and while obtaining five 100,000 denier tows for instance, I still retain my original production as if one tow of 500,000 denier had been produced in one. In addition to this, I can after-treat five tows of different deniers each, which can be cut into different staple lengths.

The advantages of the type of counter-current treatment proposed by me are, of course, retained whether one or more tows are after-treated.

I claim:

1. Method for the treatment of continuous artificial fiber tows of high denier, comprising spirally winding the continuously running tow around three horizontal and triangularly arranged rollers of which two are partly submerged in treating liquid contained in a tank and the third roller placed substantially vertically above one of the aforesaid two rollers, while circulating treating liquid through said tank according to the counter-current method with respect to the movement of the tow through said tank and pouring additional treating liquid on the tow according to the counter-current method with respect to its upward movement from the tank to said third upper roller.

2. Method for the treatment of continuous artificial fiber tows of high denier, comprising spirally winding a plurality of continuously running tows around three rollers of which two are partly submerged in treating liquid and one placed substantially vertically above one of the aforesaid two rollers, while circulating treating liquid through said tanks according to the counter-current method with respect to the movement of the tows and pouring additional treating liquid on the tows according to the counter-current method with respect to its aforesaid movement.

3. In the manufacture of artificial fibers and staple fiber yarns, a method for the two-fold countercurrent after-treating of continuous artificial fiber tows of high denier, comprising the steps of conducting a plurality of artificial threads triangularly and spirally around three rollers of which two bottom rollers are in substantially the same horizontal plane situated in a tank and one top roller situated substantially vertically above one of the said two bottom rollers, circulating after-treating baths through said tank and in a direction opposite to that of the threads traveling between the two bottom rollers and spraying after-treating baths down on the threads travelling upward from one of the two bottom rollers to the top roller to obtain a two-fold countercurrent treatment of the fiber tow.

4. In the manufacture of artificial fibers and staple fiber yarns, a method for the two-fold countercurrent after-treating of artificial fiber tows of high denier continuously conducted around three horizontal rollers triangularly arranged, comprising the use of a substantially horizontal flow of treating liquid through a tank in a direction opposite to that of the fiber tow moving through said tank and the use of a substantial vertical spray of treating liquid on the fiber tow traveling upward from said tank.

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