Aug. 19, 1958 H. A. SCHRENK ET AL 2,847,703

APPARATUS FOR PRODUCING VARYING DENIER FILAMENTS

Filed Aug. 24, 1954

Fig. 1.

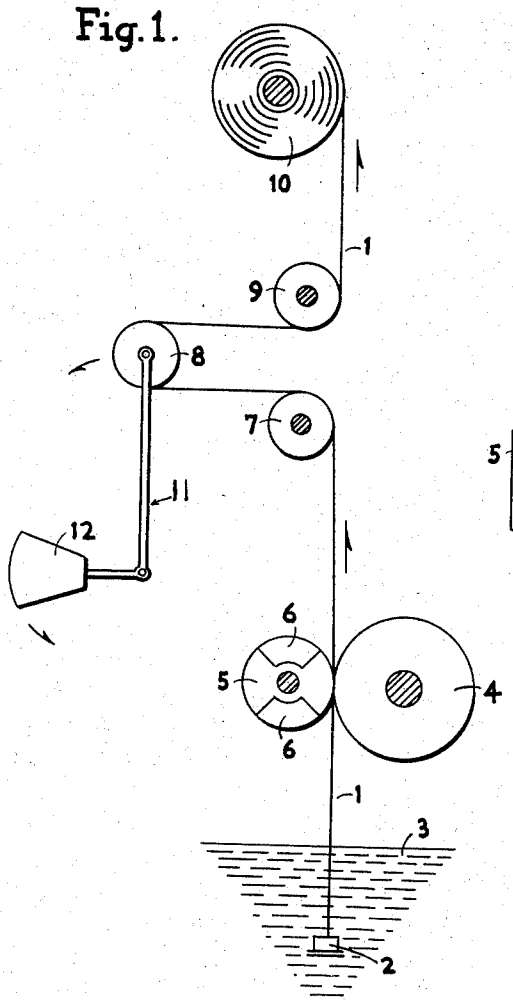
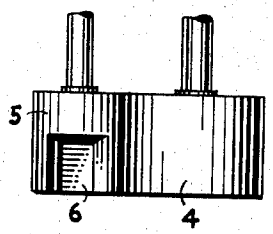


Fig. 2.



INVENTORS

Hans Alwin Schrenk and Pieter van Dijk

BY Albin F. Knight

ATTORNEY

United States Patent Office 2,847,703 Patented Aug. 19, 1958

2,847,703

APPARATUS FOR PRODUCING VARYING DENIER FILAMENTS

Hans Alwin Schrenk, Arnhem, and Pieter van Dijk, Velp, Netherlands, assignors to American Enka Corporation, Enka, N. C., a corporation of Delaware

Application August 24, 1954, Serial No. 451,866

Claims priority, application Netherlands September 4, 1953

3 Claims. (Cl. 18—8)

The present invention relates to the production of variable denier rayon, and more particularly to a process and apparatus for producing a viscose thread of varying denier, wherein the thread is intermittently drawn and collected under different degrees of tension and stretch.

In British Patent No. 554,203, there is disclosed a device which produces threads of varying denier and which specifically relates to the manufacture of nylon threads of varying denier. The device of the patent consists of two nip rollers, one of which is slotted and the thread is passed around the slotted roller for a substantial portion of its circumference, and thence between the two rollers and downwardly around the unslotted roller. Whatever the effect is, the period that the thread is not being nipped is infinitesimal, and therefore lower stretch with the resultant higher denier occurs, if at all, on a very small segment of the nylon. Such an effect would not be at all practical for viscose rayon. In any event, when the thread is being nipped between the rollers the stretch occurs between the rollers and the collecting device, and cannot revert back to the spinneret where the thread is in a nascent state and therefore more susceptible to tension variations.

Another disadvantage is that while the thread is being nipped between the rollers, the stretching may damage or break some of the filaments. Moreover, it is impossible to effect abrupt transitions in the denier so that a complete imitation of shantung cannot be realized.

According to the present invention, the objections to the process of the British Patent and other known prior art, are overcome by the simple expedient of passing a freshly spun viscose thread through two nip rollers in a straight line normal to the axes of the rollers. One of the rollers is slotted or recessed so that the thread is intermittently nipped and intermittently allowed to pass freely to a collecting device rotating at a higher peripheral speed than the nipping rollers. In this way the tension changes are abrupt and revert to the spinneret so that the transition period is instantaneous and results in a thread having abrupt differences in denier to thereby simulate shantung to a high degree. This invention also contemplates a loop forming device disposed between the nip rollers and collecting device in order to form a thread reserve while it is running freely between the nip rollers, which reserve is taken up during the nipping period.

It is therefore an object of this invention to provide a process for manufacturing a variable denier viscose thread, wherein the stretch of the thread is varied abruptly and intermittently.

It is an additional object of the invention to provide a set of nip rollers, one of which being positively driven and slotted, and passing the thread between the rollers in a straight line normal to the axes of the roller.

Another object of this invention is to provide means between the nip rollers and the collecting device to prevent tension variations in the threads.

Other objects and advantages of this invention will become apparent when considered in conjunction with the accompanying drawings, wherein;

Figure 1 is a diagrammatic side view of the apparatus according to this invention; and

Figure 2 is a top plan view of the nip rollers.

Referring to Figure 1, the thread **1** is drawn from a spinneret **2** through a spinbath **3**. It is passed between nip rollers **4** and **5**. The roller **4** is freely rotatable and is driven frictionally from roller **5** which is positively driven. The roller **5** is provided with slots or recesses **6**, so that thread **1** is intermittently held by the rollers **4** and **5** during passage therethrough. The recesses **6** do not extend the entire length of roller **5**, in order for roller **5** near its hub section to frictionally engage roller **4** at all times, (see Figure 2).

After the thread passes through the nip rollers, it is guided around thread driven, freely rotatable rollers **7**, **8** and **9** and thereby forms a loop in its passage. From roller **9**, thread **1** is led to a collecting device **10**, or if it is desired to collect the thread in a centrifugal bucket, a transport roller can be substituted for collection device **10** and interposed in advance of the centrifugal bucket (not shown).

The rollers **7** and **9** are in a fixed position and in such a relation to the nip rollers and collecting device that the thread passes in a straight line from the spinneret **2** to roller **7**, and in the same straight line direction from roller **9** to the collecting device **10**.

The loop-forming roller **8** is connected to and supported from a toggle joint lever system **11**, which in turn is connected to weight **12** so that roller **8** is biased in a left hand direction when viewed in Figure 1, and accordingly moves in a direction to lengthen the loop when the thread passes freely through rollers **4** and **5**.

During the time that the thread is being nipped between rollers **4** and **5**, as shown in Figure 1, the loop between rollers **7** and **9** will be in the position shown in that figure. However, as soon as a recess **6** is adjacent roller **4**, the thread is not in contact with either of the nip rollers and passes freely therethrough. During this free passage, gravity will cause the weight **12** to move downwardly drawing roller **8** to the left as viewed in Figure 1, and thereby lengthen the loop between rollers **7** and **9**, and in this way increase the draw-off speed of the thread from the spinneret over the circumferential speed of the collecting device.

Roller **4** may be mounted in a movable support so that during threading-in it may be lifted and as soon as the thread has been passed to the collecting device it may be lowered into contact with driving roller **5**. The proper pressure between rollers **4** and **5** may be achieved by means of a spring construction or by the weight of the movable roller.

In a machine having a plurality of spinning points, a shaft may be mounted across the entire length of the machine above the spinbath, and as many rollers as there are spinning points may be mounted thereon. The shaft is driven from one side of the spinning machine by means of, e. g., PIV or stepless drive. In this way, the rollers may be adjusted to any desired circumferential speed. It is also possible to interpose between the motor driving the PIV, a wormwheel-driven cam arrangement to thereby change the adjustment of the PIV gradually and periodically and thus change the circumferential velocity of the driven rollers in order to impart any desired degree of irregularity to the thick-and-thin lengths of the thread.

The roller **5** is shown having two recesses **6**, although in some cases, one may suffice and in other cases, more than two utilized. The recesses may have a different width so that the consecutive periods differ during which the thread passes freely through the nip rollers; this will also effect a difference in the consecutive periods of con-

tact of the thread with the rollers. This accentuates the irregularities and the lengths of the thick-and-thin thread portions.

If desired, either one or both of the nip rollers may be roughened or coated with substances to improve the adhesion between the thread and the rollers.

In the process of the invention, the thread is passed between the nip rollers, one of which being driven, preferably the one having recesses therein, and during the period that the thread is in contact with both rollers, it is propelled at a rate which is lower than that when the thread is passing freely between the rollers and being drawn directly from the collecting device. In this way, the thick places in the thread originate between the spinneret and nip rollers during the period of time that the nip rollers are in engagement with the thread. During the time the thread passes freely through the nip rollers out of contact with them, a thin place is formed at the spinneret where the filaments are in their nascent state. This thin place shows an abrupt transition and has a lower denier than the denier which would have been made if the thread were led directly to the collecting device, because the loop lengthening roller 8 is biased to increase the thread loop length, which increases the draw-off speed at the spinneret to an extent greater than the peripheral speed of the collecting device.

The coagulating bath that is used in the process is a quickly coagulating one and is known as the Muller bath which contains dilute sulphuric acid, sodium sulphate, and if required, other salts such as magnesium sulphate and/or ammonium sulphate, and/or zinc sulphate.

The nip rollers are normally driven in a direction to draw the thread from the bath in the same direction as the collecting device, although at a lower rate. However, in some cases, the nip rollers may be driven in the opposite direction, which would have the effect of a backward movement of the thread directed to the spinneret. In such a modification, however, the thread can be in contact with the nip rollers only for a very short time.

The conveying speed of the nip rollers is generally only 30% to 40%, or even less of the speed of the collecting device. In this way, the denier of the thick portions of the thread are two, three, four, or even more, times the denier of the thin portions.

Example 1

A normally matured viscose was prepared having 7% cellulose and 7% alkali. The supply of this viscose was so adjusted that a thread of 100 denier consisting of 25 filaments would have been obtained without the application of the nip rollers. The thread was spun and passed into a spinbath maintained at 50° C. containing per liter 125 g. of sulphuric acid, 125 g. of sodium sulphate, and 50 g. magnesium sulphate. The thread was drawn from the spinbath by a bobbin rotating at a speed of 60 m./min. Interposed between the bobbin and the spinbath was a recessed roller having a diameter of 3 cm. and provided with four equal recesses. The degree of thread contact between each of the recesses was 1.25 cm. The speed transport, i. e., the circumferential velocity of the roller was 5.5 m./min. during the time of thread contact. The thread assumed the path of travel between the nip rollers and the bobbin in accordance with Figure 1, namely, it passed around three loop-forming rollers which lengthened during free passage of the thread through the nip rollers.

The completely aftertreated and dried thread showed thick-and-thin places with abrupt transition points, wherein the ratio of the denier was 350:70. The thin places had a length of about 20 cm. and a thickness of about 4 cm. while the average denier corresponding with the inner adjustment of the pump yield and collection speed, was about 100.

Example 2

The same general apparatus was used as in Example 1, with the following differences: the recessed roller had a diameter of 1.75 cm. and was provided with two recesses in such a way that each of the thread contacting surfaces had a length of 0.9 cm. with distances of 2.0 cm. and 1. 7 cm. between them. The nip rollers were rotated in the opposite direction, i. e., directing the thread toward the spinneret. The conveying speed of the nip rollers was 6.3 m./min. and a spinneret having 76 orifices (each orifice 90 microns) was used. The thread was collected at 68.5 m./min. and a thread was obtained having an average denier of 220. The thick-and-thin portions of the thread had a length of 4 cm. and 23 cm., respectively, with corresponding deniers of 660 and 158.

It is obvious that the method according to the invention is applicable to any type of spinning system, such as, for example, the bobbin spinning and pot spinning method, and to the several so-called continuous spinning methods. The invention is to be limited only to the extent of the appended claims.

What is claimed is:

1. Apparatus for the production of variable denier rayon which comprises means for extruding a spinning solution to form thread, means for coagulating the thread and means for collecting the same, a pair of rollers in frictional engagement disposed between the extrusion means and collecting means, one of said rollers being provided with recesses around its periphery and one of said rollers being positively driven whereby when a thread is passed in a straight line therebetween, it is in alternate engagement with the said rollers and in alternate free flight therebetween, said rollers being driven at a lower peripheral speed than that of the collecting device.

2. Apparatus for the production of variable denier rayon which comprises means for extruding a spinning solution to form thread, means for coagulating the thread and means for collecting the same, a pair of rollers in frictional engagement disposed between the extrusion means and collecting means, one of said rollers being provided with recesses around its periphery and one of said rollers being positively driven whereby when a thread is passed in a straight line therebetween, it is in alternate engagement with the said rollers and in alternate free flight therebetween, said rollers being driven at a lower peripheral speed than that of the collecting device, and means interposed between the collecting device and said pair of rollers for increasing the thread path during the period that the thread is in free flight to build up a reserve for the period it is not in free flight.

3. In apparatus for the production of variable denier viscose thread wherein means are provided for extruding a viscose solution through spinnerets into an acid coagulating bath and for drawing the thus formed thread from the bath and collecting the same on a positively driven bobbin, the improvement which comprises a pair of rollers in frictional driving engagement, one of said rollers being recessed at at least one point on its periphery and positively driven, the other roller being driven therefrom, the rollers being disposed between the bath and the collecting device at a point where the thread passes therebetween in a straight line normal to their axes and means for rotating the recessed roller in one direction at a lower peripheral speed than the peripheral speed of the bobbin.

References Cited in the file of this patent

UNITED STATES PATENTS

2,038,722	Dreyfus	Apr. 28, 1936
2,045,530	Mattinson	June 23, 1936
2,220,403	Heim	Nov. 5, 1940
2,272,666	Hoffman	Feb. 10, 1942
2,276,999	Bauer	Mar. 17, 1942
2,296,394	Meloon	Sept. 22, 1942
2,433,325	Slaughter	Dec. 23, 1947

FOREIGN PATENTS

748,680	France	Apr. 25, 1933