Nov. 16, 1937. J. E. MOORE 2,099,215

PRODUCING HAIRY RAYON YARN

Filed July 30, 1936

Fig. 1.

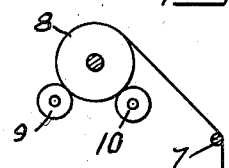
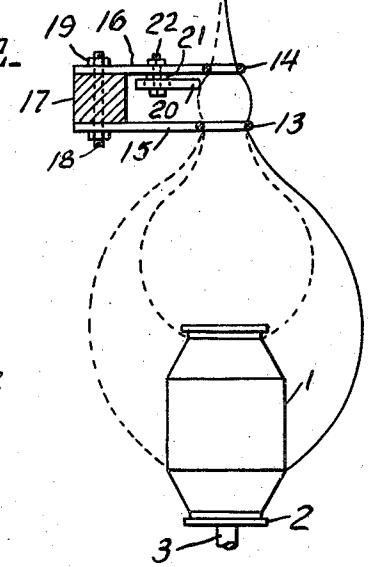


Fig. 2.



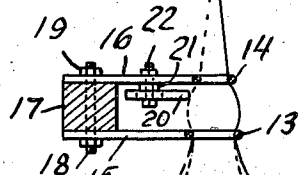


Fig. 3.

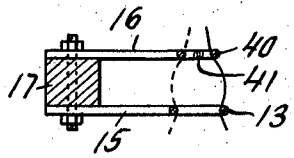


Fig. 4.

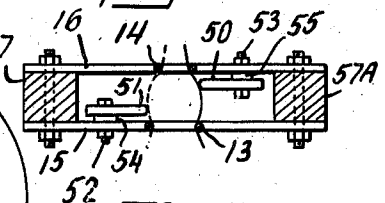
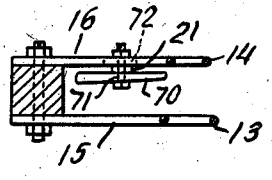


Fig. 6.



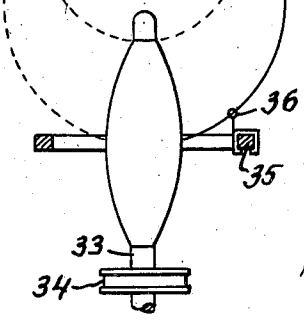
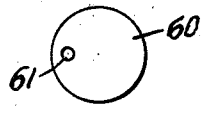


Fig. 5.



INVENTOR

James E. Moore

BY

Pennie, Davis, Marvin & Edmonds

ATTORNEYS

Patented Nov. 16, 1937 2,099,215

UNITED STATES PATENT OFFICE

2,099,215

PRODUCING HAIRY RAYON YARN

James E. Moore, Rome, Ga., assignor to Tubize Chatillon Corporation, New York, N. Y., a corporation of Delaware

Application July 30, 1936, Serial No. 93,385

10 Claims. (Cl. 117—21)

This invention relates to the production of yarn of hairy character and is concerned particularly with imparting uniform pubescence to yarns composed of continuous filaments, for example, rayon yarns.

Pubescent yarns of rayon are attractive in appearance and alone, or in combination with cotton, silk or wool yarns, may be employed to produce fabrics of novel and beautiful appearance.

Pubescent yarns have been made by chopping continuous rayon filaments in short pieces (staple fibre) comparable in length with natural cotton fibres and the like and thereafter spinning the short pieces into yarn in accordance with customary methods for spinning natural short fibres, such as cotton and the like. Yarns produced in this fashion are hairy because some of the ends of the short rayon filaments project out of the major yarn surface. This process results in a satisfactory product but entails great expense.

It has also been proposed to produce hairiness during the twisting operation on rayon yarns made up principally of continuous filaments. This practice is preferable from an economic standpoint, because continuous filament yarns are cheaper to produce than are those made of staple fibre. However, prior proposals for accomplishing this result with continuous filament yarns have not been entirely satisfactory, because they tend toward the production of yarns which do not have a uniform hairiness or a uniform tensile strength.

The twisting of continuous filament rayon yarn is usually accomplished on an upstroke twister, a ring twister, or a cap twister. In all cases the untwisted yarn, composed of a number of more or less parallel continuous rayon filaments, is reeled off one yarn cake and wound on another, and at some place in between the yarn in a loose condition and impelled by centrifugal force "balloons", i. e. it rotates between two points of support and describes a balloon shaped surface. It has been proposed to introduce an abrasive substance at some point on the balloon shaped surface so that successive points on the rotating yarn will impinge against the abrasive. In this way some of the outer filaments on the yarn tend to rupture and fray out to produce pubescence. However, whether a cap twister, a ring twister or an upstroke twister is employed, the shape and size of the balloon described by the rotating length of loose yarn changes. As a result the yarn does not always impinge upon the abrasive surface with equal force or at equal intervals. Sometimes the yarn fails to impinge; at other times it impinges with such force or at such an angle as to be completely severed.

As a result of my investigations I have found that yarns of uniform hairiness and tensile strength can be produced by rotating the yarn in a small secondary rotational surface which does not vary in size or shape. If an abrasive point is held against this surface and the rotating yarn is drawn longitudinally through it at a substantially constant rate, the point will cut the yarn at equal intervals along its length and to an equal depth each time. Uniform hairiness and tensile strength of the twisted yarn are thus assured.

In summary, the method of my invention comprises moving the yarn rapidly along an axis, rotating successive lengths of yarn in a plane of rotation coaxially disposed around the axis between retaining members and of substantially constant size and shape, disposing a cutting means at a point on the plane of rotation between the members, and cutting through the yarn to a uniform depth at substantially equal intervals along the yarn with said cutting means.

The apparatus employed, in brief, preferably comprises a pair of fixed parallel coaxial rings or "eye guides" spaced from each other along their common axis, means for drawing the yarn through the rings in the direction of the axis and in a loose condition, means for rotating the yarn as it passes through the rings so that the yarn hugs the rings and describes a plane of rotation defined by the rings, and cutting means projecting into the plane of rotation of the yarn. The plane of rotation is preferably barrel-shaped.

My invention will be more thoroughly understood in the light of the following detailed description, taken in conjunction with the accompanying drawing, in which

Fig. 1 shows the application of my invention to an upstroke twister;

Fig. 2 illustrates the application of my invention to a ring twister;

Fig. 3 is a diagrammatic representation of a modified form of apparatus of my invention for producing hairy yarn;

Fig. 4 represents another modification of the apparatus of my invention for producing a variety of hairy effects;

Fig. 5 illustrates a disk cutter of my invention; and

Fig. 6 illustrates another disk cutter of my invention.

In the up-twister illustrated in Fig. 1, a spiral-

ly wound cake 1 of untwisted yarn having continuous filaments is disposed upon a bobbin 2 mounted on a rotatable spindle 3. The untwisted yarn balloons out from the cake, passes over a guide 7 and is wound on a rotating take-up cylinder 8 disposed on two rotating rollers 9 and 10. I employ an apparatus comprising a lower horizontally disposed ring 13 having a smooth inner surface and an upper horizontally disposed ring 14 having a smooth inner surface but of smaller diameter. The yarn passes through the rings on its way from the cake to the guide. The rings are attached respectively to a pair of horizontal supports 15 and 16 which are fastened to a rigidly mounted spacer block 17 by means of the bolt 18 and the nut 19 on its upper end. The center of each ring is in line with the axis of the spindle. Interposed between the two rings is an adjustable cutter 20 which is bolted to the upper support and spaced below it by a thin spacer block 21. The cutter has a vertical slot through which the bolt 22 passes. Adjacent the ring the cutter has a cutting edge which may be moved inward or outward from the axis of the two rings. The cutter may be composed entirely of carborundum or it may have a cutting edge covered by an abrasive substance, such as emery paper.

The operation of the mechanism illustrated in Fig. 1 is as follows:

The yarn balloons off from the cake, passes up through the rings 13 and 14 past the cutter 20, over the guide 7 and is wound on the cylinder 8. The shape of the balloon as it is unwound from the cake changes. However, a secondary balloon of substantially constant size and barrel shape is described by the yarn as it passes through the two rings. The rotating yarn impinges periodically against the cutting edge which is placed at the surface of the secondary balloon. The cutter ruptures the outside filaments of the yarn which pass by it in the same way each time. In this way uniform ruptures equidistant from each other are produced. Uniform hairiness coupled with uniform tensile strength of the twisted yarn is thus assured. If it is desired to reduce the number of filaments cut at each pass, the cutter is moved out from the axis of the two rings and clamped in a new position. When smooth yarn is desired the cutter 20 may be withdrawn completely from the path of the yarn. More filaments may be cut by employing a cutting edge of greater length or width, so that the yarn remains in contact with the edge for a longer time at each pass. More filaments at each pass will be cut if the cutting edge is placed closer to the axis of the rings.

The means for producing hairy effects on continuous filament rayon yarns in Fig. 2 is the same as that in Fig. 1 except that the cutting mechanism of my invention is applied to a ring twister. In this case the yarn cake 30 is held on an immovable spindle 31. The untwisted yarn is pulled off the cake at one end, is bent over a guide bar 32, and passes through the two rings 14 and 13 past the cutter 20. The cut yarn is then wound on a vertical spindle 33 which is rotated at high speed by means of the belt driven whorl 34. Around the spindle is a circular horizontal track 35, around which is slidable a ring twister guide 36 through which the yarn passes. The track remains horizontal and concentrically disposed around the spindle but is moved slowly up and down by a means not shown, so that the yarn is wound uniformly along the length of the rotating spindle. The ring twister naturally runs rapidly around the track and imparts a twist to the yarn.

After the yarn passes over the guide bar it begins to balloon. It describes a small barrel shaped surface of substantially constant size and shape in passing through the rings, and then describes a large and constantly varying ballon in passing from the ring 13 to the rotating spindle.

The operation of the cutter of my invention as applied to a ring twister as in Fig. 2 is exactly the same as when it is disposed on an upstroke twister (Fig. 1). The shape and size of the secondary ballon between the rings 14 and 13 are substantially constant. The cutting edge at the surface of the secondary balloon, therefore, makes cuts of uniform depth at equidistant intervals along the length of yarn, provided of course that the yarn passes through the rings at a substantially uniform rate.

The modification of the apparatus illustrated in Fig. 3 offers an advantage in simplicity of construction, but sacrifices the easy adjustment of the cutter offered by the apparatus illustrated in Figs. 1 and 2. The apparatus illustrated in Fig. 3 comprises a lower horizontally disposed ring 13 of relatively large diameter and with a smooth interior surface and an upper and smaller ring 40 disposed on the same vertical axis as the ring 13. However, in the case of the ring 40 the cutter is formed of a short length of abrasive material 41 on the inside of the ring. The yarn to be cut and twisted passes through the two rings as in the case of the apparatus illustrated in Figs. 1 and 2. It forms a secondary balloon of constant shape and size between the two rings, and as the yarn is carried through the rings at a uniform rate of speed, cuts of uniform depth at uniform intervals result. The structure of Fig. 3 is not so satisfactory as those of my invention employing a removable cutter, because if the yarn breaks the re-threading of the yarn through the rings is facilitated by moving the cutter out of the way.

The modification of my apparatus illustrated in Fig. 4 permits a plurality of cuts of different character to be made on the yarn as it passes through the twister. This apparatus differs from that illustrated in Fig. 1 in that two cutters, 50 and 51, are interposed between the smooth rings 13 and 14. The cutters are both slotted and fastened respectively to supports 15 and 16 by bolts 52 and 53. Spacers 54 and 55 hold the cutters away from their respective supports. Two additional spacer blocks 57 and 57A are provided in this modification of the apparatus. The cutters may be provided with cutting surfaces of different width and length. Moreover the character of the cutting surface may be different on the two cutters. For example, one may have a knurled surface, with the abrasive surface on the other cutter composed of emery paper. The variety of napped effects that can be produced in this way are innumerable. At the same time uniformity of hairiness and tensile strength throughout the entire length of the yarn are maintained.

As hereinbefore indicated I prefer to use an apparatus with an adjustable cutter, so that the amount and character of the cutting can be regulated and the cutter removed entirely from the path of the yarn when the apparatus is being threaded or when it is desired to produce yarn that is not hairy. I have devised several forms

of adjustable cutters, the simplest of which is illustrated in Figs. 1, 2 and 4, and which comprises a simple bar **20** with a round hole through it, so that it can be bolted into operating position or swung out of the way. Instead of a round hole, the cutter may be provided with a longitudinal slot so that it can be slid out of the line of yarn passage as well as swung. Further modified cutters of my invention are illustrated in Figs. 5 and 6.

The cutter of Fig. 5 comprises a round disk **60** having a peripheral cutting edge of substantially constant width. An off-center hole **61** is provided in the disk so that it may be bolted between the rings **13**, **14** of Figs. 1, 2 or 4 in place of the cutter **20**. The degree of cutting may be varied by rotating the disk to any desired position and clamping it there. The eccentric location of the hole in the disk permits this manner of adjustment.

The cutter of Fig. 6 is a round disk **70** provided with a hole at its center. When this type of cutter is employed the ring support **16** to which it is fastened should have a longitudinal slot **72** for the passage of the clamping bolt **22**. This will permit the edge of the disk to be moved into or out from the axis of the rings **13** and **14** to increase or decrease the amount of cutting. When this form of cutter is used the edge of the disk **70** may be of varying roughness to provide a variety of abrasive surfaces merely by rotating the disk on the bolt **22** and clamping it in a new position, or the edge of the disk may vary in thickness as shown.

Other variations in the type of cutter may occur to the man skilled in the art without, however, departing from my inventive concepts.

The cutting surface on any of the cutters illustrated in Figs. 1, 2, 3, 4, 5, and 6 may be of a variety of types. Thus blocks or disks covered with emery cloth, or metal blocks with knurled or serrated cutting edges may be used.

The following is a practical example of the application of the method and apparatus of my invention for producing uniform hairiness and tensile strength on a continuous filament rayon yarn in an upstroke twister. The apparatus used is that illustrated in Fig. 1. The rotational speed of the bobbin **2** carrying the yarn cake **1** was 6200 R. P. M. The take-up speed of the twisted yarn on the horizontal take-up cylinder **8** was 34.4 yards per minute. Five turns per linear inch were made in the yarn. The distance between the rings **13** and **14** was one inch. The internal diameter of the lower ring **13** was $\frac{5}{8}$ inch. The internal diameter of the upper ring **14** was $\frac{3}{8}$ inch. The cutter **20** comprised a block having its cutting edge covered with 00 emery cloth. The cutting edge was $\frac{1}{16}$ of an inch in length and width. The cutter extended into the secondary balloon between the top and bottom rings to a distance of $\frac{1}{8}$ inch.

The method and apparatus of my invention is equally applicable to ring twisting, upstroke twisting and cap twisting. They may also be employed where no twisting is done, although it is preferable to twist the yarn at the same time that its filaments are cut.

I claim:

1. Apparatus for producing hairy yarn by cutting exterior filaments of the yarn at intervals along its length which comprises a pair of parallel stationary coaxial rings spaced from each other along their common axis, means for drawing the yarn through the rings in a loose condition, and means for cutting the loose yarn as it passes through the rings and describes a plane of rotation defined by the rings, said cutting means being disposed at one or more points in the plane of rotation and projecting thereinto.

2. Apparatus according to claim 1 in which the rings are rigidly fastened to outwardly projecting supports spaced at a fixed distance from each other.

3. Apparatus according to claim 1 in which the rings are fastened to outwardly projecting supports spaced at a fixed distance from each other and the cutting means comprises an elongated member disposed between the supports and rotatably mounted at a point remote from the plane of rotation, clamping means being provided for holding the cutting means.

4. Apparatus according to claim 1 in which the cutting means is disposed on a portion of the inside periphery of a ring.

5. Apparatus according to claim 1 provided with a plurality of cutting means having cutting surfaces of different area.

6. Apparatus according to claim 1 provided with a plurality of cutting means having cutting surfaces of different abrasive character.

7. A method of producing uniform pubescence on continuous filament yarn which comprises moving the yarn rapidly along an axis at a substantially uniform rate while rotating the yarn about the axis to describe a surface of rotation, maintaining two fixed orbits of rotation of the yarn on said surface so that the surface is of substantially constant size and shape between said orbits and cutting partially through successive lengths of yarn at substantially equal intervals as said lengths pass through the surface of rotation between the orbits.

8. A method of producing uniform pubescence on yarn composed of a plurality of filaments which comprises drawing the yarn at a substantially uniform rate in the direction of an axis while rotating successive lengths of yarn about the axis to describe a surface of rotation curved outwardly at a midpoint, restraining the yarn in two fixed spaced orbits on said surface of rotation so that the surface between said orbits is of substantially constant size and shape, and cutting partially through the successive lengths of yarn while said lengths pass through the surface of rotation between the orbits.

9. A method of producing uniform pubescence on yarn containing a plurality of filaments which comprises moving successive lengths of yarn at substantially constant speed along an axis while rotating them to describe a barrel shaped surface of rotation, maintaining two fixed orbits of rotation of the yarn on said surface, and cutting a portion of the filaments in each successive length at a point on the surface of rotation between the orbits.

10. A method of producing uniform pubescence on yarn having a plurality of filaments which comprises moving successive lengths of yarn at substantially constant speed along an axis while rotating said successive lengths about said axis at a substantially constant rate to describe a surface of rotation swelling outwardly at a midpoint, maintaining two fixed orbits of rotation on said surface, and cutting a portion of the filaments in each successive length as it passes through the surface of rotation between the orbits.

JAMES E. MOORE.