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PRODUCTION OF FILAMENTS OF UNEVEN DENIER

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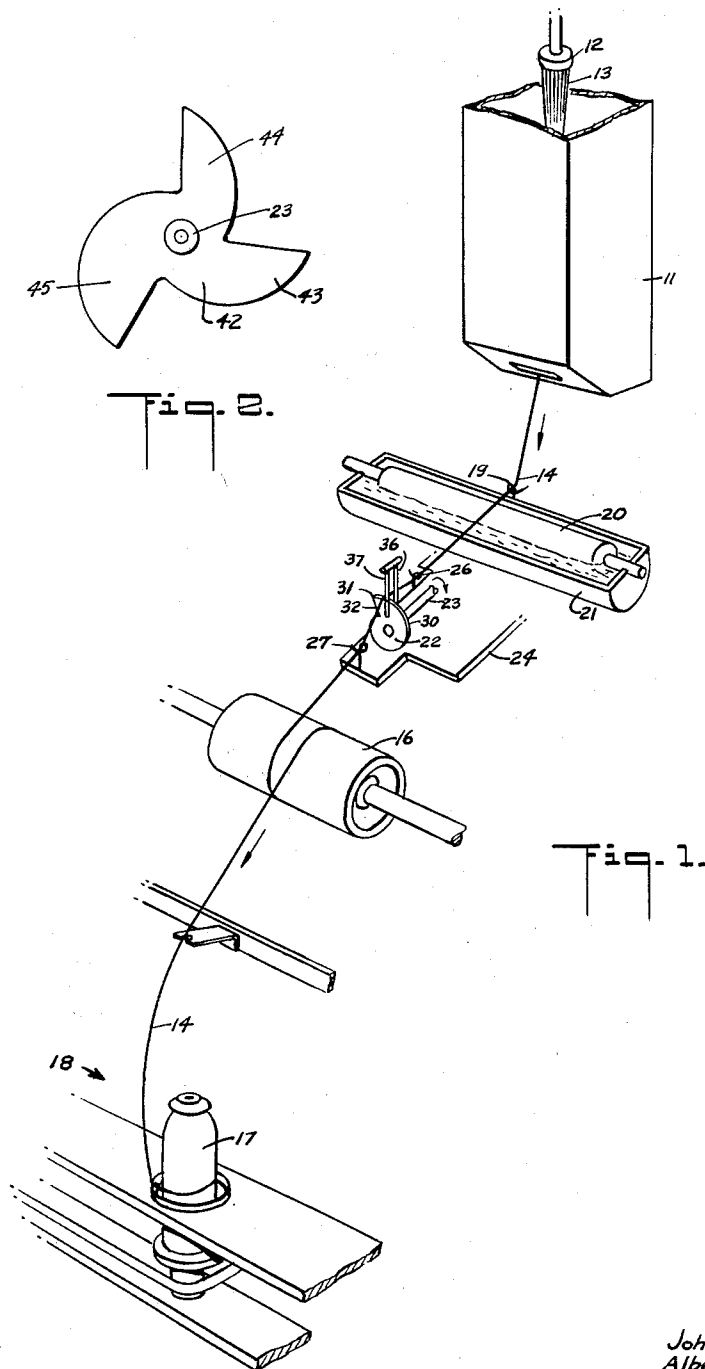


Fig. 1.

Fig. 2.

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PRODUCTION OF FILAMENTS OF UNEVEN DENIER

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7 Claims. (Cl. 18-3)

This invention relates to filaments and relates more particularly to the production of artificial filaments of uneven denier.

In one known process for the production of artificial filaments of uneven denier, the thickness of the filaments being spun is varied by alternately increasing and decreasing the "draw-down" i.e. the ratio between the linear speed at which the filaments are taken up and the linear speed at which the filament-forming material is extruded from the spinneret. The increase in draw-down, which is generally effected by pushing the filaments out of their normal path by means of a cam or rod, produces thin portions in the filaments. When the draw-down is decreased by allowing the filaments to return to said normal path, thicker portions known as "slubs" are formed. In some cases a definite and pronounced slub is desirable. However, when conventional methods and apparatus are used for producing filaments having such pronounced slubs it has generally been necessary to operate at relatively low spinning speeds in order to attain the desired results.

It is an important object of this invention to provide a new and improved process and apparatus for the more rapid production of filaments of uneven denier and having pronounced slubs.

Another object of this invention is the provision of a novel process and apparatus for making yarn of uneven denier.

Other objects of this invention will be apparent from the following detailed description and claims.

In one aspect of this invention, a filament is drawn from a spinneret under tension, as by means of a godet roller, and the draw-down is varied by periodically increasing and reducing the length of the path of the filament between the spinneret and the godet roller. When the length of said path is increased the filament runs over a guide surface which moves transversely of the running filament. Advantageously, the transverse movement of the guide surface continues until an edge of the guide surface passes the path of the filament, at which time the draw-down will be sharply reduced due to the fact that the filament is no longer constrained in its increased path by the guide surface. The reduction in draw-down causes the formation of a slub in the filament.

In one convenient and preferred embodiment of this invention, the guide surface comprises the rim of a cam mounted for rotation in a plane transverse to the path of the filament, the axis of rotation of the cam being substantially parallel to said path. The radius of the cam increases relatively gradually and then decreases abruptly, causing a corresponding abrupt decrease in the draw-down. The variations in the draw-down are much more closely correlated with the variations in the radius of the cam than would be the case if the same cam were mounted for rotation in a plane parallel to the path of the filament, instead of transverse to the path.

In a less preferred form of the invention the cam may

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indeed be mounted for rotation in a plane parallel to the path of the filament. In this case provision is made for moving the cam periodically transversely to said path. Here the desired abrupt reduction in draw-down is caused by the fact that the filament slips off the side edge of the cam as the cam moves transversely to the path of the filament. For example, the cam may be in the form of a flat bar mounted for rotation about an axis intermediate the ends thereof, which axis is transverse to the path of the filament, and there may be provision for reciprocating said bar periodically along said axis. The rotary movement of the bar in engagement with the filament will cause a lengthening of the path of the filament, then the movement of the bar along its axis in one direction will free the filament from engagement with the surface of the bar, while the subsequent movement of the rotating bar along its axis in the opposite direction will bring the bar back into contact with the filament to begin the cycle anew.

In another embodiment the guide surface in contact with the yarn need not have any rotary motion. Thus, there may be employed a rod mounted transversely to the path of the filament and below said path. In this case the rod may be moved upwardly to engage and lift the filament to lengthen the path of said filament, the rod may then be moved transversely to the path of the filament until the filament slips off the end of the rod, and thereafter the rod may be moved downwardly and under the filament to start the cycle anew.

In the production of filaments of uneven denier it is generally desirable to have the slubs spaced at irregular intervals. To this end the draw-down in the filament may be varied at corresponding irregular intervals, as by moving the aforesaid guide surface at a speed which varies continuously or periodically.

While this invention finds its greatest utility when used for the spinning of artificial filaments it may also be employed for the production of filaments of uneven denier by the stretching of previously spun filaments. In such a case instead of a spinneret and spinning cabinet there may be provided a source of previously spun filamentary material and, if desired, means for bringing said filamentary material to a plastic condition, e.g. a zone for heating said filamentary material. In fact, the invention may be used for the cold-drawing of filamentary material such as nylon to produce a cold-drawn material of uneven denier.

In the drawing, wherein two forms of the invention are shown,

Fig. 1 is a more or less diagrammatic perspective view of an apparatus for the production of yarn of variable denier, using a rotary cam, and

Fig. 2 is a view of a modified form of rotary cam.

Like reference numerals designate like parts in both views of the drawing.

Reference numeral 11 designates a spinning cabinet wherein a spinning solution or dope under pressure is extruded at a uniform rate through the fine orifices of a spinneret 12 downward into an evaporative atmosphere to form a plurality of continuous filaments 13. The filaments 13 are brought together to form a bundle, or yarn, 14 which is drawn from the cabinet 11 by the action of a draw roller 16. Preferably, the draw roller 16 is driven positively at constant speed. The yarn 14 is then wound in the conventional manner on a bobbin 17 by means of the usual ring-spinning arrangement 18. In travelling from the cabinet 11 to the draw roller 16 the yarn passes through a pigtail guide 19 and over a furnishing roller 20 which applies a suitable lubricant, contained in a trough 21, to said yarn.

Positioned between the roller 20 and the draw roller

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16 is a positively driven cam 22 which is mounted on a shaft 23 supported on a bracket 24. The bracket 24 also supports a pair of pigtail guides 26, 27 for directing the yarn in a path generally perpendicular to the plane of rotation of the cam 22 and parallel to the shaft 23, so that the yarn passes over the rim of the cam. The profile of the cam 22 shows a gradual increase in radius along a curve 30, then an edge or point 31 and a sharp decrease in radius along a line 32.

The apparatus shown in Fig. 1 includes means for maintaining the travelling yarn properly positioned on the cam 22. To this end, there are provided a pair of depending stationary vertical fingers 36, 37 suitably supported on a frame (not shown). One of the fingers 36, 37 is disposed on each side of the cam 22 to prevent the yarn from moving along said cam towards the right, as viewed in Fig. 1. Also, the pigtail guides 26, 27 are positioned on a line which makes an angle of about 90° with the plane of rotation of the cam 22, the arrangement of the pigtail guides 26, 27 being such that the yarn is urged against the fingers 36, 37.

The curve 30 is of such shape that as the cam 22 rotates in the direction shown by the arrow the length of the path of the yarn is increased at a uniform rate, so that the draw-down of the material leaving the spinneret remains constant until the edge 31 of the cam moves under the running yarn. At this point the filaments being extruded are instantaneously freed from the drawing effect of the roller 16, the only draw-down on the filaments leaving the spinneret being due to gravity. Accordingly, a slub is formed in the yarn. On continued rotation of the draw roller 16 and cam 22 the draw-down is increased so that a thin portion is formed in the yarn. The thin portions and the slubs are each of uniform denier along their lengths.

As stated, the radius of the cam decreases sharply along the line 32 on the cam surface. The slope of this line 32 is preferably such that, after the edge 31 passes under the yarn, the yarn can move freely without restraint towards the center of the cam. Thus, if it is considered that the slope of the curve 30 is positive, the slope of the line 32 is above zero; that is, its slope is either infinite (i.e. a radius) or positive, but not negative.

The modified form of cam 42 shown in Fig. 2 is similar to that of Fig. 1 except that it contains three sections 43, 44, 45 of increasing and decreasing radius, rather than only one. Thus, three slubs are produced for each revolution of the cam. The sections 43, 44, 45 are spaced at unequal distances around the circumference of the cam 42 and the rates at which the radius of the cam increases differs in each of the sections. Thus, a desirable irregularity in the spacing of the slubs is produced. It will be understood, of course, that the shaft 23 and the cam 22 or 42 may be driven at a periodically varying speed so as to produce a further irregularity in the spacing of the slubs.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention what we desire to secure by Letters Patent is:

1. Apparatus for the production of filamentary material of uneven denier comprising a spinneret for the extrusion of an artificial filament, means for drawing said filament from said spinneret and means for intermittently varying the draw-down by intermittently increasing and reducing the length of the path of the filament between said spinneret and said drawing means, said varying means including a cam mounted for rotation in a plane transverse to said path, and means for rotating said cam, said cam having a guide surface for engaging the running filament and for intermittently increasing the length of said path, the profile of said cam including a

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portion of gradually increasing radius and a portion along which the radius decreases sharply.

2. Apparatus for the production of filamentary material of uneven denier comprising a spinneret for the extrusion of an artificial filament, means for drawing said filament from said spinneret and means for intermittently varying the draw-down by intermittently increasing and reducing the length of the path of the filament between said spinneret and said drawing means, said varying means including a cam mounted for rotation in a plane transverse to said path, and means for rotating said cam, said cam having a guide surface for engaging the running filament and for intermittently increasing and decreasing the length of said path, the profile of said cam including a portion wherein the radius of the cam increases gradually and wherein the radius increases along a positive slope and a portion wherein the radius decreases along a slope which is at least zero, and means for maintaining the running filament and the guide surface engaged.

3. Apparatus for the production of filamentary material of uneven denier and having pronounced slubs comprising a spinneret for the extrusion of an artificial filament, means for drawing said filament from said spinneret and means for intermittently varying the draw-down by intermittently increasing and reducing the length of the path of the filament between said spinneret and said drawing means, said varying means including a deflecting member having a guide surface of such form that upon its rotation it is capable of intermittently contacting and deflecting said filament so as to increase the length of the filament path and intermittently releasing the filament so as abruptly to shorten its path, and means for rotating said guide surface.

4. Apparatus according to claim 3, wherein said deflecting member comprises a cam having said guide surface, said guide surface including an edge, intermittent release of said filament being achieved by slipping of said filament over said edge upon rotation of said cam.

5. Apparatus for the production of filamentary material of uneven denier and having pronounced slubs comprising a spinneret for the extrusion of an artificial filament, means for drawing said filament from said spinneret and means for intermittently varying the draw-down by intermittently increasing and reducing the length of the path of the filament between said spinneret and said drawing means, said varying means including a cam having a guide surface engaging the running filament and of such form that upon its rotation it is capable of intermittently contacting and deflecting said filament so as to increase the length of the filament path and intermittently releasing the filament so as abruptly to shorten its path, and means for rotating said cam in a plane transverse to the running filament so that different portions of said guide surface come into contact with said running filament and abruptly reduce the draw-down.

6. Process for the production of filamentary material of uneven denier and having pronounced slubs comprising extruding an artificial filament, drawing said filament, intermittently contacting and deflecting said filament by engaging the running filament with a guide surface having an edge so as to increase the length of the filament path between the points of extrusion and drawing, and intermittently effecting relative movement between said filament and said guide surface in a direction transverse to the running direction and to the direction of deflection of said filament to cause said filament to fall over said edge, thereby abruptly releasing the filament and abruptly shortening its path.

7. Process for the production of filamentary material of uneven denier and having pronounced slubs comprising extruding an artificial filament, drawing said filament, intermittently contacting and deflecting said filament by engaging the running filament with a guide surface having an edge so as to increase the length of the filament path between the points of extrusion and drawing, and

intermittently at irregular intervals effecting relative movement between said filament and said guide surface in a direction transverse to the running direction and to the direction of deflection of said filament to cause said filament to fall over said edge, thereby abruptly releasing the filament and abruptly shortening its path. 5

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