March 25, 1941. A. W. KEIGHT 2,235,889

PRODUCTION OF ARTIFICIAL FILAMENTS, YARNS, OR THREADS

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Fig. 1.

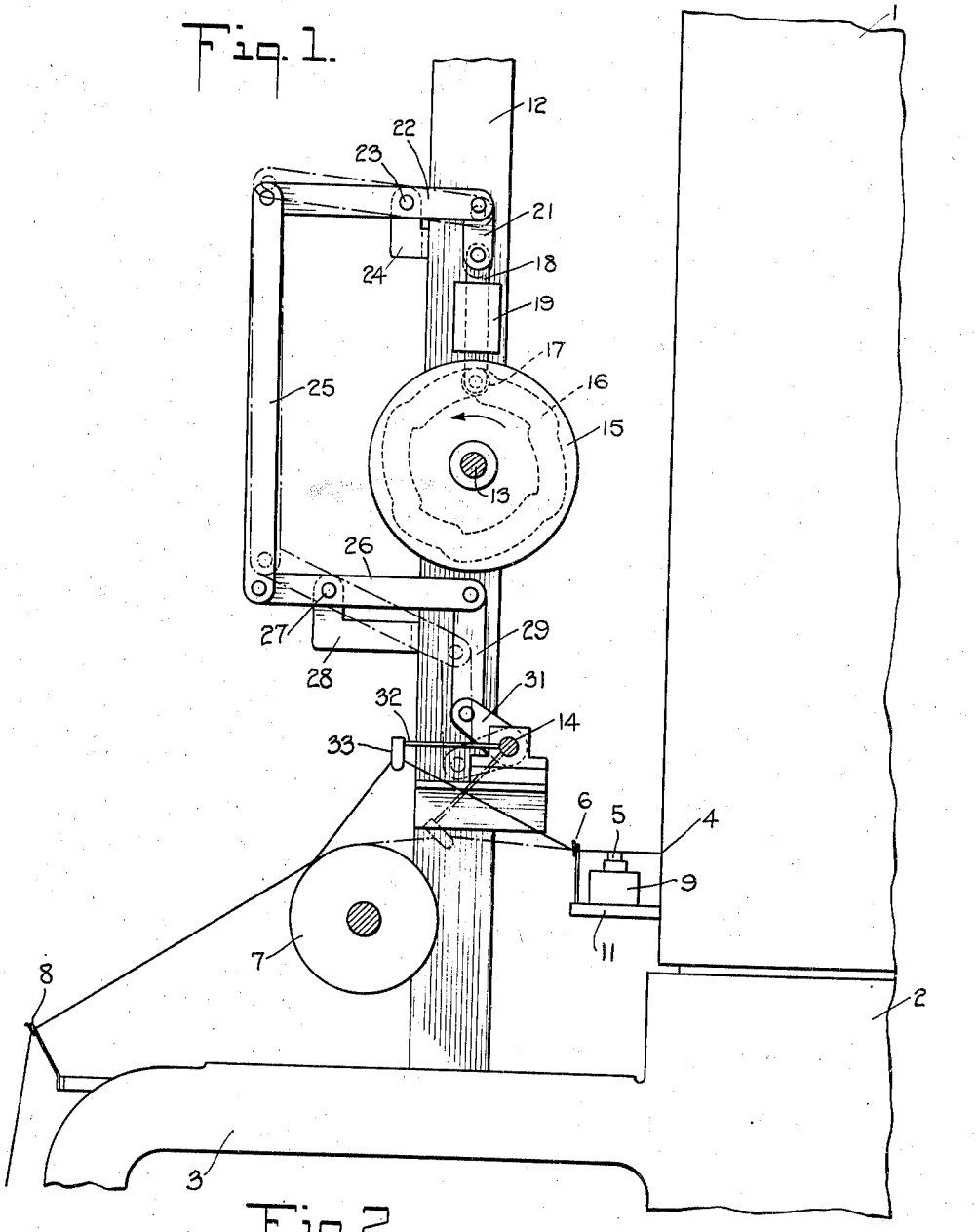
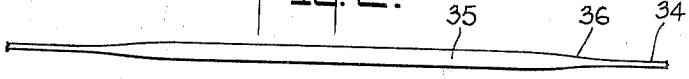


Fig. 2.



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PRODUCTION OF ARTIFICIAL FILAMENTS, YARNS, OR THREADS

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4 Claims. (Cl. 18—8)

This invention relates to artificial filaments, yarns or threads, and to their production by the extrusion of spinning solutions through jets, nozzles or other spinning orifices into a solidifying medium.

An object of the invention is the production of artificial filaments or yarns having regular or irregular changes in denier. A further object of this invention is the production of filaments or yarns of a denier which is not uniform along the length thereof, and in which the change between the portion of smaller denier and the portion of larger denier is relatively abrupt. A still further object of this invention is the construction of a device for producing the irregularity of denier in the filaments or yarns.

In the accompanying drawing, wherein like reference numerals refer to the same or similar elements in the respective views, there is shown a device constructed in accordance with this invention. In the drawing—

Fig. 1 is a view showing a part of a spinning cabinet and the device constructed in accordance with this invention mounted thereon; and

Fig. 2 is a plan view of a section of filaments or yarn produced by the device shown in Fig. 1.

According to the invention, I form filaments or yarns of artificial silk or the like which have regular or irregular changes in denier by drawing them at varying linear speeds in the course of their production in the spinning cabinet so as to stretch them at any desired intervals. The varying stretch imparted to the filaments or yarns results in a correspondingly varying denier, the variations occurring at any desired intervals and to any desired degree and extending any desired distance along the length of the filaments or yarns. This irregularity in denier is effected by a device which draws the filaments at varying linear speeds by periodically lengthening the path followed by the filaments from the forming jet to a winding, or twisting and winding device, such as a cap-winding device.

The variations in denier of the yarn may appear at regular short or long intervals or at regularly varying intervals, and variations of different degree or length, or both, may appear at any desired intervals. Furthermore, one or more groups of denier variations may appear in regular sequence or in any desired order or at any desired intervals. Thus, for example, one or more short variations may alternate with one or more long variations, or groups of short or long variations may alternate with short or long variations, or with other groups of short and long variations. Again, the denier variations or sequence of denier variations may be broken up so that the periods of larger denier appear at random along the length of the filaments or yarn, The latter method of spacing of the denier variations minimizes the possibility of the yarns producing a wood grain effect when woven into a fabric. It will be understood that where yarn or thread is formed by the association of a number of filaments, all of which have a regular or an irregular change in denier, which change is similar for all the filaments at a cross-section of the yarn, there will be a cumulative effect in change of denier of the yarn at that cross-section. Where the yarns are formed of substantially continuous filaments, there will obviously be the same number of filaments at the larger denier periods as at the smaller denier periods.

Yarns or threads which have variations in denier as above described may be wound, or twisted and wound, for example, by means of cap-spinning devices or centrifugal boxes.

The filaments of varying denier may be formed into yarns, either alone, or twisted or doubled with threads of other natural or artificial filaments or fibers. Furthermore, they may be cut or reduced to staple lengths, either continuously with their production or subsequently thereto, and spun into yarns, either alone, or mixed or blended with other natural or artificial filaments or fibers, and such spun yarns may, if desired, be twisted or doubled with the same or other yarns to form any desired type of thread.

Yarns or threads having an irregular denier and a substantial twist impart a novel effect to fabrics or articles wholly or partially formed from them by reason of the differential effect produced by the variation in denier and amount of twist at the various intervals of varying denier. The effect may, moreover, be enhanced when the fabrics or articles are dyed, printed or otherwise colored because of the difference in the degree of penetration of the dyestuff or other coloring matter, and of the difference in luster between tightly twisted small denier intervals and the intervals of large denier having little or no twist.

The yarns or threads of varying denier may be employed in the production of fabrics or articles either alone or in association with yarns or threads of regular artificial silk or other natural or other artificial filaments or fibers, and may be utilized to form any desired design

or pattern. They may be used, for example, in the warp and/or weft in weaving operations; in knitting operations; for instance, in the production of warp knitted fabrics; in circular knitting machines, in braiding or cording operations; in net or lace-making operations; or in any other fabric-forming or textile operation.

While the invention applies particularly to filaments or threads of varying or irregular denier produced by the dry or evaporative method and especially to filaments or threads having as a base cellulose acetate or other cellulose derivative, such as cellulose formate, cellulose propionate or cellulose butyrate, thiocarbamic or alkoxy-alkacyl esters of cellulose, methyl, ethyl or benzyl cellulose, or the condensation products of cellulose and glycols and other polyhydric alcohols, it applies also to filaments or yarns of varying or irregular denier produced by the wet or coagulation method, whether it has a base of cellulose acetate or other organic derivatives of cellulose or bases of reconstituted cellulose such as viscose, cuprammonium or nitrate cellulose.

As an aid in describing the invention, particular reference will be had to the drawing wherein there is shown a device constructed in accordance with this invention. The reference numeral **1** indicates a spinning cabinet which may be equipped with any suitable number of spinning jets and ducts for supplying and withdrawing evaporative atmosphere, guides, and heating or cooling elements. The exact construction of the spinning cabinet or metier is not shown as this can be of any of the types used in the production of artificial silks and like materials. The spinning cabinet or metier rests on a suitable base **2** having a forwardly projecting platform **3**. For each spinning jet or series of spinning jets contained in the spinning cabinet or metier there is provided in the side wall thereof a port through which the yarn is drawn as it is being formed.

In spinning, say with a device of the type shown in the drawing, the thread leaves the spinning cabinet or metier at the port **4**, crosses a wick **5**, through a guide **6**, around a drawing roll **7**, then through a guide **8** and on to a take-up package (not shown). The wick **5** supplies to the yarn any suitable material such as lubricants, conditioning agents, etc., which agents are contained in a receptacle **9** which rests on a shelf **11** attached to the cabinet in any suitable manner.

At the end of the spinning cabinet or metier, there is an upright frame member **12** having journalled therein shafts **13** and **14**. Mounted on shaft **13** is a cam **15** which may be of any suitable style. However, it is preferable to employ a grooved cam provided with a cam follower having a relatively close fit in the groove to prevent bumping of the lever mechanism due to the speed at which the cam normally moves said lever mechanism. Though a grooved cam is preferable, a peripheral cam may be employed and suitable dash-pots provided on the various parts of the mechanisms in order to prevent bumping. Referring specifically to the drawing, the cam **15** is provided with a cam groove **16**. In the cam groove **16** is a cam follower **17** journalled in a suitable connecting rod **18** which is mounted for reciprocal movement in a bearing **19**.

The connecting rod **18** is pivotally connected to a connecting link **21**, which connecting link is pivoted at its other end on a lever arm **22** which is pivoted at **23** on a bracket **24**. The lever arm **22** is pivotally connected by a link **25** to a second lever arm **26** which is pivoted on a support **27** mounted in a bracket **28** attached to the upright member **12**. The lever arm **26** is pivotally attached by a connecting link **29** to a crank **31**. The crank **31** is fixedly connected to the shaft **14**. At intervals across the shaft **14**, which intervals correspond to the ports **4** of the spinning cabinet or metier, are mounted arms **32**, each of which is provided with a head **33**, which contains means for retaining a porcelain or metallic thread guide through which the thread is adapted to pass.

In operation of the device, the yarns or threads formed by extruding the same through jets are threaded through the cabinet port **4** across the wick **5**, guide **6**, the guide in the head **33**, around the drawing or feed roll **7** and guide **8** to the take-up package. At the same time as the yarns or thread are being drawn from the spinning jets by means of the roll **7**, the shaft **13**, driven by any suitable source of power, is rotated in a counter-clockwise direction as shown on the drawing. The rotation of the cam, through the lever arrangement, raises and lowers the arm **32** such that, although the roll **7** rotates at a constant speed, the yarn is drawn at varying linear speeds from the jets in the cabinet. To produce a yarn as shown in Fig. 2, having a small denier portion **34** and a large denier portion **35** and having a relatively abrupt change between the two, as shown at **36**, the cam **15** is so shaped that the arm **32** is slowly raised and then allowed to drop abruptly and swiftly. By this means there is a short interval of time in which the feed roll **7** is exerting no drawing action on the yarn issuing from the jets. Thus, the drawing action of the roll **7** is interrupted. This interruption produces a thick slub on each filament and as soon as the feed roll takes up the slack produced by the dropping of the arm **32**, the feed roll again commences drawing the yarn from the jets, thus again reducing the denier of same. Yarns produced in accordance with this invention have an abrupt change between the small and large denier portions and when woven into a fabric give rise to a novel effect. Yarns having a gradual change from the small to large denier, when woven into fabrics, produce an effect which is called a shadow; that is, the raised portion caused by the tapering down of the large denier extends for quite a distance at either end of the main body of the large denier portion producing an effect which appears as the shadow of the main portion. The yarns formed in accordance with this invention with an abrupt change from the small to large denier, when woven into fabrics, give a sharp ending to the raised portion of the fabric and produce no shadow effect. For this reason, yarns so formed may be woven into patterns, etc., giving an effect which cannot be produced by other types of varying denier yarns.

The spacing of the swells and depressions in the cam may be of any suitable arrangement such that there are produced slubs of equal length or slubs of varying length, or such that there be varying intervals in which no slubs are formed. Furthermore, the shaft **13** may be rotated by means of elliptical gears or sets of cone pulleys having a reciprocating drive belt from one to the other or other means such that the shaft **13** rotates at a constantly or an irregularly varying speed. This method of driving the cam wheel produces slubs on the yarn at random intervals.

If desired, the receptacle **9** and the wick **5** may be eliminated from the device. Furthermore, other suitable arrangements of levers may be employed. Where the spinning cabinet or metier is of considerable length, there may be provided a

plurality of uprights 12 each containing a cam wheel and lever arrangement, such that a uniform oscillation of the shaft 14 is produced throughout the entire machine, thus producing a set of yarns, each yarn of the same characteristics and the same variation in deniers. By regulating the speed of the cam and the shape of the groove therein, as well as the levers, yarn may be produced having a ratio between thin and thick places of 1 to 1½, 1 to 2, 1 to 4, 1 to 7 or other ratios while the intervals between slubs and the length of the slubs may be regulated by adjustment of the speed of the cam relative to the feed roll and by the length of the oscillating arm.

It is to be understood that any desired number of devices may be arranged for simultaneous operation on the filaments or threads produced by the plurality of jets or nozzles in a single metier or spinning cabinet, and driving means being provided for such parts as the oscillating shaft 14 and the feed roll 7 used for the several filaments or threads. Thus, the shaft 14 may extend across the length of the metier or spinning cabinet occupied by several jets or nozzles, a single cam 16, or a plurality of cams spaced across the machine, operating said shaft.

The foregoing apparatus may be applied to the treatment of artificial filaments produced by the dry or evaporative method as shown in the drawing or by the wet or coagulation method by obvious rearrangement of the parts. It is to be understood that the foregoing description and the device shown in the drawing are merely given by way of illustration and many alterations or substitutions may be made without departing from the spirit of my invention.

What I desire to secure by Letters Patent is:

1. Apparatus for the production of artificial filaments comprising an oscillating member having a thread guide thereon through which the filaments are caused to pass, and means for alternately causing said oscillating member to rise slowly at a substantially constant speed and permitting said oscillating member to drop abruptly under gravity, said means including a cam, a cam follower and a lever connecting said follower with said oscillating member, the construction and arrangement being such that filaments having an appreciable variation in denier are produced.

2. In apparatus for the production of artificial filaments, the combination with a stationary spinneret for spinning the filaments, of an oscillating member adjacent to said spinneret, through which the filaments are caused to pass and means for causing said oscillating member to operate slowly in one direction and rapidly in the opposite direction so as to effect an abrupt variation in denier of the filaments.

3. In apparatus for the production of artificial filaments, the combination with a stationary spinneret for spinning the filaments, of an oscillating member adjacent to said spinneret, through which the filaments are caused to pass and means, including a cam, for causing said oscillating member to operate slowly in one direction and rapidly in the opposite direction so as to effect an abrupt variation in denier of the filaments.

4. In apparatus for the production of artificial filaments, the combination with a stationary spinneret for spinning the filaments, of an oscillating member adjacent to said spinneret, through which the filaments are caused to pass and means for causing said oscillating member to operate at a substantially constant speed in one direction and rapidly in the opposite direction, said means including a cam, a cam follower and a lever connecting the cam follower to said oscillating member, the construction and arrangement being such that there is effected an abrupt variation in the denier of the filaments.

ALBERT WALTER KEIGHT.