

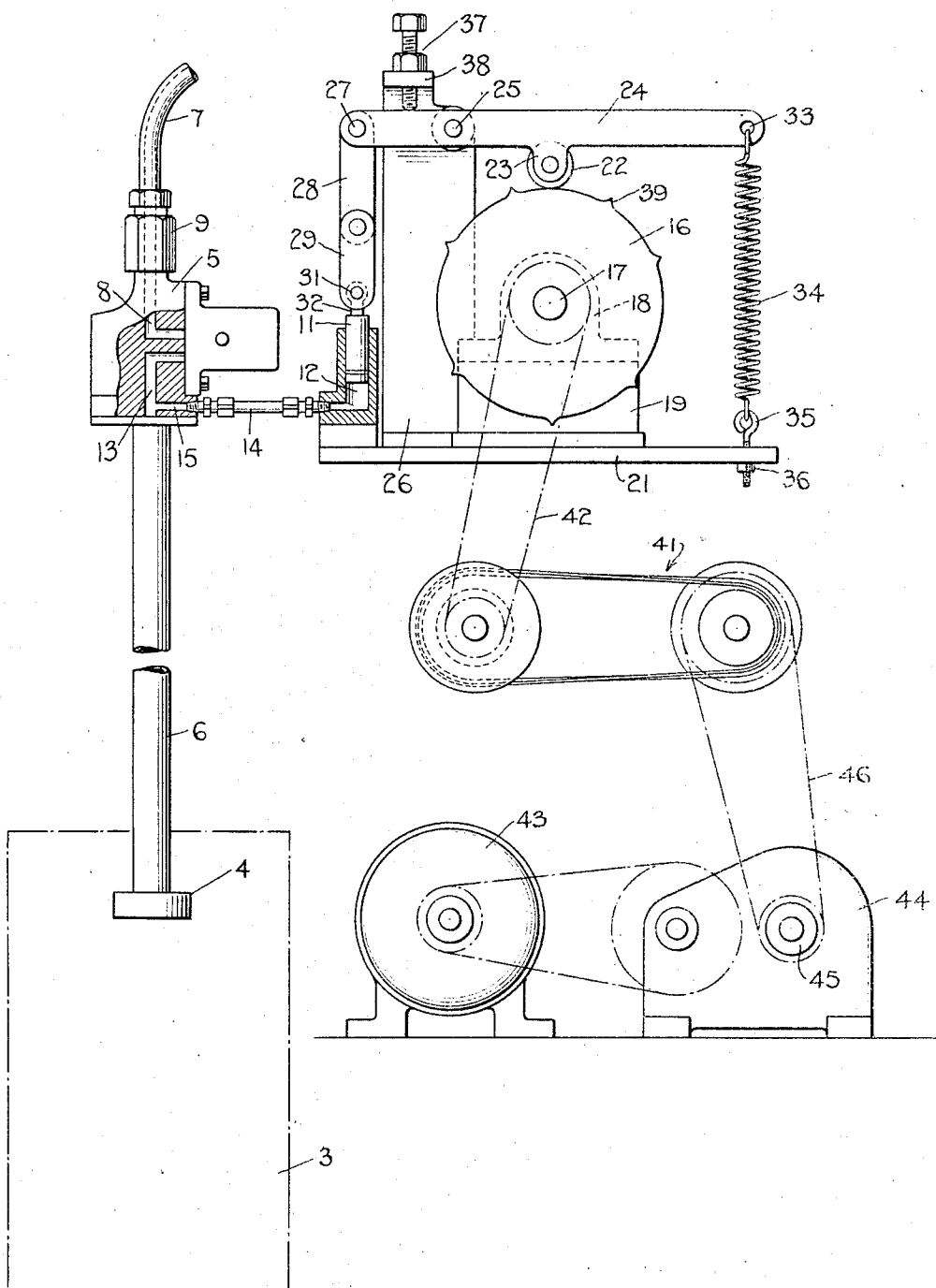
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PRODUCTION OF ARTIFICIAL FILAMENTS OR THREAD

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PRODUCTION OF ARTIFICIAL FILAMENTS
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This invention relates to the production of artificial filaments, yarns or threads of varying denier, and relates more particularly to the production of such materials by the extrusion of spinning solutions through jets, nozzles, or other spinning orifices.

It is an important object of this invention to provide an improved device for producing artificial filaments or threads of varying denier.

Another object of this invention is to provide a novel means for varying the pressure in the spinning solution being delivered to the spinning nozzle whereby filaments or threads of varying denier are produced.

Other objects of this invention will appear from the following detailed description.

According to the instant invention, artificial filaments or threads of varying or irregular denier are prepared by creating fluctuations of pressure in the spinning solution between the pump outlet and the spinning nozzle by means of a device operated so as to give a quick increase in pressure in the spinning solution, then a release in pressure, and a period at which constant spinning pressure is maintained. The fluctuations in pressure in the spinning orifices, the variations occurring at the desired intervals and to any desired degree, while extending any desired amount along the length of the filaments or threads.

Any desired means such as cams or eccentrics may be employed for actuating the device for creating the fluctuation of pressure in the spinning solution. Thus, a cam may actuate a plunger adapted to reciprocate in a cylinder connected to the delivery pipe feeding spinning solution to the orifices, thereby increasing the pressure on the spinning solution being fed to the orifices and releasing the pressure to restore the same to the normal operating pressure.

It is important that the conduit conducting the spinning solution to the nozzle be of a rigid character in order to prevent the damping or absorption of the pressure before the spinning solution reaches the nozzle.

All the jets or nozzles, whether in a single metier or machine, or in a series of such, which are required to produce the same quality of filaments have similarly operating devices to produce the same variable extrusion from all the spinning orifices, and preferably, a common operating device is employed in connection with all such jets and nozzles in each metier or machine.

The variations in denier produced according to the invention may appear at regular short or

regular long intervals of length or at regularly varying intervals, and variations of different degree or extent, or both, may appear at any desired intervals. Or one or more groups of irregularities 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 longer variations, or groups of short and long variations may alternate with short or long variations or with other groups of short and long variations, always with the object of producing a regular or systematic effect from the alternating or periodically recurring irregularities of denier of the filaments, yarns or threads. Or periodical irregularities forming groups of, for example, 2, 3, 4, 6 or 10 or more variations may occur on the filaments, yarns, or threads, the groups alternating with each other or appearing in any desired order according to the effect to be produced.

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 irregularity in denier which is the same for all the filaments, the variations in the individual filaments may be arranged to produce by a cumulative effect a similar regular irregularity in the denier of the yarn or thread formed therefrom.

The yarns or threads which have received the regular irregularities as above described may be wound or twisted and wound, for example, by means of cap-spinning devices, ring spinning 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. Or 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 with irregular denier according to the invention impart a novel effect to fabrics or articles wholly or partly formed from them, by reason of the differential effect produced by the variations, and this effect may, moreover, be enhanced when the fabrics or articles are dyed, printed, or otherwise colored, because of the regular irregularity of denier of the yarns or threads causing different penetration of the dyestuff or other coloring matter to

be effected, a great variety of color effects thereby being produced.

The yarns or threads of varying denier may be applied to the production of fabrics or articles, either alone or in association with yarns or threads of regular artificial silk or of other natural or artificial filaments or fibers, and may be utilized to give any desired design or pattern. They may be used, for example, in the warp and/or weft in weaving operations; in knitting operations, for example in the production of warp-knitted fabrics; in circular hosiery or other knitting machines; in braiding or cording operations; in net or lace-making operations; or in any other fabric-forming or textile operations.

This invention applies particularly to the production of filaments or threads of varying or irregular denier by every method wherein spinning solution is extruded through orifices in a jet or nozzle. Thus, this invention applies to filaments or threads of varying or irregular denier produced by the wet or coagulation method, whether having a base of cellulose acetate or other organic derivative of cellulose, or composed of a regenerated or reconstituted cellulose such as viscose, cuprammonium or nitrocellulose silk, or produced by the dry or evaporated method such as filaments or threads having a base of cellulose acetate, cellulose propionate or cellulose butyrate, thiocarbamic or alkoxy-alkacyl esters of cellulose or ethyl or benzyl cellulose. This invention applies likewise to filaments or threads having a basis of condensation products of cellulose and glycols or other polyhydric alcohols, or a basis of synthetic linear polyamide condensation products such as polyamides derived from amino-acids or from the condensation products of diamines with carboxylic acids, e. g. polyhexamethylene adipamide.

In the accompanying drawing, the figure illustrates, more or less diagrammatically, one form of carrying out the instant invention.

In the figure, the reference numeral 3 indicates a spinning cell in which is arranged a spinning jet or nozzle 4. The spinning jet is connected to a pump 5 by means of a rigid pipe or tube 6. The pump 5 is of the type commonly in use in spinning of artificial silk, and in normal operation is adapted to force a regular and accurate amount of spinning solution, under a constant pressure, through the fine orifices of the spinning nozzle. The pump receives spinning solution from any convenient supply through a conduit 7 connected to the inlet passage 8 of the pump by means of a coupling 9.

The fluctuations of pressure are created in the spinning solution between the pump 5 and the spinning nozzle 4 by means of a plunger 11 adapted to be reciprocated in a cylinder 12 which is connected to the delivery passage 13 of the pump by a rigid tube 14 coupled to said cylinder and to a passage 15 leading to the delivery passage 13 of the pump. The plunger 11 is vertically reciprocated in the cylinder by the rotation of a cam 16 carried on a shaft 17 journaled in suitable bearings 18. The bearings 18 are carried on suitable standards 19 carried by a support 21. The cam 16 operates a roller cam follower 22 rotatably mounted in a boss 23 integral with a lever 24 pivoted at 25 on standard or support 26. One end of lever 24 is pivotally connected at 27 to toggle links 28 and 29, the latter of which has attached thereto, as in a universal mounting 31, the neck 32 of the plunger 11. The other end of lever 24 has an opening 33 therein to which is attached a spring 34 the lower end of which is

attached to an eye-bolt 35 fixed to a support 21 by means of nut 36. The function of said spring is to maintain the cam follower 22 in contact with cam 16 and will also effect the raising of the plunger 11 when the cam follower comes off the lifting points. If desired, the cam follower may be maintained in contact with the cam by providing a suitable groove in said cam, in which groove the cam follower would be adapted to ride. The movement of lever 24 is controlled or regulated by an adjusting screw 37 mounted on a flange 38 of standard 26.

Preferably the lifting points 39 of cam 16 are staggered about the periphery of the cam to break up the pattern of the thick and thin portions along the length of the filaments or thread. The shape of the lifting points of the cam, which are brought to a rather sharp point as shown in the drawing, effects a rapid downward movement of plunger 11, a slow gradual withdrawal of the plunger from the cylinder, and cause the plunger to have a stationary period at the top of the plunger stroke. This construction furnishes a quick increase in pressure in the spinning solution between the pump and the spinning nozzle, then a release of the increased pressure and a period at which constant, or normal, spinning pressure is maintained. The pattern of the thick and thin portions along the length of the filaments or thread may be further broken up by means of a coned roller arrangement generally indicated by reference numeral 41 which is connected to and drives cam 16 by means of a belt or similar means 42. The coned roller arrangement is in turn driven by a motor 43 through a reduction unit 44, the output shaft 45 of which is connected to the coned roller arrangement by a belt or other suitable means 46.

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

Having described my invention, what I desire to secure by Letters Patent is:

1. Method of producing artificial filaments or threads varying in denier along the length thereof by processes wherein a spinning solution is extruded through orifices into a setting medium, which comprises supplying spinning solution at a constant rate and at a constant pressure to a confined space directly connected to the point of extrusion and extruding said spinning solution at a varying rate from the point of extrusion to form artificial filaments having variations in denier along the length thereof, said varying rate of extrusion being effected by withdrawing a portion of said spinning solution from said confined space, and returning said portion of said spinning solution to the confined space and to the bulk of the spinning solution by a cycle of steps which consists in applying a quick increase in pressure on said withdrawn portion of the spinning solution, slowly releasing said increased pressure and permitting a period of constant pressure.

2. Method of producing artificial filaments or threads varying in denier along the length thereof by processes wherein a spinning solution is extruded through orifices into a setting medium, which comprises supplying spinning solution at a constant rate and at a constant pressure to a confined space directly connected to the point of extrusion and extruding said spinning solution at a varying rate from the point of extru-

sion to form artificial filaments having variations in denier along the length thereof, said varying rate of extrusion being effected by withdrawing a portion of said spinning solution from said confined space, and returning said portion of said spinning solution to the confined space and to the bulk of the spinning solution by a cycle of steps which consists in applying a quick increase in pressure on said withdrawn portion of the spinning solution, slowly releasing said increased pressure and permitting a period of constant pressure, the periodicity of the steps in said cycle being caused to constantly vary.

3. Apparatus for the production of artificial filaments or threads having variations in denier along the length thereof comprising a spinning nozzle, a delivery passage leading to said spinning nozzle, a pump connected to said passage for delivering spinning solution thereto at a constant rate and at a constant pressure, and a pressure applying means connected to said delivery passage at a point removed from the discharge end of said pump for causing said spinning solution to be extruded from said spinning nozzle at a varying rate, said pressure applying means including a cylinder connected to said delivery passage, a plunger in said cylinder and a cam for reciprocating said plunger in said cylinder so as to cause a portion of said spinning solution to be withdrawn from said delivery passage and to be forced back thereto, the construction and arrangement of said cam being such that it operates said plunger in said cylinder in such a manner as to apply a quick increase in pressure on the spinning solution, to release slowly said increased pressure and to allow for a period of constant pressure before applying another quick increase in pressure on the spinning solution.

4. Apparatus for the production of artificial filaments or threads having variations in denier along the length thereof comprising a spinning nozzle, a delivery passage leading to said spinning nozzle, a pump connected to said passage for delivering spinning solution thereto at a constant rate and at a constant pressure, and a pressure applying means connected to said delivery passage at a point removed from the discharge end of said pump for causing said spinning solution to be extruded from said spinning nozzle at a varying rate, said pressure applying means including a cylinder connected to said delivery passage, a plunger in said cylinder and a cam having irregularly spaced lifting points in the periphery thereof for reciprocating said plunger in said cylinder so as to cause a portion of said spinning solution to be withdrawn from said delivery passage and to be forced back thereto, the construction and arrangement of said cam being such that it operates said plunger in said cylinder in such a manner as to apply a quick increase in pressure on the spinning solution, to release slowly said increased pressure and to allow for a period of constant pressure before ap-

plying another quick increase in pressure on the spinning solution.

5. Apparatus for the production of artificial filaments or threads having variations in denier along the length thereof comprising a spinning nozzle, a delivery passage leading to said spinning nozzle, a pump connected to said passage for delivering spinning solution thereto at a constant rate and at a constant pressure, and a pressure applying means connected to said delivery passage at a point removed from the discharge end of said pump for causing said spinning solution to be extruded from said spinning nozzle at a varying rate, said pressure applying means including a cylinder connected to said delivery passage, a plunger in said cylinder, pivoted levers attached to said plunger, a cam follower on one of said levers, and a cam cooperating with said cam follower and having irregularly spaced lifting points on the periphery thereof for reciprocating said plunger in said cylinder so as to cause a portion of said spinning solution to be withdrawn from said delivery passage and to be forced back thereto, the construction and arrangement of said cam being such that it operates said plunger in said cylinder in such a manner as to apply a quick increase in pressure on the spinning solution, to release slowly said increased pressure and to allow for a period of constant pressure before applying another quick increase in pressure on the spinning solution.

6. Apparatus for the production of artificial filaments or threads having variations in denier along the length thereof comprising a spinning nozzle, a delivery passage leading to said spinning nozzle, a pump connected to said passage for delivering spinning solution thereto at a constant rate and at a constant pressure, and a pressure applying means connected to said delivery passage at a point removed from the discharge end of said pump for causing said spinning solution to be extruded from said spinning nozzle at a varying rate, said pressure applying means including a cylinder connected to said delivery passage, a plunger in said cylinder, pivoted levers attached to said plunger, a cam follower on one of said levers, a cam cooperating with said cam follower and having irregularly spaced lifting points on the periphery thereof for reciprocating said plunger in said cylinder so as to cause a portion of said spinning solution to be withdrawn from said delivery passage and to be forced back thereto, and means for constantly varying the speed of rotation of said cam, the construction and arrangement of said cam being such that it operates said plunger in said cylinder in such a manner as to apply a quick increase in pressure on the spinning solution, to release slowly said increased pressure and to allow for a period of constant pressure before applying another quick increase in pressure on the spinning solution.

ALBERT W. KEIGHT.