

April 9, 1935.

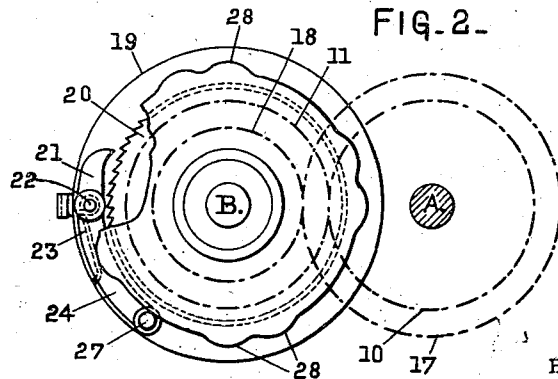
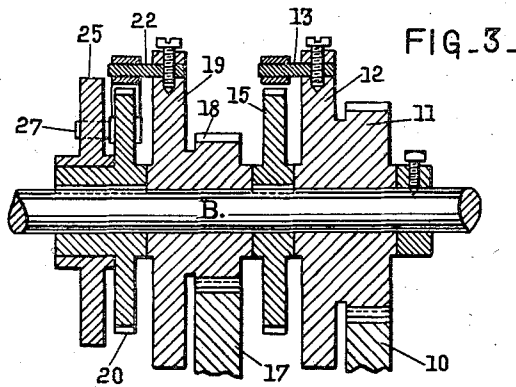
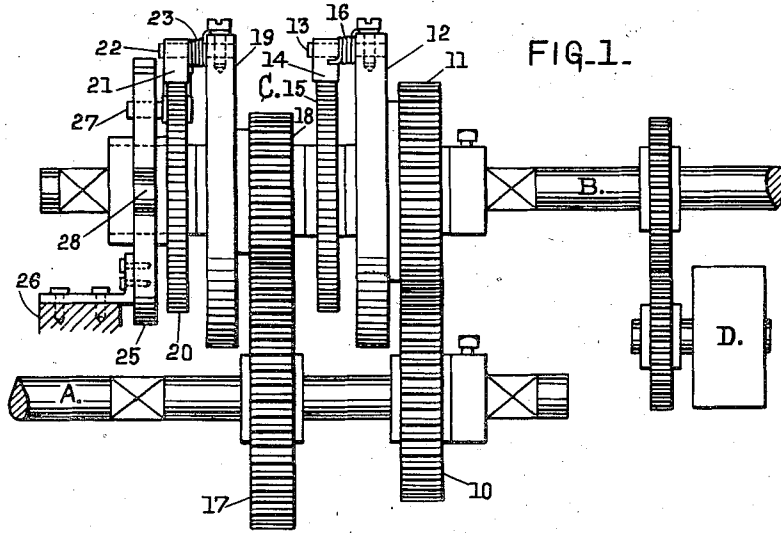
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1,996,796

ARTIFICIAL FILAMENT, YARN, OR THREAD

Filed Sept. 4, 1929

2 Sheets-Sheet 1



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FIG. 4.

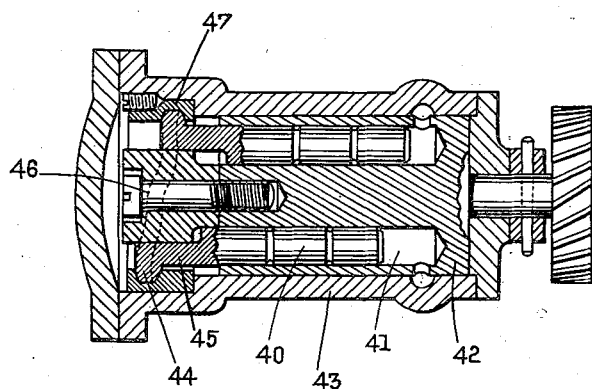
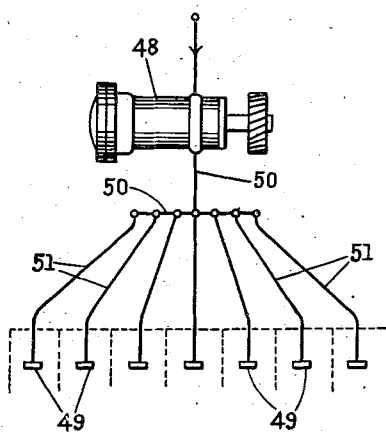


FIG. 5.



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# UNITED STATES PATENT OFFICE

1,996,796

## ARTIFICIAL FILAMENT, YARN, OR THREAD

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Application September 4, 1929, Serial No. 390,400  
In Great Britain September 13, 1928

2 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.

5 According to the invention, artificial filaments or threads are given a regular or systematic irregularity in denier by varying the output of the pump or pumps feeding the spinning solution to the spinning jets or nozzles, the variations in extrusion resulting in a correspondingly varying denier, which variations may occur at any desired intervals and to any desired degree, while extending any desired amount along the length of the filaments or threads.

15 The variation in extrusion may be effected by suitably varying the speed at which the spinning pump is driven, or by constructing the pump to give a variable output. It is important that the spinning solution follows a short path from the pumps to the jets or nozzles, and that the conduit conducting the solution to each jet or nozzle is of a rigid character, in order to prevent the damping or absorption of the pulsations before the solution reaches the jet or nozzle.

25 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 filament are supplied with spinning solution by similarly operating pumps which produce the same variable extrusion from all the jets or nozzles.

30 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.

55 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 ir-

regularity 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.

5 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, or centrifugal boxes.

10 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 fibres. 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 fibres, and such spun yarns may, if desired, be twisted or doubled with the same or other yarns to form any desired type of thread.

20 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 coloured, because of the regular irregularity of denier of the yarns or threads causing different penetration of the dyestuff or other colouring matter to be effected, a great variety of colour effects thereby being produced.

35 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 fibres, 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.

45 While the invention applied particularly to filaments or threads of varying or irregular denier, produced by the dry or evaporative method, and especially filaments or threads having as a base cellulose acetate or other cellulose derivatives, such as cellulose formate, propionate, or butyrate, thiocarbamic or alkoxy-alkacyl esters of cellulose, methyl, ethyl or benzyl cellulose, or the condensation products of cellulose

and glycols or other polyhydric alcohols, it applies likewise 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 derivatives of cellulose, or composed of a reconstituted cellulose, such as viscose, cuprammonium, or nitro-cellulose silk.

Two forms of apparatus which may be employed in carrying the invention into effect are illustrated in the accompanying drawings, but it is to be understood that the following description is given by way of example only and is in no way limitative.

In the drawings:

Figs. 1, 2, and 3 illustrate one form of apparatus, Fig. 2 being an end elevation of the plan view shown in Fig. 1, and Fig. 3 a horizontal section of part of Fig. 1.

Fig. 4 shows a pump of the multi-cylinder type, arranged to give a varying delivery in accordance with the invention, and

Fig. 5 shows diagrammatically the application of the pump shown in Fig. 4 to a plurality of spinning jets.

In Fig. 1, A is a shaft driven from any suitable source of power, and B is a shaft arranged to drive any suitable number of pumps. C indicates generally gearing by which the shaft B is driven from the shaft A, and D indicates one of the pumps.

A pinion 10 secured to the shaft A engages a pinion 11 freely mounted on the shaft B and connected to a disc 12 from the face of which projects a pin 13. A pawl 14 pivotally mounted on the pin 13 is held in engagement with a ratchet wheel 15 by means of a spring 16, the ratchet wheel 15 being secured to the shaft B. The shaft B can thus be driven from the shaft A at a speed dependent on the ratio of the gears 10 and 11. A further pinion 17 is secured to the shaft A and meshes with a gear 18 freely mounted on the shaft B and connected to a disc 19. A ratchet wheel 20 secured to the shaft B is arranged alongside the disc 19, a pawl 21 mounted on a pin 22 projecting from the face of the disc 19 being adapted to be brought into engagement with the ratchet wheel 20. Normally, however, a spring 23 acting on the tail 24 of the pawl 21 maintains the pawl out of engagement with the ratchet wheel.

A cam disc 25 is mounted close to the ratchet wheel 20 and is held against rotation by being secured to any suitable fixed part 26 of the apparatus. A pin 27 projecting from the tail 24 of the pawl 21 is pressed against the periphery of the cam 25 by the spring 23, so that as the pawl 21 is carried round the ratchet wheel 20 by the rotation of the disc 19, the pin 27 rides up projections 28 of the cam disc 25, and causes the pawl to be brought into engagement with the ratchet wheel. The ratio of the gears 17, 18 is higher than that of the gears 10, 11, so that the pawl 21 rotates round the shaft B at a speed greater than the ratchet wheel 15. Thus, whenever the pawl is brought into engagement with the ratchet wheel 20, it causes the shaft B to be rotated at a greater speed during the engagement of the pawl with the ratchet wheel.

Depending on the number and the length of the cam projections 28 round the disc 25 speed variations are imparted to the shaft B, the drive through the gears 10, 11 being over-ridden whenever the drive through the gears 17, 18 becomes effective. By these means all the pumps D driven

by the shaft B are caused to deliver spinning solution to the jets at varying rates in accordance with the form of the cam 25. By substituting other forms of cam various arrangements of varying denier may be effected.

Instead of the cam 25 being held stationary, it may be caused to rotate continuously or intermittently, preferably in a direction opposite to that of the disc 19.

Referring now to Fig. 4, the pump shown consists of a plurality of plungers 40 sliding in cylinders 41 in a barrel 42 which is rotated in a housing 43. Projections 44 on the stems 45 of the plungers 40 engage a cam groove 46 formed round a member 47 secured in the housing 43. The cam groove 46 is given an irregular outline considered with respect to the axial direction of the pump, so that the plungers are caused to move irregularly in the cylinders 41, the discharge stroke of each plunger producing an irregular flow of spinning solution to the jet or jets, it being preferred to employ several jets in connection with each pump.

Fig. 5 shows a pump 48 of the type shown in Fig. 4 supplying spinning solution to a number of nozzles 49, the discharge outlet of the pump being connected to a header 50 communicating with pipes 51 leading to the jets 49. The nozzles supplied by each pump should be few in number in order to provide a short path for the spinning solution.

Pumps having a varying output such as are described above may be used in conjunction with pumps supplying spinning solution to the jets at a regular rate, the variations in denier being produced by the superposition of the varying output from one pump upon the regular output of the other pump. Similarly, two or more pumps some or all of which have a varying output may operate to supply spinning solution to one or more jets.

It will be understood that apparatus for the supply of spinning solution such as described above is applicable to both the dry-spinning and the wet-spinning processes of producing artificial filaments or threads.

The herein described process and apparatus may be employed in conjunction with the process and apparatus described and claimed in British applications Nos. 26350/28 and 37392/28, wherein filaments or threads of varying denier are produced by drawing the filaments or threads at varying linear speeds in the course of their production.

What we claim and desire to secure by Letters Patent is:—

1. Apparatus for the production of artificial silk comprising a spinning jet, a pump adapted to supply spinning solution thereto, a plurality of means for driving the pump at different speeds, clutch means adapted to connect one or other of said driving means to the pump, and control means adapted to operate said clutch means to alter periodically the driving means in driving connection, whereby the pump is driven at a systematically varying speed so that the spinning solution is extruded from the spinning jet at a correspondingly varying speed to form filaments having a corresponding systematic variation in denier.

2. Apparatus for the production of artificial silk comprising a spinning jet, a pump adapted to supply spinning solution thereto, a plurality of means for driving the pump at different speeds, a pawl and ratchet gear in connection with each

of said driving means and adapted to effect driving connection between said driving means and the pump, and control means adapted periodically to release the ratchet gear of the driving means moving at higher speed, so that the pump is driven in turn by one or other of said driving means, whereby the pump is driven at varying

speed, and the spinning solution is extruded from the spinning jet at a correspondingly varying speed to form filaments having a corresponding systematic variation in denier.

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