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Langanke et al.

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[54] **PROCESS FOR PRODUCING MOLECULARLY ORIENTED, TEXTURED CONTINUOUS FILAMENTS**

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[52] **U.S. Cl.** ..... **57/157 TS**

[51] **Int. Cl.** **D02g 1/02**

[58] **Field of Search** ..... 57/140 R, 157 TS, 34 HS

[56] **References Cited**

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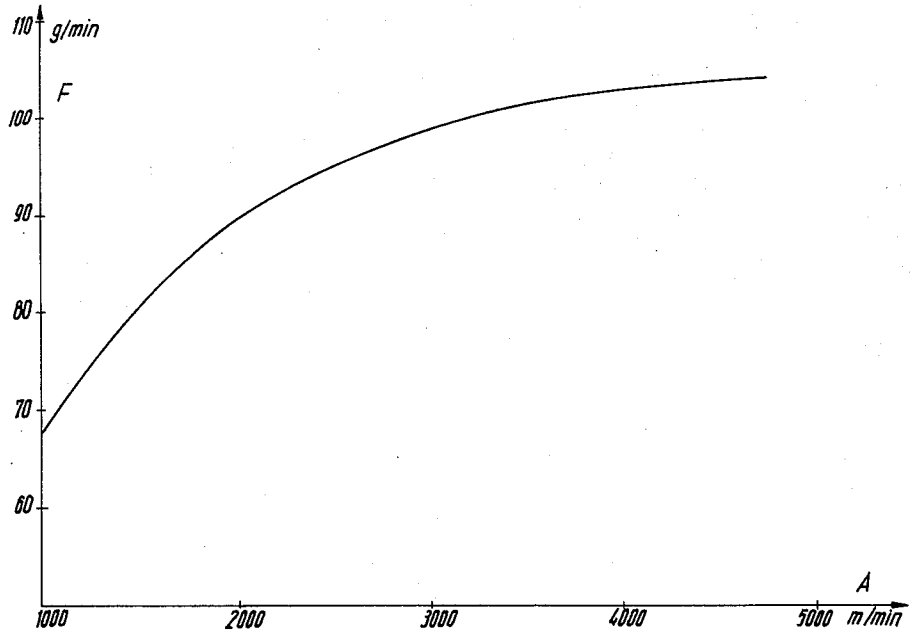
[57] **ABSTRACT**

Molecularly oriented, textured continuous filaments are made from thermoplastic materials by

a. spinning continuous filaments from a multi-orifice spinneret and drawing the filaments therefrom without deforming same at a speed of at least 2,500 meters per minute to a residual elongation at break of not greater than 200%; thereafter

b. crimping the prestretched filaments from (a) and further stretching same to a residual elongation by a false-twisting step carried out in the first heating passage of a texturing device.

2 Claims, 1 Drawing Figure



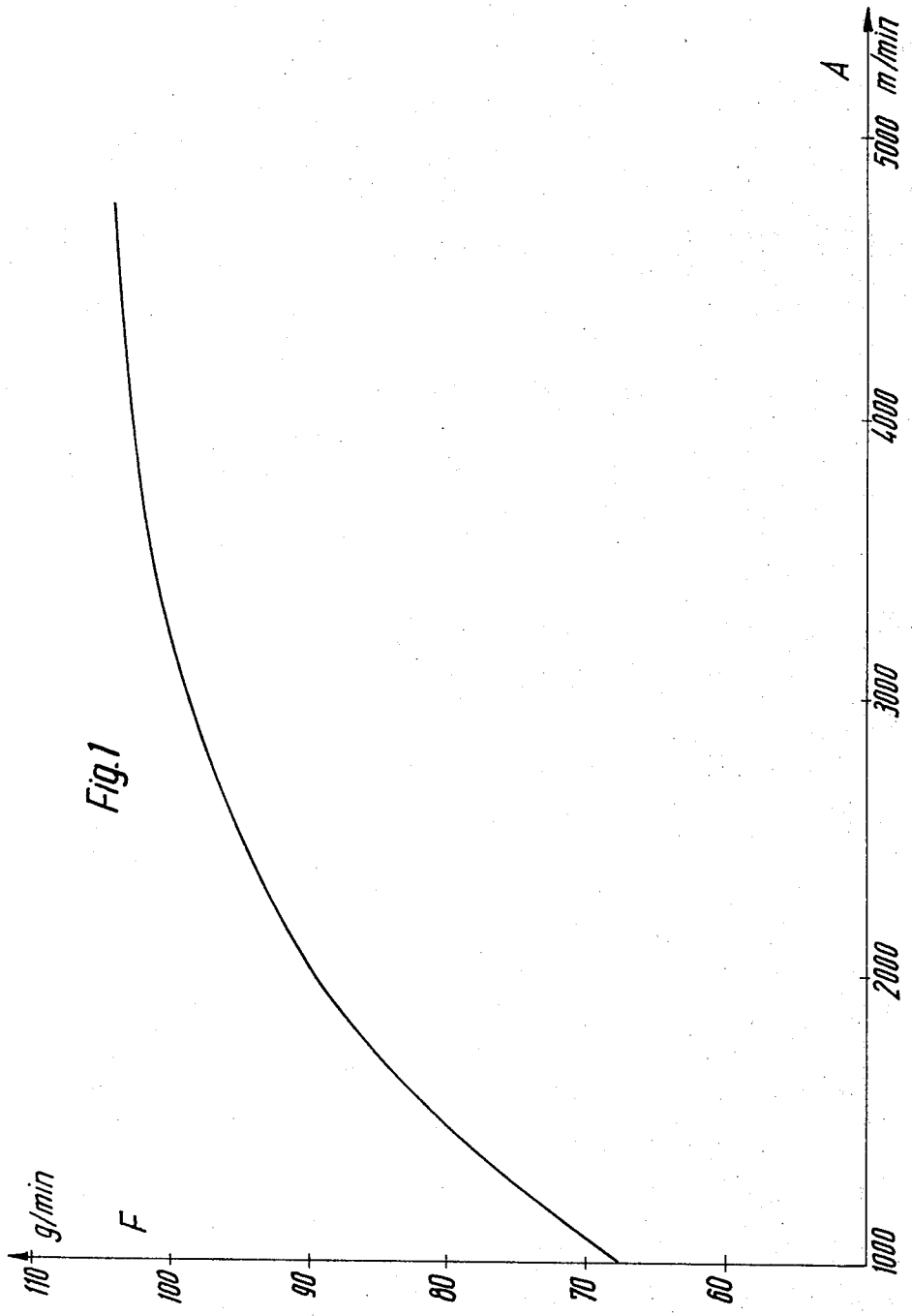


Fig.1

PROCESS FOR PRODUCING MOLECULARLY ORIENTED, TEXTURED CONTINUOUS FILAMENTS

BACKGROUND

This invention relates to a process of producing textured and molecularly oriented, continuous filaments from synthetic thermoplastics, particularly polyester or polyamide.

In a widely used, conventional process of producing textured, molecularly oriented filaments of plastics materials, filaments are taken off from a molten material and wound up. Where polyester is used as a raw material in this process, the denier of the filaments is between 70 and 150 and the take-off velocity is about 1,000 to about 1,500 meters per minute. These filaments are substantially non-oriented and are subsequently stretched with a ratio of about 1:3.2 to 1:4.0 on a two-stage stretch-twisting machine comprising a hot galette and a heated flatiron and are wound up at velocities of about 800–1,000 meters per minute.

In subsequent operation, the resulting spools are supplied to a texturing machine, e.g. by false twisiing and are crimped therein at velocities of an order of 100–150 meters per minute.

This process however has the following disadvantages: at least three operations are required to make the final crimped yarn; the filament is thermally stressed several times, and in the spinning step the throughput of the material per spinneret orifice is limited. In the case of a material which when stretched on a stretch-twisting machine has a final denier of 150 and an elongation at break of 24%, the throughput is about 65–80 grams per minute (see FIG. 1).

In another known process, filaments which have been spun and wound up at 1,000–1,500 meters per minute as described above are directly supplied to a modified texturing machine, whereas the operation carried out in the stretch-twisting machine is omitted. In this texturing machine, the material is subjected to after-stretching to the required extent of about 350%. This after-stretching is effected either by a heated stretching mechanism which precedes the texturing machine or in the first heated passage of the texturing machine. In the latter case, the feeding mechanisms and transmissions of the texturing machine must be adapted to the required velocities and the stresses to which the filaments are subjected.

These processes have the following disadvantages:

The material which has been wound at velocities of 1,000–1,500 meters per minute and is non-oriented to a large extent and has only a very limited stability in storage. It changes in time as to stretchability and stretching tension as a result of varying temperature and humidity conditions. Besides, the material can be deformed very easily.

A further disadvantage resides in the fact that special machines must be used or existing machines must be altered to texture this yarn.

The above-described, relatively small throughput per unit of time and spinneret orifice is not changed.

In view of the above, it is an object of the invention to provide a process which is free of the disadvantages mentioned above and which can be carried out with simple means to produce filaments which have a high stability in storage and can be subsequently processed

in conventional texturing machines with very little after-stretching. Specifically, the expenditure should be optimally low for high economy and a yarn should be produced which can be dyed as desired. Besides, deformation of the filaments as they are drawn should be avoided and particularly the filaments should be taken off fast as possible by commercially available means and with such a large stretching that the resulting yarn has a virtually unlimited stability in storage and the final stretching can be carried out in a simple manner during the subsequent texturing.

SUMMARY

This object is accomplished according to the invention by the combination of the following steps:

a. The filaments are spun through a multi-orifice spinneret and are drawn without deformation to a residual elongation at break of at least 200% at a velocity of at least 2,500 meters per minute. This insures stability of the filaments in storage, and

b. then crimped the prestretched filaments which have been wound up are and further stretched to a residual stretchability which is conventional in crimped yarns by a false-twisting step carried out in the first heating passage of a texturing machine.

DESCRIPTION OF THE DRAWING

In the accompanying drawing,

FIG. 1 is a graph of the extrusion rate plotted against the drawing velocity.

DESCRIPTION

The two process steps which have been described can be carried out with a high economy because relatively simple take-off means of known type may be used and the second process step may be carried out by conventional texturing machines if they are adjusted to stretch the material to a certain extent.

The filaments may be desirably taken off and wound up at speed of about 3,000–4,000 meters per minute. At these speeds, a polyester filament will have an elongation at break of about 150-90%. When the wound-up filaments are crimped, they are subjected to after-stretching with a ratio of about 1:1.2 to 1:1.8.

The drawing step is preferably carried out by mechanical means. The filaments are drawn and wound up by a highspeed winder, which is operated at a peripheral velocity that corresponds to the drawing velocity. Because the resulting filaments have been stretched to a considerable extent, but not completely, they have a high degree of molecular orientation and for this reason a high stability. Specifically, the filaments thus produced can be stored for a long time even under varying climatic conditions.

On the other hand, the known filaments having a low orientation have only a low stability in storage and are mechanically weak. Due to these properties, the use of the filaments after a relatively long time and the shipment of the filaments are rather difficult. According to the invention, the drawing means are preferably operated without using heated parts, such as galettes or heated passages and without using fluids at elevated temperature.

When the filaments has emerged from the spinneret, it is no longer subjected to thermal stresses. During the subsequent take-off, the take-off forces are not so strong that a substantial deformation of the filaments

other than the reduction in cross-section can result. Specifically, the cross-section of a filament which has been extruded through a circular spinneret orifice will remain circular.

It has been surprisingly found that the use of take-off velocities within the range taught by the invention results in an optimum economy and productivity, on the one hand, and in filaments having an excellent quality.

FIG. 1 is a chart plotting the extrusion rate in grams per minute per spinneret hole (F axis) against the take-off velocity (A axis). The curve corresponds to an extrusion rate which is required to produce a final product having a nominal denier of 150. It is apparent that this extrusion rate, which is important for the productivity, is about 100 grams per minute for velocities in the range of 3,000–4,000 meters per minute. This corresponds to an increase by more than 25% over the value for 1,000–1,500 meters per minute.

The underformed filaments produced in the process according to the invention are a starting material which can easily be processed in conventional machines for producing crimped yarn. It has surprisingly been found that these filaments have a better dye acceptance than filaments which have drawn and stretched in the conventional process over cold and/or hot galettes and over heated flatirons.

The filaments are preferably withdrawn at a rate of about 3,000–4,000 meters per minute to an elongation at break below 150% down to about 90%. It has been found that with an elongation at break in this range, the filaments can be supplied in an advantageous manner to the texturing machines such as are known and used in the textile industry, without need for a further adaptation of such machines. As a result, special texturing machines need not be procured. Details of the process according to the invention will be explained more fully hereinafter:

Polymer granules are melted in an extruder. The polymer may consist, e.g., of polyester or polyamide although other meltspinnable polymers and copolymers are possible as a starting material.

The polymer is supplied from the extruder by a spinning pump to a multi-orifice spinneret. Filaments emerge from the spinneret orifices and are cooled by an air stream. The filaments are mechanically drawn by means of a high-speed winder at a filament velocity of about 3,000 meters per minute so that the elongation at break of the filaments is, e.g., about 150% in the case of polyester.

Filament guides and/or a non-heated galette provided with deflecting rollers may be disposed between the spinneret and the drawing assembly. Filaments having a denier in the textile range have a considerable molecular orientation and a tensile strength of, e.g., 2.7 grams per denier. If a somewhat higher take-off velocity of 4,000 meters per minute is selected, the filaments will have a residual elongation at break of about 90%. After this process step, the partly stretched filaments can be stored for a considerable time of several months.

The filaments are further processed by being mechanically crimped on a false-twisting machine known per se and are simultaneously afterstretched in the first heated passage. This stretching should be carried out at a stretch ratio of 1:1.6 (in case of an initial elongation at break of 115%) or of 1:1.5 (in case of an initial elongation at break of 100%). This ratio can easily be adjusted on conventional texturing machines. The clamping pressure applied by the feed rollers may be increased to some extent, if required.

The set polyester yarns produced by this process are similar in physical properties to filaments which have been processed to form set yarns in conventional processes.

In a texturing machine for carrying out the known false-twisting process, the filament travels between the feed rollers and through a heated passage to the false-twisting spindle, further to the first drawing mechanism and in the production of so-called set yarns through another heated passage to the second set of draw rolls and finally to the winder. The filament travelling through the false-twisting spindle rotating at 700,000 revolutions per minute has imparted to it on the feed side a false twist, which is immediately set in the first heating passage. On the discharge side of the false-twisting spindle, this twist is removed. Between the two doffers, part of the resulting elasticity is removed by the action of heat in the second heated passage so that the resulting yarn is crimped but is not highly elastic.

What is claimed is:

1. Process for producing synthetic textured yarn of molecularly oriented filaments which comprises
   a. spinning continuous filaments from a multi-orifice spinneret and at the same time winding the freshly spun filaments and thus drawing them with a longitudinal speed of at least 2,500 meters per minute to a residual elongation at break of not greater than 200% to produce a prestretched and still drawable untextured yarn; thereafter
   b. in a false twisting step, crimping said drawable untextured yarn and stretching it in the first heating passage of the false twisting device, the stretching being done at a draw ratio between 1.2 and 1,8.

2. Process of claim 1 wherein the filaments are drawn at a velocity of about 3,000–4,000 meters per minute to an elongation at break less than 150% down to about 90%.

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