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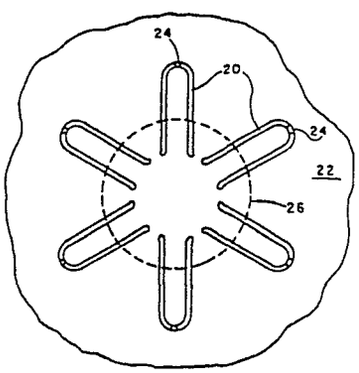
(54) **Process for melt-spinning a splittable conjugate filament; self-texturing splittable conjugate filament; and method of splitting such a filament.**

(57) Self-texturing sub-filaments split from a conjugate filament. The conjugate filament is melt spun from dissimilar polymers, the spinning and quenching conditions being selected such that the conjugate filament has no substantial crimp while the sub-filaments split therefrom have substantial latent torqueless helical crimp. Preferably the conjugate filament is hollow. A preferred spinneret blank 22 has horseshoe shaped slots 20 with recessed web regions 24. Two dissimilar polymers are fed as a sheath-core conjugate stream with polymer interface 20.



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PROCESS FOR MELT-SPINNING A SPLITTABLE CONJUGATE FILAMENT; SELF-TEXTURING SPLITTABLE CONJUGATE FILAMENT; AND METHOD OF SPLITTING SUCH A FILAMENT

The invention relates to the art of conjugate filaments splittable into sub-filaments. More particularly, it relates to a process and product wherein the conjugate filament itself has no substantial texture while sub-filaments splittable therefrom have substantial latent torqueless helical crimp.

Conjugate filaments splittable into sub-filaments are known to the art, as typified by Hayashi U.S. Patent 4,051,287. As disclosed therein, alternating segments of polyamide and polyester are spun in a side-by-side adhering relationship to form a hollow filament splittable into sub-filaments. Such sub-filaments can be of smaller denier than can be conventiently spun as separate filaments, lending a soft hand to fabrics made therefrom. The sub-filaments of Hayashi are not disclosed as possessing significant crimp, and, as illustrated in Figure 10 of the patent, are substantially flat (untextured) even though the conjugate filament had been textured by the false-twist heat-set method before being split into sub-filaments.

According to the invention, there is provided a conjugate filament splittable into sub-filaments having substantial latent torqueless helical crimp.

According to a major aspect of the invention, there is provided a process for melt-spinning a hollow conjugate filament splittable into spontaneously texturing sub-filaments, the process comprising extruding a hollow

molten stream formed from axially extending segments of dissimilar polymers arranged alternately in side-by-side adhering relationship to form the hollow molten stream; quenching the stream under given conditions to form a filament; and withdrawing the filament from the molten stream at a given spinning speed, the polymers, the given spinning speed and the given conditions being selected such that sub-filaments split from the filament possess substantial latent torqueless helical crimp.

According to another aspect of the invention, some of the segments are of polyamide polymer and others of the segments are of polyester polymer.

According to another aspect of the invention, the polyamide polymer is nylon 66 and the polyester polymer is polyethylene terephthalate.

According to another major aspect of the invention, there is provided a conjugate filament comprising sub-filaments releasably attached to one another in a side-by-side relationship, the filament being substantially free of crimp, the sub-filaments possessing substantial latent torqueless helical crimp.

According to another aspect of the invention, the filament is hollow.

According to another aspect of the invention, some of the sub-filaments are formed from a polyamide polymer and others of the sub-filaments are formed from a polyester polymer.

According to another aspect of the invention, the polyamide polymer is nylon 66 and the polyester polymer is polyethylene terephthalate.

Other aspects of the invention will in part appear hereinafter and will in part be obvious from the following detailed description taken together with the accompanying drawing, in which:

The FIGURE is a bottom plan view (looking up) of the preferred spinneret orifice used in practicing the invention.

As shown in the FIGURE, the preferred spinneret construction includes several generally arched or horseshoe-shaped slots 20 in spinneret blank 22 arranged symmetrically about a central point, the open ends of the horseshoe shape facing inwardly. The several slots 20 constitute a combined orifice for spinning a single filament. Slots 20 extend entirely through blank 22 except for a recessed web region 24 at the apex of each slot 20. The two dissimilar polymers are fed to the combined orifice as a sheath-core stream, with dotted circle 26 representing the interface between the two polymers. The adjacent ends of adjacent slots 20 are sufficiently close that the streams issuing therefrom unite just below the spinneret. The molten stream is thus a hollow structure composed of alternating axially extending segments of the two polymers. Surface tension and other effects tend to make the molten stream approach a hollow circular cross-section prior to solidification, substantially as shown in Hayashi Figure 1.

Each polymer segment accordingly has a portion of its periphery exposed to quenching on the exterior of the hollow stream, and an opposite portion shielded and not so exposed since it lies in the interior. According to the invention, the molten stream is exposed while under the stress of spinning to quenching sufficiently rapid as to produce substantial latent torqueless helical crimp in the sub-filaments splittable from the conjugate filament.

Example I

Nylon 66 polymer and polyethylene terephthalate polymer, each of normal molecular weight for apparel end uses, are extruded at a temperature of 290°C. through the combined orifice, the nylon polymer being the core of the sheath-core stream approaching the combined orifice. Equal volumes of the two polymers are supplied, with the extrusion rate selected to produce a conjugate filament having a denier of 19.5 at a spinning speed of 1500 yards (about 1350 meters) per minute. A quench zone just beneath the spinneret and $1\frac{1}{2}$ meters in height is supplied with quenching air at 20°C., the air being directed horizontally onto the polymer stream and having a speed of 25 meters per minute. Below the quench

zone, steam is applied to the filament, a conventional finish is applied, and the filament is wound.

The spun filament is then drawn at 65 meters per minute and at a draw ratio of 2.16 over a contact heater at 132°C., the heater being 0.4 meters long. The resulting drawn yarn, when mechanically worked to break the conjugate filament into 12 sub-filaments, develops substantial torque-less helical crimp when subjected to boiling water.

Example II

Seventeen of the above spun filaments are spun simultaneously and collected as a multifilament yarn under the spinning conditions of Example I. The spun yarn is then draw-textured at 540 meters per minute over a two meter heater set at 220°C. The resulting textured yarn, when separated into sub-filaments and relaxed, is very voluminous and has high covering power.

Example III

Example I is repeated, except that the spinning speed is increased to 4500 meters per minute while the denier of the conjugate filament is reduced to 4. The resulting sub-filaments, after separation and immersion in boiling water, form a highly voluminous and lofty yarn. Fabrics formed from the conjugate yarn acquire a very soft hand and increased bulk and covering power when the fabric is mechanically worked enough to separate the yarn into sub-filaments. Simple exposure of the fabric to boiling water is adequate in many instances, since the flexing of the yarn involved in certain fabric formations separates the sub-filaments.

What is claimed is:

1. A process for melt-spinning a hollow conjugate filament splittable into spontaneously texturing sub-filaments, said process comprising:

a. extruding a hollow molten stream formed from axially extending segments of dissimilar polymers arranged alternately in side-by-side adhering relationship to form said hollow molten stream;

b. quenching said stream under given conditions to form a filament; and

c. withdrawing said filament from said molten stream at a given spinning speed, said polymers, said given spinning speed and said given conditions being selected such that sub-filaments split from said filament possess substantial latent torqueless helical crimp.

2. The process defined in claim 1, wherein some of said segments are of polyamide polymer and others of said segments are of polyester polymer.

3. The process defined in claim 2, wherein said polyamide polymer is nylon 66 and said polyester polymer is polyethylene terephthalate.

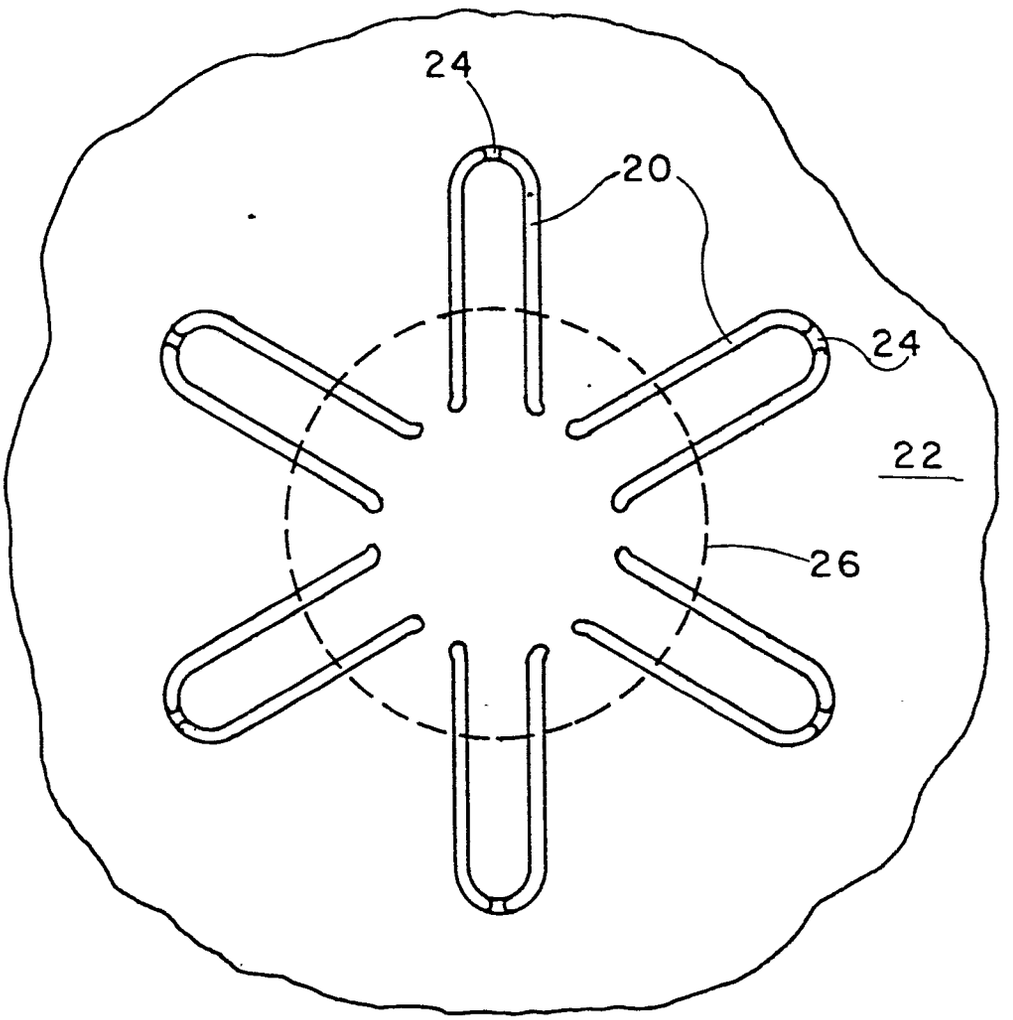
4. A conjugate filament comprising sub-filaments releasably attached to one another in a side-by-side relationship, said filament being substantially free of crimp, said sub-filaments possessing substantial latent torqueless helical crimp.

5. The filament defined in claim 4, wherein said filament is hollow.

6. The filament defined in claim 4, wherein some of said sub-filaments are formed from a polyamide polymer and others of said sub-filaments are formed from a polyester polymer.

7. The filament defined in claim 6, wherein said polyamide polymer is nylon 66 and said polyester polymer is polyethylene terephthalate.

8. A method comprising splitting a filament defined in any of claims 4 to 7 into sub-filaments.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EUROPEAN SEARCH REPORT

Application number 0013186

EP 79 30 3081

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 3 117 906 (DU PONT) * Claims 1,4,5 * --	1-4,6,7
D,A	US - A - 4 051 287 (TEIJIN) * Claim 29; column 10, lines 41-50; column 8, lines 13-19 * ----	1,2,6,8

CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)

D 01 D 5/30
5/24

TECHNICAL FIELDS SEARCHED (Int.Cl. ³)

D 01 D 5/30
5/32
5/36
5/24
5/22

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
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X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12-03-1980	CATTOIRE

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