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A. G. BEAUMONT
FILAMENTARY MATERIAL
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3,273,771

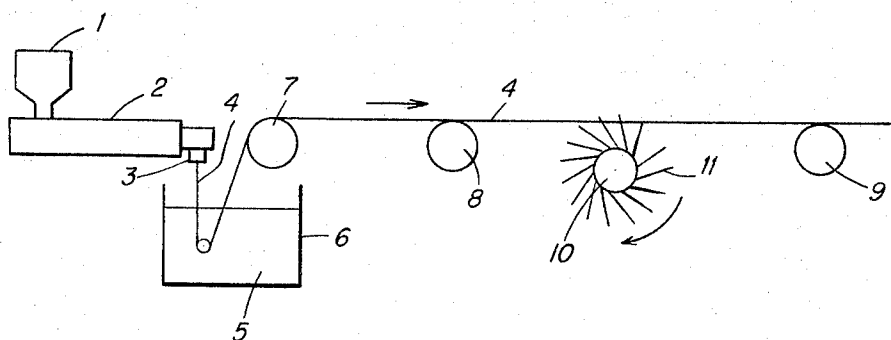
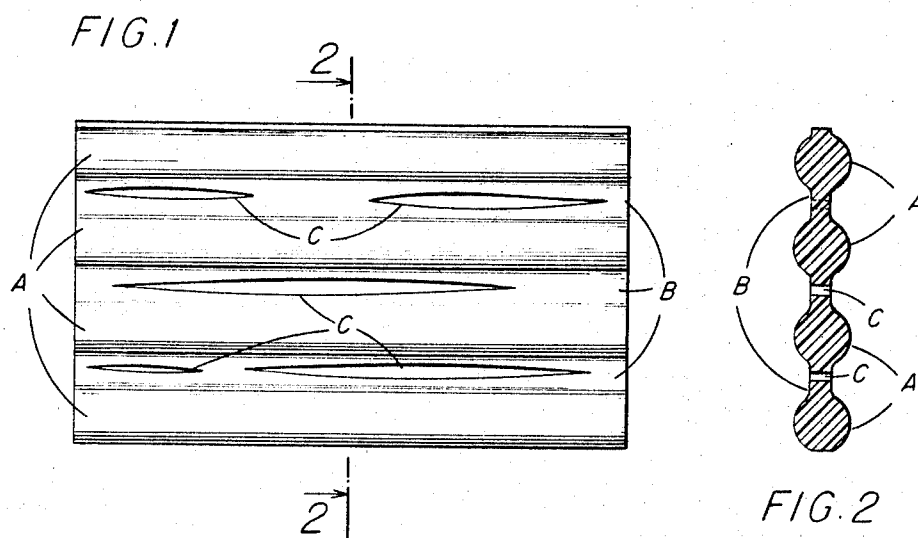


FIG. 3

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FILAMENTARY MATERIAL

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2 Claims. (Cl. 225—3)

This invention concerns a filamentary product of polyethylene or polypropylene, referred to hereafter as a "polyolefinic filamentary material."

Polyolefinic filaments are made by two processes, both of which employ melt-extrusion of the polymer. One process is capable of making only relatively coarse filaments, the other produces yarns of finer filaments. The former, referred to herein as the "monofilament process," is the cheaper to operate and it would be advantageous if the process could be modified to produce finer filaments, or combinations of finer filaments which can be twisted into a yarn which has a greater flexibility than yarns composed of coarse monofilaments.

A difficulty in the manufacture of filaments by the monofilament process is the increase in the rate at which filaments break at the jet and during stretching when a reduction is made in the size of the filament. The problem becomes acute at filament deniers below about 80.

It has been proposed to manufacture finer filaments by extruding a polyolefin to form a ribbon and subsequently slicing the ribbon into filaments. This modified process takes advantage of the easier conditions of extruding the polyolefin through a slit of relatively large cross-sectional area, but the slicing process is not easily controlled continuously. The ribbon is usually sliced by drawing it through a comb of teeth having cutting edges facing the oncoming ribbon and, as the ribbon has no lines of weakness corresponding to the pitch of the teeth, changes in the action and reaction of the teeth and ribbon can divert more or less of the ribbon between a pair of teeth and, in this way, filament denier variation occurs. One cause of changes in the reciprocal forces between the teeth and the ribbon is the collection of fibrils on the comb. Fibrils are produced by the abrading action of the teeth on the freshly cut surfaces of the filaments and they tend to congregate on and near the cutting edges, increasing the tension in the already separated filaments and doing this unevenly across the width of the ribbon, so that the ribbon and the teeth are subjected to fluctuating transverse forces.

An object of the present invention is a filamentary material which can be twisted to form a yarn more flexible than a yarn of the same denier and composed of monofilaments of more than 80 denier.

According to the present invention a polyolefinic filamentary material comprises a close array of collateral filaments each of less than 80 denier and connected by a web between each adjacent pair of filaments, at least some of the webs having longitudinally disposed slits at intervals along their length.

The invention includes a process of making the filamentary material by extruding the array with continuous webs and, after stretching the array longitudinally of the filaments, providing longitudinally disposed slits at intervals along at least some of the webs. The width of the webs need not exceed the diameter of a component filament, but, apparently, the webs cannot be eliminated entirely, as would occur in an array of filaments fused directly to one another along their length, because of the difficulties of duplicating the cross-sectional shape of the jet-hole in the extruded array.

The extruded array has an advantage over the ribbon referred to above, in that it has clearly defined lines of weakness, namely the webs. It is, therefore, unnecessary for the slitting operation to provide a cutter in which the cutting edges are spaced from one another at the pitch of the filaments in the array. The problem referred to above of fouling of the cutter by fibrils may be solved by drawing the array longitudinally onto an endless assembly of points moving in the same direction as, but more rapidly than the array. The points cyclically pierce and slit the webs longitudinally and then disengage, so that the fibrils made by any point are freed from that point with its disengagement and carried away by the array. In this way the harmful congregation of fibrils on the cutting point is eliminated.

The slitting operation works best when the points are raked relatively to their direction of movement, that is when the base precedes the head. The raked points are apparently more easily diverted from a first contact with a filament into contact with an adjoining web.

The endless assembly of points may be a roller clothed with points, a cylindrical wire brush rotatable on its axis or yet again contra-rotating outerdigitating spiders carrying points on the extremities of the fingers, the array passing between the nip of the spiders and thereby being forced onto at least one set of points continuously.

The filamentary material may be continuous or in short lengths. The continuous material may be twisted on itself or together with other similar arrays to form a yarn. Such a yarn is more flexible than a yarn of equal denier but composed of coarse monofilaments, and is not merely a twisted ribbon, for the longitudinally slit webs allow adjacent filaments to adjust their relative positions in response to the twisting forces and the yarn has the condensed structure of a more conventional multifilament yarn and none of the buckled character of a twisted ribbon.

When the filamentary material is cut into shorter lengths, an amount of discrete staple fibres are produced from those filaments which were lying between slits in adjacent webs. The cut material will also include arrays of staple fiber joined by webs, some of which are slit. This material may be rendered into staple fibre on conventional opening and carding machinery and slivers of the aligned fibres can be spun into yarns which, too, exhibit improved flexibility over the known yarns of coarser filaments.

The invention is illustrated by the accompanying drawings of which FIGURE 1 is a plan view of part of an array of filaments, FIGURE 2 is a view in vertical section along the line 2—2 of FIG. 1, and FIGURE 3 is a schematic representation of the process.

Referring to FIGURES 1 and 2, the polyolefinic material is composed of collateral filaments A, with adjacent pairs joined by webs B having longitudinally disposed slits C.

In FIGURE 3, a fibre-forming grade of a high-density polyethylene was fed from a hopper 1 to a heated extruder 2 which melted the polymer and forced it through a jet 3 comprising a slit 1.5 inches long and 0.005 inch wide connecting forty-three equi-spaced circular holes, each having a diameter of 0.018 inch. The extruded polymer, in the form of an array 4 of webbed collateral filaments was quenched with water 5 at a temperature of 90° C., under steady conditions, in a bath 6. The array was stretched by 850 percent its original length in passing from a godet 7 rotating at a peripheral speed of seven metres/minute to a take-up roller 8 rotating at a peripheral speed of 59.5 metres/minute. At this stage, the denier of the array 4 was 4000 and the component filaments had a diameter of 0.004 inch. The

3

array 4 was drawn by a second roller 9 from the roller 8 and into contact with a cylindrical wire brush 10 having raked points 11 rotating with a peripheral speed of 85 metres/minute in the sense that the array 4 and the points 11 in contact were moving in the same direction. The points 11 pierced and split the webs B to produce longitudinally disposed slits C, forming the filamentary material which was drawn onto the roller 9.

What I claim is:

1. A method of making filamentary material comprising combing an array of collateral filaments each of less than 80 denier with webs connecting adjacent filaments, the thickness of said webs being substantially less than the diameter of said filaments, which comprises moving the array longitudinally into contact with an endless assembly of points moving in the same direction as and more quickly than the array, whereby the points pierce and slit lengths of the webs.

2. A method as claimed in claim 1 in which the end-

4

less assembly of points is a roller clothed with raked points.

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