(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 182 615**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **85308296.4**

(22) Date of filing: **14.11.85**

(51) Int. Cl.⁴: **D 01 D 4/02**

(30) Priority: **15.11.84 US 671920**

(43) Date of publication of application: **28.05.86 Bulletin 86/22**

(84) Designated Contracting States: **DE GB IT NL**

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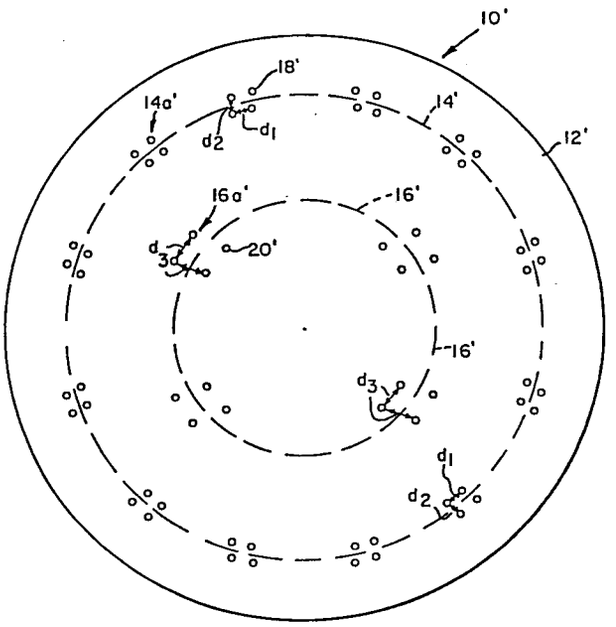
(54) Spinneret.

(57) The conventional spandex spinneret has two rings of equally spaced grouped orifices, each filament being formed by coalescence of the extrudate from the grouped orifices. A spandex spinneret having the holes of the orifices of each group of the outer ring of groups more closely spaced than those of the inner ring or groups has eliminated the power differences between inner and outer threadlines. The closer spacing within each group of the outer ring of groups also increases the spacing between groups, thereby reducing filament migration.



TITLE

SPINNERET

BACKGROUND OF THE INVENTION

This invention relates to composite textile yarns. More particularly it relates to coalesced multifilament yarn, especially spandex yarn and to a spinneret for obtaining such a yarn.

Smith U.S. Patent No. 3,094,374 and Hunt U.S. Patent No. 3,428,711 describe methods for preparing coalesced spandex filaments. In a preferred embodiment described by Smith the yarns contain individual filaments which adhere to one another to form a unitary group of filaments. The Hunt patent which discloses a preferred process for making the filaments in Examples I and II is incorporated herein by reference.

The conventional spinnerets used for light denier spandex production have two rings, i.e., an outer ring and an inner ring of grouped orifices wherein each group is composed of four holes. The spacing between holes of each grouping is the same regardless of whether the group is in the inner or outer ring.

Higher spinning productivity has been achieved by increasing the number of groups of filaments per spinning cell. The greater number of groups increases the frequency of filament migration between groups and magnifies differences in drying environment between inner and outer groups. This results in different power levels that adversely influence yarn and fabric appearance.

SUMMARY OF THE INVENTION

A new spinneret wherein the orifice spacing of the groupings of the outer ring is substantially less than those of the inner ring has been shown to

essentially eliminate power differences between groups. Further, filament migration is reduced thereby increasing yields.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a plan view of a prior art spinneret used for spandex production.

FIG. 2 shows a plan view of a preferred embodiment of the spinneret of this invention for spandex production.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, the prior art spinneret 10 chosen for purposes of illustration includes a plate 12 having an outer ring 14 and an inner ring 16 of grouped orifices 14a, 16a respectively with each individual orifice in the groups in the outer ring and inner ring designated by the numbers 18 and 20 respectively. The peripheral and radial distances d between orifices of each group 14a, 16a in the outer and inner rings 14, 16 are the same for both outer and inner ring groups.

By comparison, the spinneret of this invention is shown in FIG. 2 wherein like numerals for like elements are used. More particularly, the spinneret 10' includes a plate 12' having an outer ring 14' and an inner ring 16' of groups of orifices 14a', 16a'. As before, each individual orifice is designated 18' and 20' in the outer and inner rings, respectively. The peripheral distance d_1 and the radial distance d_2 between the orifices in the groups 14' in the outer ring 14' of groups are the same for each group in the outer ring. In the preferred embodiment shown, d_1 is greater than d_2. However, each of the distances d_1, d_2 are less than the distance d_3 between the orifices in the groups 16a'.

While the preferred embodiment shows d_1 to be greater than d_2, a spinneret with d_1 equal to d_2 or d_1 less than d_2 will perform as well.

In addition, while the preferred embodiment shows four orifices in each group, three orifices in each group will work as well providing the distance between orifices in the groups in the outer ring of groups is less than the distance between orifices in the groups in the inner ring of groups.

LOAD POWER TEST DESCRIPTION

Load power (T300) is stress at 300% elongation. Five samples of spandex yarn each 5" long, are tested at 2" gauge length using an Instron® tensile tester at 1000% per minute strain rate. The value in grams (g) of the stress at 300% elongation is reported as load power.

The spinneret described in connection with FIG. 2 has been shown to essentially eliminate load power differences between threadlines or coalesced groups of filaments.

EXAMPLE 1

A spandex spinning solution, prepared as described in Examples I and II of U.S. Patent No. 3,428,711, was extruded through a 64-hole spinneret to form 16 coalesced threadlines. The arrangement of holes in the spinneret is shown in FIG. 2. Within each quadrant of the spinneret, there are four groups of orifices, each group made up of four holes. Three of the groups are located equidistant from the center of the spinneret so as to form an outer ring, the remaining group is located between the center and the outer ring. Within each group of orifices of the outer ring, the four holes are spaced approximately 0.20" (5.1 mm) from each other. The hole spacing for the orifices of the inner group is 0.39" (9.9 mm).

The spinning solution was extruded at a rate of 6.2 pph and wound up at about 730 mpm to yield sixteen 40 denier fibers, each fiber formed from 4 coalesced 10 denier filaments. Of the sixteen fibers, twelve are designated outer ring fibers, four are inner ring fibers.

The load power (T300), for inner and outer ring fibers is given in Table 1 in comparison to those of a product from a prior art spinneret of Example 2.

EXAMPLE 2

Example 1 was repeated using a prior art spinneret as shown in FIG. 1. This spinneret has 64 holes, arranged in sixteen groups of four holes. Twelve of the groups form the outer ring, four groups form the inner ring. The spacing between the orifices of each group is 0.39" (9.9 mm) for both outer and inner ring groups.

The load power for inner and outer ring fibers are given in Table 1.

TABLE 1

	Example 1	Example 2
Load Power (T300) g.		
Inner	15.89	15.77
Outer	15.90	16.39
Difference, %	0.06	4.0

EXAMPLE 3

A 24-thread, 40 denier spandex fiber was produced using a 96-hole spinneret. The 96 holes are divided among 24 groupings, each group having 4 holes. There are 16 outer groupings and 8 inner groupings. Hole-to-hole spacing is 0.32" for both inner and outer threadlines. Solution was fed at a rate of 10.0 pph and fiber wound up at about 814 mpm.

The outer threadline load power (T300) is 16.39 g, the inner threadline retractive load power (T300) is 15.94 g, a difference of 0.45 g.

EXAMPLE 4

Example 3 was repeated using a 96-hole spinneret of this invention wherein the outer hole spacing was 0.20" and the inner hole spacing was 0.35".

Outer threadline load power (T300) was 16.89 g, inner threadline load power is 16.94 g. The 0.05 g difference in threadline retractive load power (T300) is an order of magnitude improvement over the fiber of Example 3.

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CLAIMS:

1. A spinneret for the production of spandex filaments comprising a plate having an outer ring and an inner ring of grouped orifices, each group being comprised of a plurality of orifices spaced from each other, characterized in that the distance between orifices in each group in the outer ring of groups is less than the distance between the orifices in each group in the inner ring of groups.

2. A spinneret as claimed in claim 1, there being four groups of orifices in the inner ring of groups and twelve groups of orifices in the outer ring of groups.

3. A spinneret as claimed in claim 1 or claim 2, there being four orifices in each group.

4. A spinneret as claimed in any one of claims 1 to 3, further characterized in that the peripheral distance between the orifices in each group in the outer ring is greater than the radial distance between the orifices in each group in the outer ring.

5. A spinneret as claimed in any one of claims 1 to 3, further characterized in that the peripheral distance between the orifices in each group in the outer ring is equal to the radial distance between the orifices in each group in the outer ring.

6. A spinneret as claimed in any one of claims 1 to 3, further characterized in that the peripheral distance between the orifices in each group in the outer ring is less than the radial distance between the orifices in each group in the outer ring.

FIG. 1
(PRIOR ART)

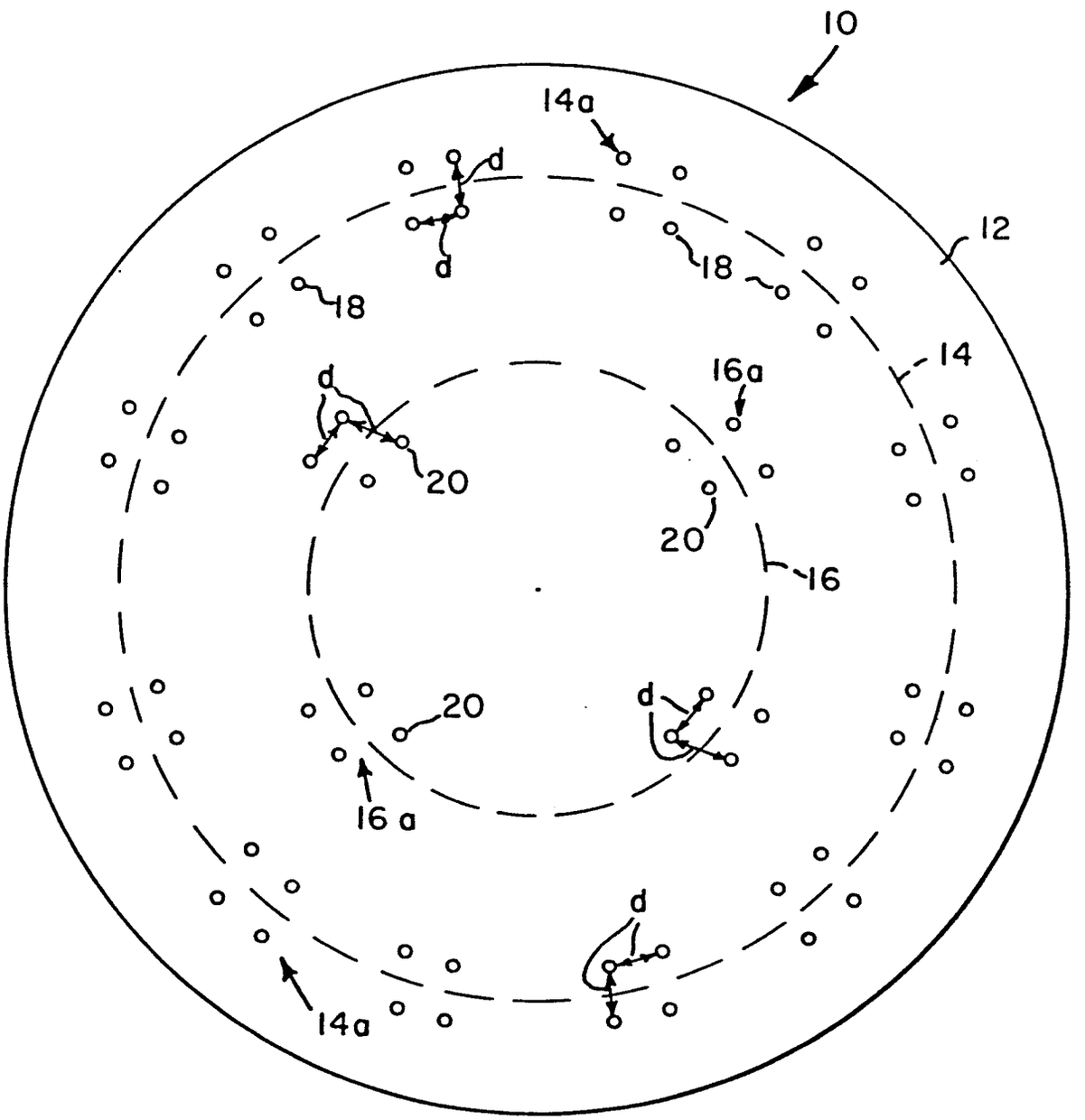

FIG. 2