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EUROPEAN PATENT APPLICATION

21 Application number: 81300457.9

51 Int. Cl.³: **D 02 G 3/34**

22 Date of filing: 03.02.81

30 Priority: 18.02.80 GB 8005388

43 Date of publication of application:
26.08.81 Bulletin 81/34

84 Designated Contracting States:
DE FR GB IT NL

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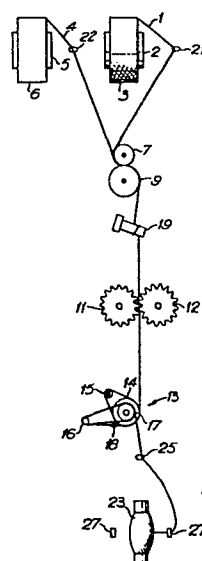
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54 Gear crimped jaspé yarns and processes for their manufacture.

57 There is provided a drawn gear-crimped yarn with latent bulk, the yarn being a nodally interlaced composite yarn comprising polyester continuous filaments and polyamide continuous filaments in the weight ratio 90:10 to 10:90 and the amount and nature of the bulk and the interlacing being such that the composite yarn has an initial crimp as defined of 2% to 12%, a mechanical crimp stability as defined of above 0% and has 40 to 140 nodes per metre. The gear-crimped yarn may be produced by heating a drawable polyester yarn (1) having a birefringence of at least 30×10^{-3} and a drawable polyamide yarn (4) having a birefringence of at least 30×10^{-3} , simultaneously drawing and gear-crimping the composite yarn by means of toothed draw rolls (11, 12), forwarding the crimped composite yarn from the toothed draw rolls under a controlled tension within the range 0.15 to 0.50 g per decitex based on the decitex of the drawn composite yarn and subsequently nodally interlacing (18) the composite yarn such that it has 40 to 140 nodes per metre, the weight ratio of the polyester yarn to the polyamide yarn being in the range 90:10 to 10:90.



GEAR CRIMPED JASPE YARNS AND PROCESSES
FOR THEIR MANUFACTURE

The present invention relates to improved jasje yarns and to processes for their manufacture.

5 A jasje yarn has the general appearance of two differently coloured yarns twisted together; however, it is made by texturing together two continuous filament yarns of different dyeability and then dyeing the textured yarn, generally in fabric form.

10 Gear crimping of synthetic yarns is well known in the art. A process for drawing and gear crimping an undrawn synthetic yarn is described in British Patent Specification 984 922. The use of undrawn polyamide and polyester yarns is described. Gear crimping of drawn synthetic yarns is also known. The use of undrawn polyester yarn in a draw-gear crimping process is unsatisfactory because of extremely low bulk and breaking of
15 filaments in the process. The use of drawn polyester yarn in a gear crimping process is unsatisfactory because of unacceptably low bulk. The low bulk achieved is particularly apparent in finished fabric made from the crimped yarn.

20 In our co-pending European patent application number 79302089, there is described a drawn gear-crimped polyester yarn with latent bulk the amount and nature of the bulk being such that the yarn has an initial crimp as defined of at least 1.5%, preferably of above 2%, and a mechanical crimp stability as defined of above 0%. The crimped polyester yarn may be produced
25 by heating a drawable polyester yarn having a birefringence in the range 32×10^{-3} to 125×10^{-3} inclusive, preferably 35×10^{-3} to 125×10^{-3} inclusive, crimping the yarn by guiding it between the intermeshing teeth of a set of toothed wheels such that the yarn is caused to follow a sharply zig-zag path,
30 the toothed wheels being rotated at a sufficient speed such that the yarn is drawn by the tension so imparted to the yarn by the toothed wheels and subsequently forwarding the crimped yarn from the toothed wheels under a controlled tension within the range 0.15 to 0.50 g per decitex inclusive based on the

decitex of the drawn polyester yarn.

It has now been found possible to produce a drawn gear crimped jaspe yarn having a useful bulk. Compared with conventional false twist crimped yarns, the bulk of the gear-
5 crimped yarns according to the present invention is low; however, the amount and nature of the bulk make the present yarns extremely suitable for the production of fabrics having desirable aesthetics.

According to the present invention, there is provided
10 a drawn gear-crimped yarn with latent bulk characterised in that the yarn is a nodally interlaced gear-crimped composite yarn comprising polyester continuous filaments and polyamide continuous filaments in the weight ratio 90:10 to 10:90 inclusive, the gear-crimped composite yarn having an initial
15 crimp as defined herein of 2% to 12%, preferably 2% to 8%, a mechanical crimp stability as defined herein of above 0% and having 40 to 140 interlaced nodes per metre.

Preferably the composite gear crimped yarn has been nodally interlaced to an extent such that the yarn has 70
20 to 100 nodes per metre.

According to the present invention, there is further provided a process for producing a drawn gear-crimped yarn with latent bulk characterised in that a drawable polyester continuous filament yarn having a birefringence of at least
25 30×10^{-3} and a drawable polyamide continuous filament yarn having a birefringence of at least 30×10^{-3} are heated and simultaneously drawn and gear crimped together as a composite yarn by means of toothed draw rolls and the composite yarn is forwarded from the toothed draw rolls under a controlled
30 tension within the range 0.15 to 0.50 g per decitex inclusive based on the decitex of the drawn composite yarn and is subsequently interlaced to have 40 to 140 nodes per metre, the weight ratio of the polyester yarn to the polyamide yarn being in the range 90:10 to 10:90 inclusive.

35 Initial crimp (EK) and mechanical crimp stability (KB) are defined as follows:-

The gear crimped composite yarn with latent bulk is wound at a tension of 1.0 centi-newtons (cN) per tex to form a skein of 1 metre circumference and total decitex of 2500. Thus, for example, 16 wraps are required for a yarn having a decitex of 76. The skein is hung and preloaded with a load of 0.01 cN per tex. The preloaded skein is heated at 120°C for 10 minutes to develop the bulk and is then cooled. The skein is subjected to a force of 1 cN per tex for 10 seconds and its length (L_0) is measured. After an interval of 10 minutes, the length of the skein is remeasured (L_1) supporting the pre-load of 0.01 cN per tex. After an interval of 10 minutes, a force of 0.1 cN per tex is applied for 10 seconds and immediately afterwards a high force of 10 cN per tex is applied for 10 seconds. After 20 minutes the length of the skein is measured (L_3) under the pre-load of 0.01 cN per tex.

$$\text{Initial crimp (EK)} = \frac{L_0 - L_1}{L_0} \times 100\%$$

$$\text{Mechanical crimp stability (KB)} = \frac{L_0 - L_3}{L_0 - L_1} \times 100\%$$

Initial crimp and mechanical crimp stability values used herein are the mean of EK and KB measurements respectively on at least 5 skeins of yarn.

The above procedure is similar to that described in the German standard DIN 53840 and is conveniently carried out on a Texturmat machine manufactured by Herbert Stein, Munchengladbach W Germany.

Initial crimp (EK) is a measure of the percentage reduction in length from the straightened length of a bulked yarn as the result of the bulked structure. Mechanical crimp stability (KB) is a measure of the proportion of bulk remaining after release of a specified high load.

The yarns of the present invention possess a level of bulk which is commercially acceptable and the bulk is sufficiently stable to tension. The advantages of such yarns are particularly apparent in finished fabrics in which the bulk

has been developed.

The jaspe yarns of the present invention, when made into fabrics and dyed such as to colour the polyester and polyamide components differently, exhibit an attractive speckled appearance. In order to achieve this appearance, it is important that the gear-crimped composite yarn has been nodally interlaced such that the yarn has 40 to 140 nodes per metre. Composite yarns having less than 40 nodes per metre produce dyed fabrics in which undesirable streaks of each yarn component are seen.

The term yarn as used herein means a monofilament yarn or a multifilament yarn.

The drawable polyester and polyamide feed yarns are made by melt spinning, the spinning conditions being selected such that both yarns have a similar residual draw ratio.

Preferably the decitex of the drawn composite yarn is less than 150 decitex.

The term polyester as used herein means a polyester or a copolyester and the term polyamide means a polyamide or a copolyamide. The polyester and polyamide yarns may contain additives such as antioxidants, stabilisers, antistatic agents, delustrants or colouring materials.

The filament or filaments of the polyester yarn or the polyamide yarn may have a filament cross-section which is circular or non-circular for example trilobal.

The crimped composite yarn is forwarded from the toothed draw rolls under a preferred tension in the range 0.20 to 0.40 g per decitex based on the decitex of the drawn composite yarn. Forwarding the crimped composite yarn from the toothed draw rolls under a low tension of less than 0.15 g per decitex leads to problems of filamentation and yarn breaking and the yarn tends to lick back around the toothed wheels. The use of a high tension of above 0.50 g per decitex produces a yarn having poor mechanical properties and a bulk which appears to be due predominantly to edge crimping. Such bulk produced from edge

crimping does not yield useful bulk in fabrics made from the yarns. The amount of bulk due to true gear crimping, measured by EK, is low and its stability is poor.

5 The drawable polyester and polyamide yarns may be heated by contact with a heated plate or a heated circular pin or by passage through a tube supplied with a heated fluid such as hot air or superheated steam. The drawable yarn is preferably heated by contact with a heater at a temperature of at least 150°C.

10 The toothed draw rolls may comprise two or three gear wheels one of which is driven and drives the other wheel or wheels. Preferably the teeth are involute in shape. Preferably the gear wheels have an integral step structure as described in British Patent Specification No 1 255 478. Tension sufficient
15 to draw the yarn is exerted by passage of the yarn over the tips of the intermeshing teeth of the rotating gear wheels.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawing which is a diagrammatic representation of a process according
20 to the invention.

A drawable polyester multifilament yarn 1 having a birefringence of at least 30×10^{-3} is withdrawn over one end of cylinder 2 from a package 3 of wound yarn. A drawable polyamide multifilament yarn 4 having a birefringence of at
25 least 30×10^{-3} is withdrawn over one end of cylinder 5 from a package 6 of wound yarn. Withdrawal is effected via pigtail guides 21, 22 by rotation of feed roll 9 and nip roll 7, the combined yarns being passed around nip roll 7 a sufficient number of times to avoid slippage of the yarn.

30 Downstream of the feed roll 9 and nip roll 7 there are located intermeshing gear wheels 11, 12 and a yarn tensioning roll 13. The gear wheel 12 is driven by driving gear wheel 11. A single passage of the composite yarn between the intermeshing teeth of the gear wheels 11 and 12 induces crimp in the yarn by
35 causing it to follow a sharply zig-zag path. Between the feed roll 9 and the gear wheels 11, 12 the yarn is passed once around

an electrically heated metal pin 19. The gear wheels 11, 12 are rotated at a sufficient speed compared to the feed roll 9 such that the composite yarn is drawn by the tension exerted on it. the location of the draw point being on the heated pin 19.

Yarn tensioning roll 13 is a stepped roll and comprises roll 14 and roll 17 which is of smaller diameter than roll 14. Rolls 14 and 17 have associated separator rolls 15 and 16 respectfully. The crimped drawn yarn is withdrawn from gear wheels, 11, 12 by tensioning roll 14 under a controlled tension within the range 0.15 to 0.50 g per decitex based on the decitex of the drawn composite yarn. The yarn is passed sufficient times around tensioning roll 14 and separator roll 15 to avoid slippage of the yarn. The tension in the yarn is then reduced by passing the yarn around separator roll 16 and roll 17. Between roll 14 and roll 16 the composite yarn is nodally interlaced by passing it through interlacing jet 18.

On leaving the roll 17, the yarn is wound on a ring spindle package 23 twist being inserted in the yarn below balloon-guide 25 by rotation of the spindle and rotation of a traveller (not shown) around ring 27.

The yarn so produced is a drawn composite yarn having latent bulk. The bulk may be developed by subjecting the yarn in yarn or fabric form, to a thermal treatment.

The following examples illustrate but do not limit the present invention.

EXAMPLE 1

A 95 decitex 25 filament drawable poly(ethylene terephthalate) yarn having a birefringence of 63×10^{-3} and a 27 decitex 7 filament drawable poly(hexamethylene adipamide) yarn having a birefringence of 46.6×10^{-3} were drawn and gear crimped by a process as shown diagrammatically in the accompanying drawing. The polyester filaments had a trilobal filament cross-section and the polyamide filaments had a circular filament cross-section. The weight ratio of the polyester filaments to the

polyamide filaments was 78:22. The heated metal pin was of circular cross-section having a diameter of 2.22 cm and a temperature of 170°C. The gear wheels were made of stainless steel and had 38 teeth per inch. The intermeshing of the gear wheels was such that the maximum overlap of teeth on the two gears was 0.356 mm.

The speed of the gear wheels was adjusted such that the composite yarn was drawn by the tension imparted to the yarn between the heated pin and the gear wheels. The surface speed of the larger diameter tensioning roll was 840 metres per minute and the ratio of the surface speed of the larger diameter tensioning roll to the surface speed of the feed roll was 1.30. The yarn tension between the gear wheels and the larger diameter tensioning roll was controlled at 31 g, that is at 0.32 g per decitex based on the decitex of the drawn composite yarn.

The diameters of the two rolls of the stepped tensioning roll were such that the yarn was overfed from the larger diameter roll to the smaller diameter roll at an overfeed of 3.1%. On leaving the larger diameter tensioning roll, the overfed yarn was nodally interlaced by passing it through an interlacing jet to which air was supplied at an air pressure of 60 pounds per square inch. The interlacing jet had a yarn passageway in the form of a truncated cone and two directly opposed air passageways for directing air into the yarn passageway at right angles to the longitudinal axis of the yarn. The truncated cone form of the yarn passageway caused the major portion of the exhaust air to pass out of the yarn passageway in the same direction as the yarn.

The composite yarn so produced had a decitex of 96 and possessed latent bulk. The yarn had 86 interlaced nodes per metre (mean of 3 visual count measurements on 1 metre lengths of the yarn). The yarn had an initial crimp, measured as hereinbefore described, of 3.4%, a mechanical crimp stability of 27.0%, a breaking load of 347 centi-newtons and an extension to break of 30.9%.

The latent bulk yarn was knitted into fabric which was then dyed at 130°C to colour the polyester and polyamide components differently. Bulk was fully developed in the knitted yarn during the dyeing process. The fabric showed good bulk and an attractive jaspe or speckled appearance.

EXAMPLE 2

Example 1 was repeated except that the poly(hexamethylene adipamide) feed yarn was a 42 decitex 10 filament yarn having a birefringence of 45.5×10^{-3} . The weight ratio of the polyester filaments to the polyamide filaments was therefore 69:31. Similar process conditions as in Example 1 were used except that the yarn tension between the gear wheels and the larger diameter tensioning roll was controlled at 37.5 g, that is at 0.35 g per decitex based on the decitex of the drawn composite yarn.

The composite yarn so produced had a decitex of 107 and possessed latent bulk. The yarn had 85 interlaced nodes per metre (mean of 3 visual count measurements on 1 metre lengths of the yarn). The yarn had an initial crimp of 3.4%, a mechanical crimp stability of 32.8%, a breaking load of 370 centi-newtons and an extension to break of 27.5%.

The latent bulk yarn was knitted into fabric which was then dyed as in Example 1. Bulk was fully developed in the knitted yarn during the dyeing process. The fabric showed good bulk and an attractive jaspe or speckled appearance.

EXAMPLE 3

Example 1 was repeated except that the poly(hexamethylene adipamide) feed yarn was a 56 decitex 13 filament yarn having a birefringence of 45.0×10^{-3} . The weight ratio of the polyester filaments to the polyamide filaments was therefore 63:37. Similar process conditions as in Example 1 were used except that the yarn tension between the gear wheels and the larger diameter tensioning roll was controlled at 40 g, that is, at 0.34 g per decitex based on the decitex of the drawn composite yarn.

The composite yarn so produced had a decitex of 118 and possessed latent bulk. The yarn had 85 interlaced nodes per metre (mean of 3 visual count measurements on 1 metre lengths

of the yarn). The yarn had an initial crimp of 3.7%, a mechanical crimp stability of 48.6%, a breaking load of 433 centi-newtons and an extension to break of 30.1%.

The latent bulk yarn was knitted into fabric which
 5 was then dyed as in Example 1. Bulk was fully developed in the knitted yarn during the dyeing process. The fabric showed good bulk and an attractive jasje or speckled appearance.

EXAMPLE 4

Example 1 was repeated except that the poly(hexamethylene
 10 adipamide) feed yarn was a 96 decitex 20 filament yarn having a birefringence of 46.0×10^{-3} . The weight ratio of the polyester filaments to the polyamide filaments was therefore 50:50. Similar process conditions as in Example 1 were used except that the yarn tension between the gear wheels and the larger
 15 diameter tensioning roll was controlled at 68g, that is, at 0.46 g per decitex based on the decitex of the drawn composite yarn.

The composite yarn so produced had a decitex of 148 and possessed latent bulk. The yarn had 90 interlaced nodes
 20 per metre (mean of 3 visual count measurements on 1 metre lengths of the yarn). The yarn had an initial crimp of 4.1%, a mechanical crimp stability of 44.9%, a breaking load of 523 centi-newtons and an extension to break of 27.6%.

The latent bulk yarn was knitted into fabric which
 25 was then dyed as in Example 1. Bulk was fully developed in the knitted yarn during the dyeing process. The fabric showed good bulk and an attractive jasje or speckled appearance.

COMPARATIVE EXAMPLE A

Example 1 was repeated except that the following
 30 conditions were used:-

Feed yarns	50 decitex 22 filament drawn poly(ethylene terephthalate) yarn.
	40 decitex 10 filament drawn poly(hexamethylene adipamide) yarn.
Pin temperature	160°C

35

Surface speed of larger
 diameter tensioning roll 532 metres per minute
 Ratio of tension roll surface
 speed to feed roll surface
 speed 1.03
 Yarn tension between gear
 wheels and tensioning roll 20g
 Overfeed to interlacing jet 1%

The composite yarn so produced had only 31 nodes per
 10 metre. Dyed fabric made from the yarn showed undesirable
 streaks of each yarn component. Attempts to increase
 the extent of nodal interlacing by increasing the overfeed of
 the yarn to the interlacing jet led to difficulties in controlling
 the threadline at interlacing and still produced a dyed fabric
 15 with streaks of each yarn component.

COMPARATIVE EXAMPLE B

Example 1 was repeated except that the following
 conditions were used:-

Feed yarns 333 decitex 30 filament drawable
 20 poly(ethylene terephthalate)
 yarn of birefringence 27×10^{-3}
 100 decitex 20 filament draw-
 able poly(hexamethylene
 adipamide) yarn
 25 Ratio of tension roll
 surface speed to feed roll
 surface speed 1.9
 Yarn tension between
 gear wheels and
 30 tensioning roll 46g
 Overfeed to interlacing
 jet 1%

The composite yarn so produced had a decitex of 217
 and had only 22 nodes per metre. Dyed fabric made from the
 35 yarn showed undesirable streaks of each yarn component.

Attempts to increase the extent of nodal interlacing by increasing the overfeed of the yarn to the interlacing jet still produced a dyed fabric with streaks of each yarn component.

MMR/NDW

CLAIMS

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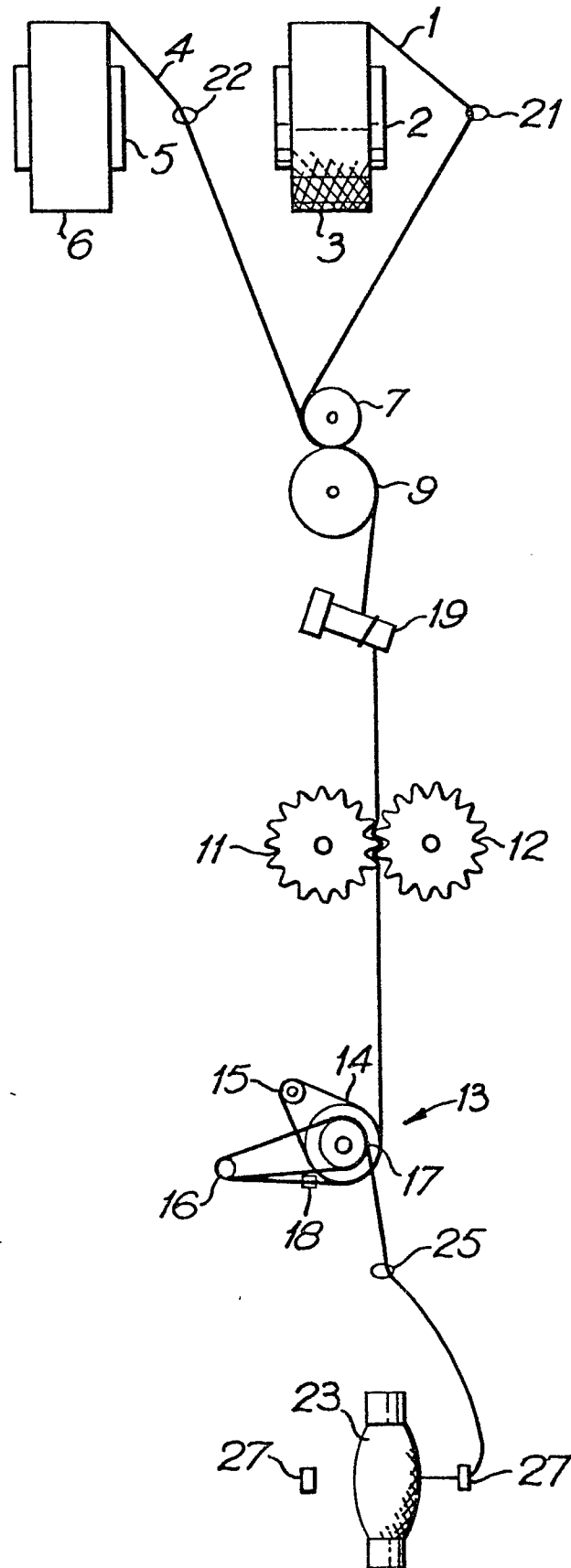
1. A drawn gear-crimped yarn with latent bulk characterised in that the yarn is a nodally interlaced gear-crimped composite yarn comprising polyester continuous filaments and polyamide continuous filaments in the weight ratio 90:10 to 10:90 inclusive, the gear-crimped composite yarn having an initial crimp as defined of 2% to 12%, a mechanical crimp stability as defined of above 0%, and having 40 to 140 interlaced nodes per metre.
2. A gear-crimped yarn according to Claim 1 having an initial crimp of 2% to 8% inclusive.
3. A gear-crimped yarn according to either Claim 1 or Claim 2 in which the gear-crimped composite yarn has 70 to 100 nodes per metre.
4. A gear-crimped yarn according to any one of the preceding claims in which at least some of the filaments of the yarn have a non-circular cross-section.
5. A gear-crimped yarn according to any one of the preceding claims in which the polyester is poly(ethylene terephthalate).
6. A gear crimped yarn according to any one of the preceding claims in which the polyamide is poly(hexamethylene adipamide).
7. A gear crimped yarn according to any one of the preceding claims in which the drawn composite yarn has a decitex of less than 150.
8. A gear crimped yarn according to any one of the preceding claims in which the bulk has been developed.
9. A fabric containing a gear-crimped yarn according to any one of the preceding claims.
10. A process for producing a drawn gear-crimped yarn with latent bulk characterised in that a drawable polyester continuous filament yarn having a birefringence of at least 30×10^{-3} and a drawable polyamide continuous filament yarn having a birefringence of at least 30×10^{-3} are heated and simultaneously drawn and gear crimped together as a composite

yarn by means of toothed draw rolls and the composite yarn is forwarded from the toothed draw rolls under a controlled tension within the range 0.15 to 0.50 g per decitex inclusive based on the decitex of the drawn composite yarn and is

5 subsequently interlaced to have 40 to 140 nodes per metre, the weight ratio of the polyester yarn to the polyamide yarn being in the range 90:10 to 10:90 inclusive.

11. A process according to claim 10 in which the crimped composite yarn is forwarded from the toothed

10 draw rolls under a tension in the range 0.20 to 0.40 g per decitex based on the decitex of the drawn composite yarn.





European Patent
Office

EUROPEAN SEARCH REPORT

0034439

Application number

EP 81 30 0457.9

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 3 605 393</u> (SCHROEDER) * fig. 2 *	1	D 02 G 3/34
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A	<u>GB - A - 1 172 361</u> (IMPERIAL CHEMICAL INDUSTRIES)		
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A	<u>US - A - 4 058 968</u> (BENSON)		
	--		
D	<u>GB - A - 984 922</u> (BRITISH NYLON SPINNERS)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
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P	<u>EP - A1 - 0 011 915</u> (IMPERIAL CHEMICAL INDUSTRIES)		D 02 G 3/00

			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 L: citation for other reasons
			&: member of the same patent family, corresponding document
X	The present search report has been drawn up for all claims		
Place of search Berlin		Date of completion of the search 05-05-1981	Examiner KLITSCH