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(54) Method and system for making laps of high toughness continuous synthetic fibers, the laps made thereby and non-woven fabric materials made by the fibers

(57) A method for making laps (15) of thermoplastic polymer continuous fibers or filaments, comprises a drawing step in which the filaments (3) are drawn on a vertical plane, by a mechanical action thereon.

With respect to prior methods, the inventive method provides the advantage that it allows to continuously make a non-woven fabric having strength and ultimate elongation properties better than that of the available standard fabrics.

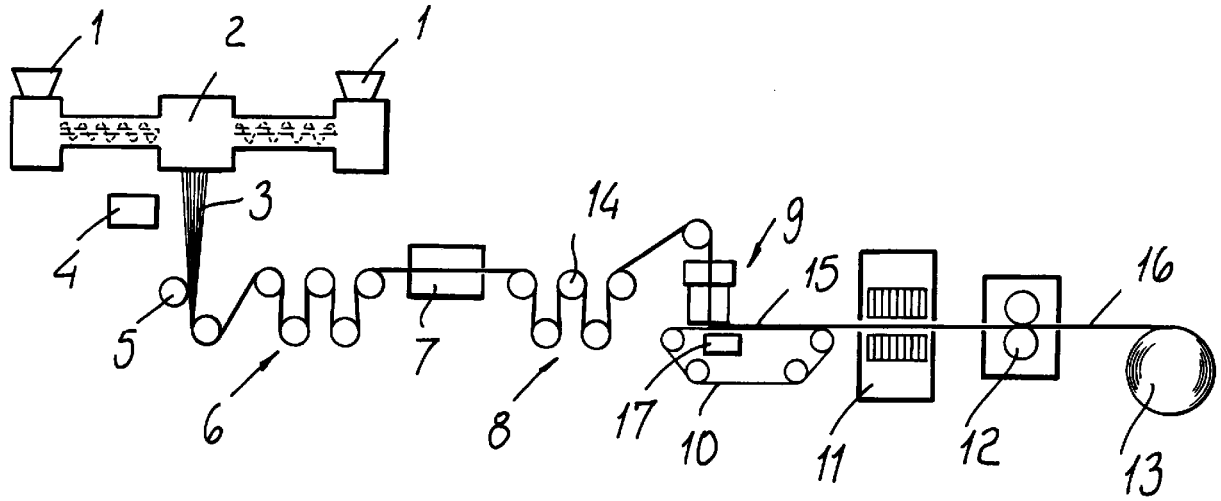

Fig. 1

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a novel method and system for making continuous high toughness fiber or filament laps.

[0002] The invention also relates to the laps made by the inventive novel method, as well as a non-woven fabric material made by said fibers.

[0003] More specifically, the field of the invention is that of the processes used for making synthetic fiber laps, comprising a filament mattress which, as suitably needled and thermocalendered, can be used for making non-woven fabric materials.

[0004] These methods (which are conventionally called "spun-bonding" methods) provide to form thermoplastic polymer (PP-HDPE-PET-PA and the like) continuous filaments, which are made by extruding the polymers through longitudinal dies having a large number of die holes. The extruded filament assembly will form, at the outlet of the extruding die, a vertical filament flat beam, which will be then subjected to a drawing operation.

[0005] The drawing of the filaments, as necessary for increasing the fiber toughness, is conventionally carried out in said spun-bonding systems, by using strong air jets, oriented in the direction of the filament plane (i.e. the vertical plane).

[0006] The filament lap is made by feeding the drawn filament flat beam to an air jet entangling device, for forming a filament mattress which, upon needling or calendering, will allow a non-woven fabric material.

[0007] The above disclosed prior methods, however, have the drawback that the air jets can only provide a low drawing ratio, thereby generating filaments which are only partially oriented and drawn (the so-called "Partial Oriented Yarn - POY" filaments).

[0008] Accordingly, the non-woven material made by the above mentioned prior fibers does not always provide the desired mechanical strength properties. Moreover, the use of very strong air jets, in order to better drawing the fibers, would involve a comparatively high power cost.

SUMMARY OF THE INVENTION

[0009] Accordingly, the main object of the present invention is to provide a novel method, and the related system, for continuously making fiber laps, as well as a non-woven material made from said laps, said laps being made from improved toughness fibers, having mechanical toughness and strength properties better than that of prior fibers as conventionally made in conventional air jet drawing systems.

[0010] Another object of the present invention is to provide such a non-woven fabric having mechanical characteristics better than that of prior like fabric materials.

[0011] The above mentioned objects are achieved, according to the invention, by the system, the laps and the non-woven fabric material as claimed in the independent claims 1, 5, 7 and 12, respectively.

[0012] Further advantages and preferred embodiments of the invention are defined by the dependent claims.

[0013] With respect to prior methods, the inventive method provides the advantages of making laps which are obtained from filaments having a toughness larger than that of prior filaments made by conventional pneumatic drawing methods.

[0014] Moreover, the method according to the present invention advantageously provides a non-woven fabric having better mechanical properties and which can be continuously made directly starting from one or more basic polymers.

[0015] The non-woven material, made starting from needled or thermosealed filament laps, is provided of strength and ultimate elongation properties [M.D. ("Machine-Direction") and C.D. ("Cross Direction")], which are better than those of standard available fabric materials.

BRIEF DESCRIPTION OF THE DRAWING

[0016] The above mentioned and yet other features and advantages of the present invention will become more apparent hereinafter from the following detailed disclosure of a preferred embodiment of the system according to the invention, which is illustrated, by way of a schematic but not limitative example, in the sole figure of the accompanying drawing table.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] The starting polymeric material (polypropylene thermoplastic polymer PP, high density polyethylene HDPE, polyester PET, polyamides PA and the like) is supplied to a plurality of extruders 1 and being conveyed therefrom, in a molten condition, toward a flow head 2.

[0018] Said head 2 comprises one or more longitudinal dies having a high number of die holes (not shown), from said die holes a flat beam of filaments 3 being ejected.

[0019] Said filament beam is then subjected to a preliminarily cooling by air at a cooling station 4 and being then processed in a sizing or antistatic oil application station 5, for facilitating subsequent needling and drawing operations.

[0020] The filament beam 3, after having passed through a conveyor region 6, will enter an oven 7 for bringing the fibers to the drawing temperature. Said filaments, moreover, are drawn, inside said oven 7, by a drawing station 8, including a suitably designed tension

and transmission rollers 14 for mechanically drawing the fibers, against a braking action provided by the entrainment or conveyor region 6.

[0021] The thus drawn filament beam is then caused to pass through an air jet entangling device 9, in which a filament mattress or lap 15 will be formed, the lap being then deposited, at the outlet of said device 9, on a conveyor belt 10, including an air suction box 17.

[0022] The thus made mattress or lap is made with a set weight in grams for specific surface and will have conventionally a width from 1 to 10 m.

[0023] The lap 15 is then conveyed to a needling apparatus 11 and then to a calender 12, thereby providing a non-woven fabric material 16 which, at the end of the process, will be wound in a winding device 13.

[0024] Owing to the disclosed mechanical drawing processing, the beam filaments 3 will be brought to the desired end count (1.5 to 70 dtex), with a high toughness per filament value (greater than 30 cN/dtex). The thus made thermoplastic fiber filaments will have, owing to the above mentioned mechanical drawing processing, a high level of toughness. This result, in particular, is achieved due to the fact that the filaments forming the filament beam 3 are fully drawn, with a consequent high molecular orientation obtained owing to the disclosed mechanical drawing operation (Full Oriented Yarn - FOY filaments).

[0025] The disclosed drawing will provide the non-woven fabric with mechanical properties, in the terms of strength and ultimate elongation [M.D. (Machine Direction) and C.D. (Cross Direction)] much greater than the standard values provided by like fabric materials made by filaments of the same type, but drawn by an air jet method (i.e. the so-called Partial Oriented Yarn - POY filaments).

[0026] The disclosed mechanical drawing of the filaments, in addition to providing improved toughness fibers, will also provide the great advantage of allowing a great power saving with respect to prior pneumatic drawing equipment, larger than 30%, the weight of the fabric being the same, and the non-woven fabric coverage capability being the same.

[0027] The invention as disclosed and illustrated is susceptible to several modifications and variations all of which will come within the scope of the invention as defined in the accompanying claims.

[0028] Actually, the filament mechanical drawing unit could also comprise drawing means different from the disclosed rollers (such as opposite conveyor belts and/or the like) provided that they are adapted to subject the fibers to a mechanical drawing process as necessary for fully orienting said fibers. Moreover, the number of extruders could be different from that which has been above shown and disclosed.

Claims

1. A method for making thermoplastic polymer continuous fibers or filaments by extruding a molten mass of said thermoplastic polymers through one or more extruding dies, characterized in that said method comprises a drawing step for mechanically drawing said filaments.

2. A method according to Claim 1, characterized in that said filaments obtained by said mechanical drawing step are fully drawn and oriented filaments (of the Full Oriented Yarn type).

3. A method according to Claim 2, characterized in that said drawing step is carried out at a temperature adapted to favour a full molecular orientation of said filaments.

4. A method according to the preceding claims, characterized in that said method is adapted to continuously provide a non-woven fabric material, directly starting from one or more basic polymers for preparing said laps.

5. A system for carrying out a method according to the preceding claims, of the type comprising at least a thermoplastic material extruder for applying a molten thermoplastic material to one or more dies, characterized in that said system further comprises mechanical means for mechanically drawing said filaments.

6. A system according to claim 4, characterized in that said mechanical means comprise a tension roller (14) unit (8) cooperating with a driving or entrainment unit (6) arranged upstream of said unit (8).

7. A continuous lap made by a method and system according to the preceding claims, characterized in that said laps comprises continuous filaments having a specific toughness greater than 30 cN/dtex.

8. A lap according to Claim 7, characterized in that, after the drawing step, said filaments have a count of 1.5-70 dtex.

9. A lap according to the preceding claims, characterized in that said lap comprises thermoplastic polymer filaments as fully drawn and oriented (of the Full Oriented Yarn type).

10. A lap according to one or more of the preceding claims, characterized in that said filaments either of a mono or of a bicomponent type.

11. A lap according to any preceding claims, characterized in that said lap has a width from 1 to 10 m.

12. A non-woven fabric material, characterized in that said material comprises one or more needled

and/or thermosealed laps according to one or more of the preceding claims 7 to 11.

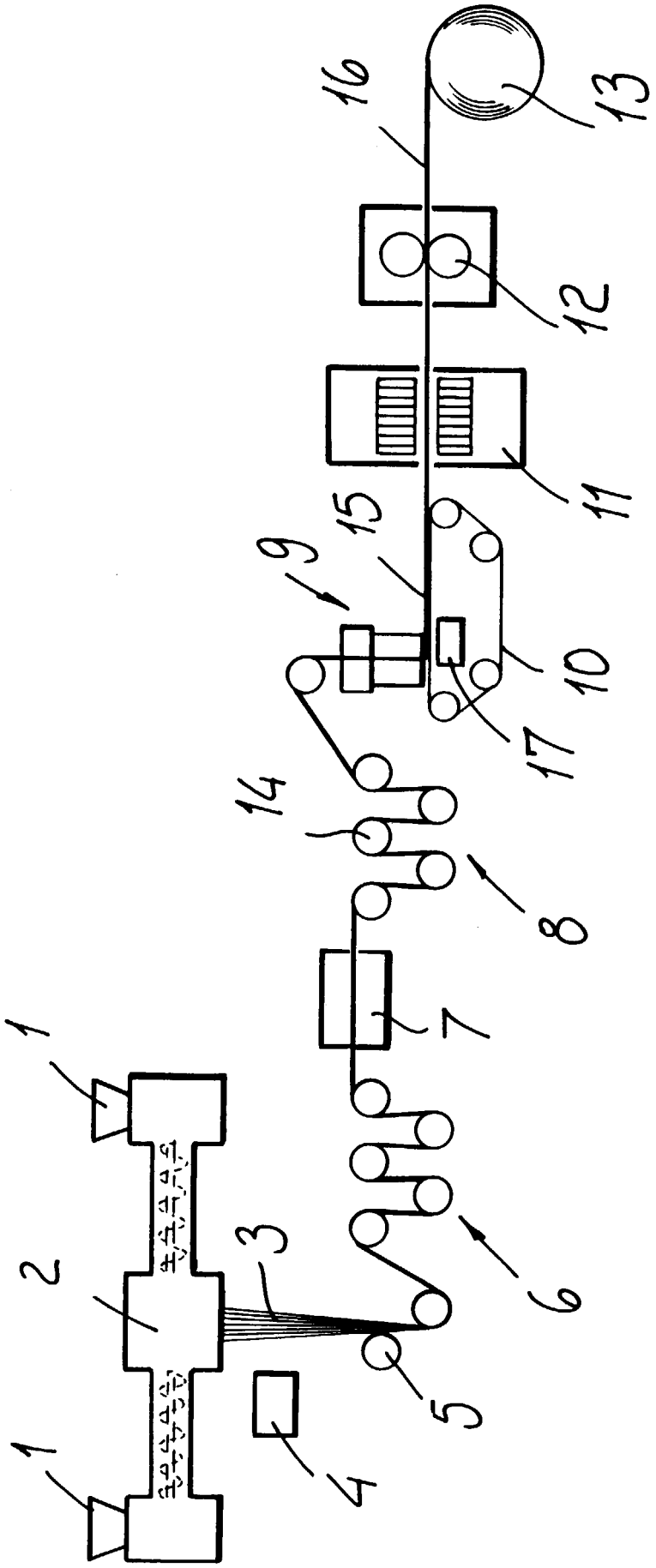

FIG. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 3123

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D04H
D01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 February 2000	Tarrida Torrell, J

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 11 3123

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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