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

(11) EP 2 119 816 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.11.2009 Bulletin 2009/47

(21) Application number: **08008901.4**

(22) Date of filing: **14.05.2008**

(51) Int Cl.:
D01D 5/253 *(2006.01)* ***D01D 5/098*** *(2006.01)*
D01D 4/02 *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(71) Applicant: **ALBIS Spa**
20123 Milano (IT)

(72) Inventor: **Boscolo, Galliano**
Vigliano Biellese (IT)

(74) Representative: **Matkowska, Franck et al**
Matkowska & Associés
9 Rue Jacques Prévert
59650 Villeneuve d'Ascq (FR)

(54) Spinneret comprising bilobal spinning orifices

(57) The spinneret (140a) is used for manufacturing a web by a spunbond process or meltblown process, and has longitudinal axis (X) that corresponds to the width of the spunbonded or meltblown web. Said spinneret comprises bilobal spinning orifices (141) each having a longitudinal central axis (A). The angle (α) between the longitudinal axis (X) of the spinneret and the longitudinal central axis (A) of one bilobal spinning orifice (141) is between 75° and 87°, in order to improve the cooling and attenuation of the filaments.

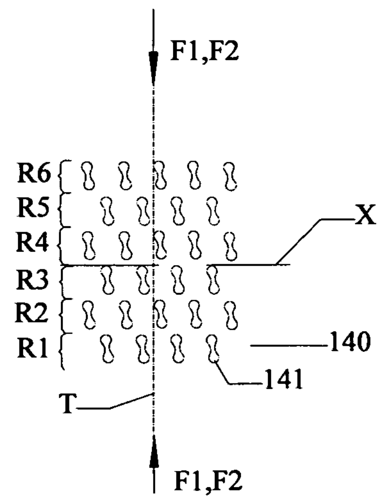

FIG.3

EP 2 119 816 A1

Description

Technical field

[0001] The present invention relates to the field of spunbond technology or meltblown technology. In this field, the invention relates to an improved spinneret for manufacturing spunbonded or meltblown nonwovens, said spinneret comprising bilobal spinning orifices.

Prior art

[0002] Spunbonded nonwoven webs are produced by depositing extruded spun filaments onto a collecting moving belt, preferably a foraminous belt, in a random manner, and by bonding the filaments.

[0003] For spinning the filaments, an extrusion die comprising a plate perforated with a lot of small orifices, and usually referred as spinneret plate, is used. Generally, a spinneret plate comprises more than one hundred spinning orifices per meter. The continuous spun filaments are formed by forcing one or several molten thermoplastic polymers to pass through said small orifices of the spinneret plate. For producing spunbonded nonwoven webs having a large width, only one spinneret plate can be used or several spinneret plates that are placed side by side can be used.

[0004] The shape in cross section of each filament is given by the geometry of the spinning orifice of the spinneret plate through which the filament is being formed. Different shapes of filaments can be produced to date, like for example round filaments, bilobal filaments, trilobal filaments. More particularly, for producing a bilobal filament, also commonly referred as "papillon" filament, a bilobal orifice consisting essentially of two circular apertures connected with one another by a connecting aperture is used. All the spinning orifices of a spinneret plate can have the same geometry, or a spinneret plate can have spinning orifices of different shapes, like for example round orifices combined with bilobal orifices.

[0005] In a spunbond process, before depositing the filaments onto the collecting moving belt, the spun filaments are rapidly cooled by cold air streams that are blown below the spinneret plate (quenching step), and the filaments are then stretched and attenuated by additional blown air streams in order to orient the molecular chains and increase the filament strength.

[0006] The melt blown process is somewhat similar to the spunbond process from an equipment and operator's point of view. The two main differences between a melt blown process and a spunbond process that use air attenuation are: (i) the temperature and volume of air used to attenuate the filaments and (ii) the location where the filament draw or attenuation force is applied. More particularly, in the meltblown process, a high volume air flow at a temperature which is typically equal or slightly greater than the melt temperature of the polymer, is used to attenuate the filaments. In contrast, the spunbond process generally uses a smaller volume of cold air close to ambient temperature to first quench and solidify the filaments and then to attenuate said filaments. Thus in the meltblown process, the draw or attenuation force is applied at the exit of the extrusion die (spinneret) while the polymer is still in the molten state, whereas in the spunbond process, this force is applied at some distance from the spinneret plate, after the polymer has been cooled and solidified (quenching step).

[0007] Another difference between a spunbonding unit and a meltblown unit consists in the structure of the spinneret. More particularly, whereas the spinneret of a spunbonded unit comprises an apertured spinneret plate through which the molten polymer is extruded, in a typical meltblown unit, the spinneret generally comprises a so-called die nosepiece with spinning orifices. There are typically two types of die nosepiece. One type is the capillary type wherein slots are milled into a flat surface and then matched with identical slots milled into a mating surface. The two halves are then matched and carefully aligned to form a row of spinning orifices. The second type is the drilled-hole type wherein spinning orifices are drilled in a single block of metal.

Object of the invention

[0008] One main objective of the invention is to improve the spinning of bilobal filaments in a spunbond process or in a meltblown process.

Summary of the invention

[0009] This objective is achieved by using the spinneret of claim 1.

[0010] According to the invention, the particular orientation of the bilobal spinning orifices as defined in claim 1 improves the circulation of the air around the filaments, and thus improves the cooling and attenuation of the filaments.

Brief description of the drawings

[0011] Other characteristics and advantages of the invention will appear more clearly on reading the following description preferred embodiments of the invention, which description is given by way of non-limiting example and is made with reference to the accompanying drawings, in which:

- Figure 1 is a schematic representation of a spunbonding unit,
- Figure 2 is a top view of a spinneret plate according to the invention,
- Figure 3 is an enlarged view of a part of the spinneret plate of figure 2,
- Figure 4 is an enlarged view of a bilobal orifice of the spinneret plate of figure 2 or 3,
- Figure 5 is a view in transversal cross section of the

spinneret plate of figure 2 in the region of spinning orifice,

- Figure 6 is a schematic representation in perspective view of a die nosepiece of a spinneret for a melt blown unit,
- Figure 7 is a schematic view in cross section of a part of spinneret of a melt blown unit, comprising the die nosepiece of figure 6,
- Figure 8 is a bottom view of the die nose piece of figure 7 showing the row of bilobal spinning orifices.

Detailed description

[0012] Figure 1 shows a spunbonding unit 1 comprising:

- an extruder 10,
- a spinning pump 11 connected to the outlet of the extruder via a duct 12 and a filter 13,
- a spinning beam 14 comprising a spinning pack 140 connected to the outlet of the spinning pump 11 and fitted with a spinneret plate 140a,
- air suction means 15,
- air quenching means 16,
- an air drawing unit 17
- a conveyor belt 18.

[0013] In operation, a thermoplastic polymer, optionally blended with additives, is processed in the extruder 10 in order to obtain a molten polymer. Said molten polymer is pumped by the spinning pump 11 within the duct 12 and through the filter 13, and is fed by the spinning pump 11 to the spinning pack 140 (extrusion die).

[0014] Referring to figure 2, the spinning pack 140 comprises a spinneret plate 140a of longitudinal axis X and having a lot of bilobal spinning orifices 141. Typically, the spinneret plate 140a comprise for example between 2000 orifices per meter (in the direction of longitudinal axis X), and 6000 orifices per meter. This plate 140 is orientated in such a way that the longitudinal axis X of the plate is perpendicular to the plan of figure 1.

[0015] Referring to figure 5, the spinneret plate 140a comprises a top surface 140b and a bottom surface 140c. For each bilobal spinning orifice 141, a first cavity 141 a, a second cavity 141 c of smaller dimension in cross section, and a transition cavity 141 b connecting the first 141 a and second cavity 141c are drilled in the plate 140a. The first cavity 141a has a cylindrical cross section and has a polymer inlet 141d in the top surface 140b of the spinneret plate 140a. The second cavity 141c has a bilobal cross section and a polymer outlet 141 (bilobal orifice) in the bottom surface 140c of the spinneret plate 140a.

[0016] In figure 5, the polymer flow is symbolized by arrow P. In operation of the spinneret plate 140a, the filtered molten polymer is pushed and forced by the spinning pump 11 through the cylindrical cavity 141a, through the transition portion 141 b and through the second bilobal cavity 141 c of each spinning orifice 141 and forms continuous spun filaments F at the outlet of the spinneret plate 140a. The spun continuous filaments F have a bilobal shape corresponding to the shape of the bilobal spinning orifices 141.

[0017] Below the spinneret plate 140a, air suction means 15 comprising two suction boxes are provided for sucking the monomers and oligomers (by products) from the spinning pack.

[0018] Below the suction means 15, air quenching means 16 comprising air cooling boxes 16a, 16b, are provided for blowing cold air streams F_1, F_2 on both sides of the curtain of filaments F. Said cold air streams $F_{1,}$ F_2 are directed towards the curtain of filaments F in a transversal direction (figure 1 - arrow T) that is substantially parallel to the spinneret plate 140a and perpendicular to the longitudinal axis X of the spinneret plate 140a. In operation, the filaments F are rapidly cooled by said cold air streams F_1. F_2. This cooling step is more commonly referred as quenching step.

[0019] The air drawing unit 17 is positioned below the air quenching means 16, and is knowingly used for stretching and attenuating the filaments F trough an attenuating slot 17a, by means of compressed air streams F3 blown towards the filaments F. This attenuation step increases the orientation of the polymer chains and is performed in order to obtain filaments having notably the required strength and count.

[0020] Finally, at the outlet of the air drawing unit 17, the attenuated filaments F are deposited in a random manner onto the moving belt 18 in order to form a spunbonded web. The width of this spunbonded web corresponds to the longitudinal axis (X) of the spinneret plate 140a.

[0021] Referring to figures 2 to 4, each bilobal orifice 141 is constituted by two round apertures 141a, 141b that are connected to each other by a straight junction aperture 141c as shown in figure 4. Each bilobal orifice 141 is characterized by a longitudinal central axis A passing through the centre O_a, O_b of the two aforesaid round portions 141 a, 141 b.

[0022] According to the invention, the longitudinal central axis A of each bilobal orifice 141 is titled in relation to the transversal direction T (main direction of the air streams F1, F2). The angle between direction T and the longitudinal axis A of a bilobal orifice 141 is referred β. The angle between the longitudinal axis X of the spinneret plate 140a and the longitudinal axis A of a bilobal orifice 141 is referred α. For each bilobal orifice 141, the relationship between α and β is defined by the following equation: $\beta = 90° - \alpha$

[0023] According to the invention, for each bilobal orifice 141, angle β is between 3° and 15°, and preferably between 5° and 10°, which correspond to an angle α between 87° and 75°, and preferably between 85° and 80°.

[0024] In the prior art, β is generally equal to zero (i.e. α=90°), which in turn leads to a non uniform cooling of the bilobal filament. By increasing the value of angle β

to a value that is at least equal to 3° and preferably at least equal to 5°, a better circulation of the air flows between the filaments F is achieved and the cooling of the bilobal filaments is more efficient and more uniform on the whole surface of the filament. As a result, the attenuation of the filaments F is also improved.

[0025] In return, angle β is preferably not more than 15°, and even more preferably not more than10°, because for higher values, the surfaces of the bilobal filament in front of the air stream F1 or F2 is in that case too large, and the curtain formed by the filaments F tends to be detrimentally deformed by the air streams (F1, F2).

[0026] More particularly, it has been tested that an optimum value for angle β is 7.5°, i.e. angle α is preferably equal to 82.5°.

[0027] Preferably, but not necessarily, as shown on the example of figure 3, all the bilobal orifices 141 have the same orientation (i.e. angle α is the same for all the bilobal orifices 141 or otherwise stated the central longitudinal axis A of the bilobal orifices 141 are parallel). In another variant however, the values of the angle α (or β) of the bilobal orifices 141 can be different ; preferably, but not necessarily, all angles α (or β) are however within the range of the invention. Within the scope of the invention, all the orifices of the spinneret plate 140a are not necessary bilobal, but in another variant the spinneret plate 140a can have bilobal orifices combined with non bilobal orifices (e.g. round orifices, trilobal orifices).

[0028] Referring to the particular example of figure 3, the bilobal orifices 141 of the spinneret plate 140a are aligned in order to form a plurality of row R_i that are substantially parallel to the longitudinal axis X of the spinneret plate 140a. Preferably, but not necessarily, the bilobal orifices 141 of two adjacent rows R_i of orifices 141 are longitudinally offset to achieve a better circulation of air between the rows R_i and thus a better cooling and attenuation of the filaments F.

[0029] The invention is not limited to a spinneret plate 140a for a spunbonding unit, but in reference to figures 6 to 8 the invention can also be used for making a spinneret of a meltblown unit.

[0030] Referring to figure 6 and 7, a spinneret for a meltblown unit comprises a die nosepiece 140'a wherein spinning bilobal orifices 141 are drilled. Like the previously described spunbonding unit, the melt blown unit further comprises at least one extruder, a spinning pump, and air blowing means for attenuating the filaments that are extruded from the spinneret ; These technical means are well known in the art and are thus not further described, nor shown on the appended figures.

[0031] All the bilobal orifices 141 are aligned along axis X of the die nosepiece 140'a (figure 8) and are fed with the polymer through an internal distribution cavity 140'b having a polymer inlet 140'c (figure 7). This die nosepiece 140'a is assembled with a block 140'd for forming two lateral air channels 140'e. The high velocity and hot air for the attenuation of the filaments is blown in a known way inside these air channels 140'e (figure 7/ arrow F4).

[0032] Referring to figure 8, and according to the invention, the longitudinal central axis A of each bilobal spinning orifice 141 is tilted in relation to the longitudinal axis X of the spinneret (angle α).

Claims

1. A spinneret (140a; 140'a) for producing a spunbonded or meltblown web, said spinneret having a longitudinal axis (X) that corresponds to the width of the web, and said spinneret comprising bilobal spinning orifices (141) each having a longitudinal central axis (A), **characterised in that** the angle (α) between the longitudinal axis (X) of the spinneret and the longitudinal central axis (A) of one bilobal spinning orifice (141) is between 75° and 87°.

2. The spinneret of claim 1 wherein the angle (α) between the longitudinal axis (X) and the longitudinal central axis (A) of one bilobal spinning orifice (141) is between 80° and 85°.

3. The spinneret of claim 2, wherein the said angle (α) is about 82.5°.

4. The spinneret of any one of claims 1 to 3, wherein the longitudinal central axes (A) of all the bilobal spinning orifices (141) are parallel.

5. The spinneret of any one of claims 1 to 4, wherein the bilobal spinning orifices (141) are arranged in rows (R_i) that are parallel to the longitudinal axis (X) of the spinneret, and the bilobal spinning orifices (141) of two adjacent rows (R_i) are longitudinally offset.

6. The spinneret of any one of claims 1 to 5 being an apertured spinneret plate (140a).

7. A spunbonding unit comprising at least one extruder (10), a spinning pump (11), a spinneret (140a) and air blowing means (16, 17) for cooling and attenuating the filaments that are extruded from the spinneret, wherein the spinneret (140a) is the one defined in any one of claims 1 to 6.

8. A meltblown unit comprising at least one extruder, a spinning pump, a spinneret (140'a), and air blowing means for attenuating the filaments that are extruded from the spinneret, wherein the spinneret (140'a) is the one defined in any one of claims 1 to 6.

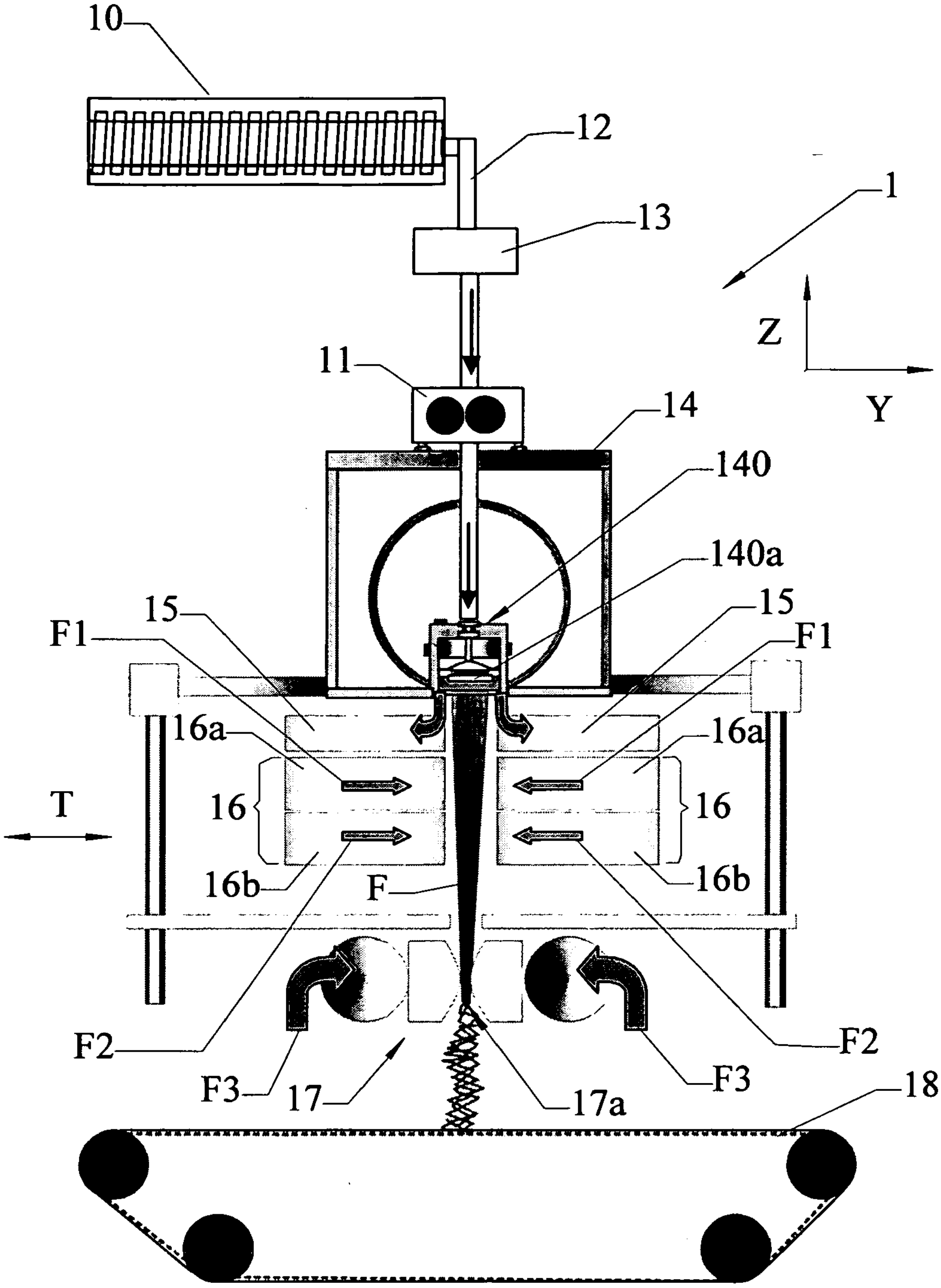
10
12
13
1
Z
Y
11
14
140
140a
15
15
F1
F1
16a
16a
16
16
T
16b
16b
F
F2
F2
F3
F3
17
17a
18

FIG.1

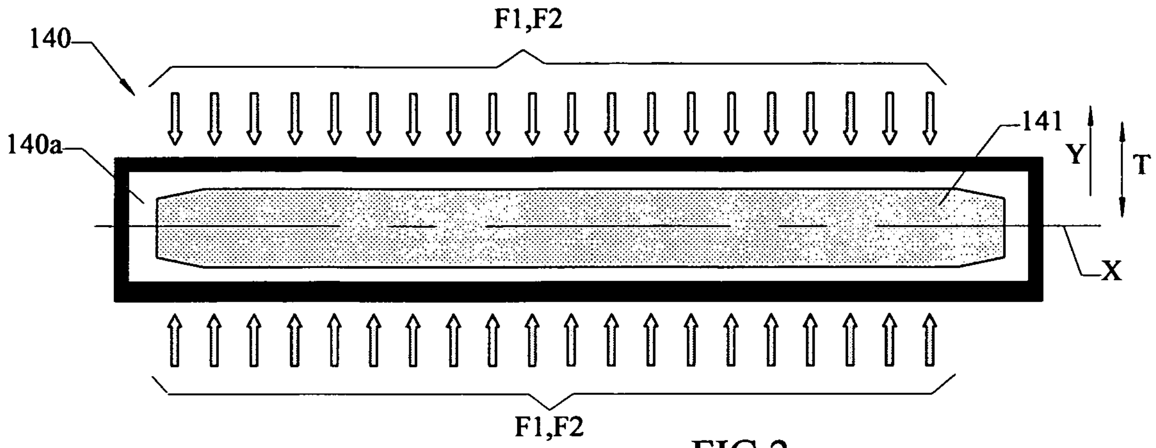

FIG.2

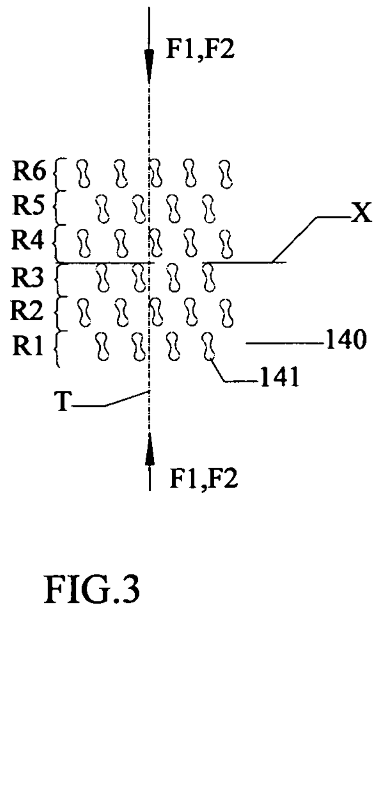

FIG.3

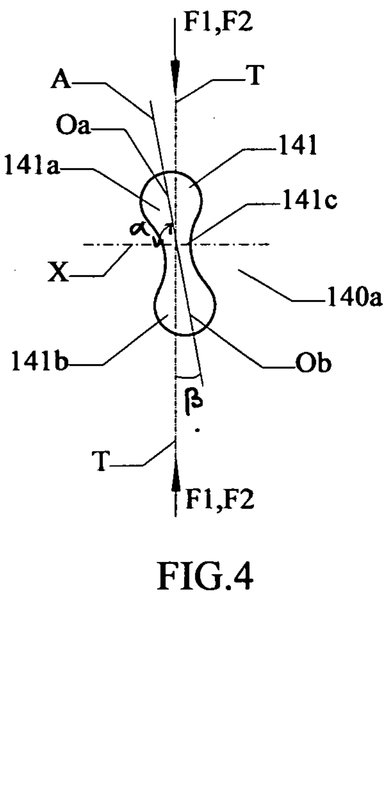

FIG.4

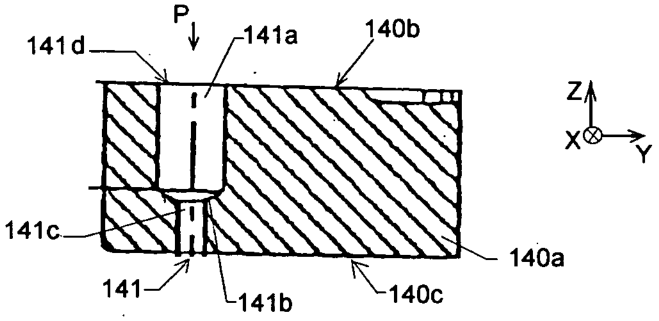

FIG.5

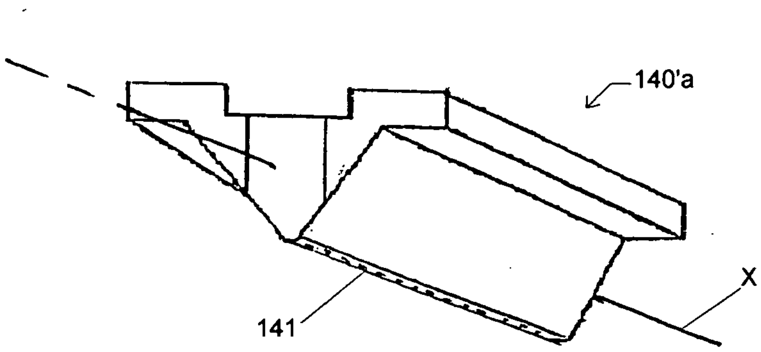

FIG.6

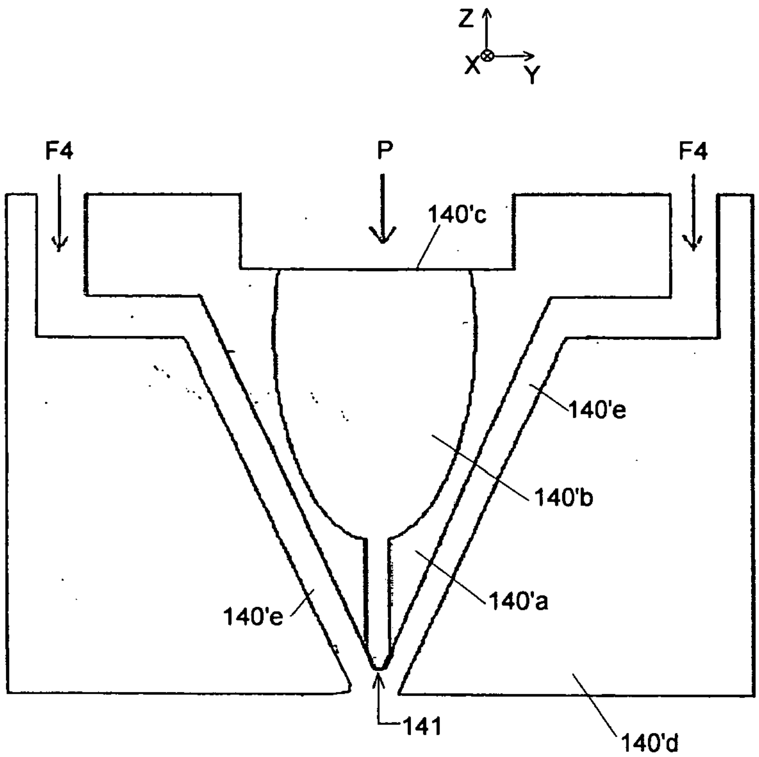
Z
X
Y
F4
P
F4
140'c
140'e
140'b
140'a
140'e
141
140'd

FIG.7

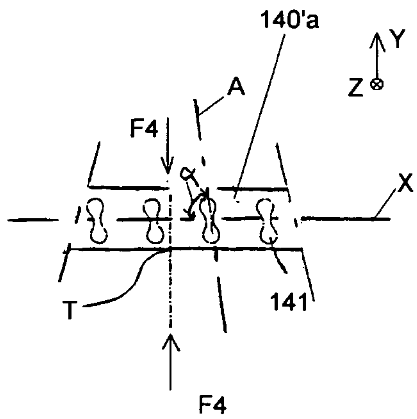
140'a
Y
Z
A
F4
α
X
T
141
F4

FIG.8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 8901

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 753 834 A (BRAUN RALPH V [US] ET AL) 28 June 1988 (1988-06-28) * column 3, line 41 - line 57 * * column 5, line 64 - column 6, line 41 * * figures 2,3 * -----	1-8	INV. D01D5/253 D01D5/098 D01D4/02
A	WO 2008/000354 A (IREMA FILTER GMBH [DE]; JUNG ANKE [DE]; SEEBERGER ANDREAS [DE]) 3 January 2008 (2008-01-03) * page 2, line 1 - line 21 * * page 4, line 16 - line 18 * * figure 3 * -----	1-8	
A	US 3 554 854 A (HARTMANN LUDWIG) 12 January 1971 (1971-01-12) * column 2, line 49 - line 72 * * column 6, line 24 - line 34 * * figure 3 * -----	1-8	
A	DATABASE WPI Week 200849 Thomson Scientific, London, GB; AN 2008-H60239 XP002504596 -& CN 201 053 042 Y (SHANGHAI DEFULUN CHEM FIBER CO LTD) 30 April 2008 (2008-04-30) * abstract * * figure * -----	1-8	TECHNICAL FIELDS SEARCHED (IPC) D01D
A	WO 03/014429 A (TENCEL LTD [GB]; LIBERA ULRICH MATTHIAS [DE]; FRISCHMANN GUENTER [DE];) 20 February 2003 (2003-02-20) * page 2, line 27 - page 3, line 8 * * figure 2 * -----	1-8	

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	19 November 2008	Fiocco, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 00 8901

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-11-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4753834	A	28-06-1988	NONE	
WO 2008000354	A	03-01-2008	DE 102006029972 A1	03-01-2008
US 3554854	A	12-01-1971	NONE	
CN 201053042	Y	30-04-2008	NONE	
WO 03014429	A	20-02-2003	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82