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

(11) EP 2 020 456 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.02.2009 Bulletin 2009/06

(21) Application number: **07425479.8**

(22) Date of filing: **30.07.2007**

(51) Int Cl.:
D01D 5/02 *(2006.01)* ***D01D 5/098*** *(2006.01)*
B65H 54/88 *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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(54) Apparatus and method of producing synthetic yarns

(57) In an apparatus (1) for the production of a non-woven fabric of filaments, a plurality of filaments (5) are extruded from at least one spinneret (2), and are cooled in a cooling chamber (4) by at least one flow of air. Advantageously, the cooling chamber (4) is provided with at least one wall (12) opening to make available to the filaments (5) an alternative path that allows the side disposal of the filaments (5) of discarded products during the transitory starting period of the apparatus (1). The filaments laterally diverted are collected in containers or collection areas by means of adjustable draught units.

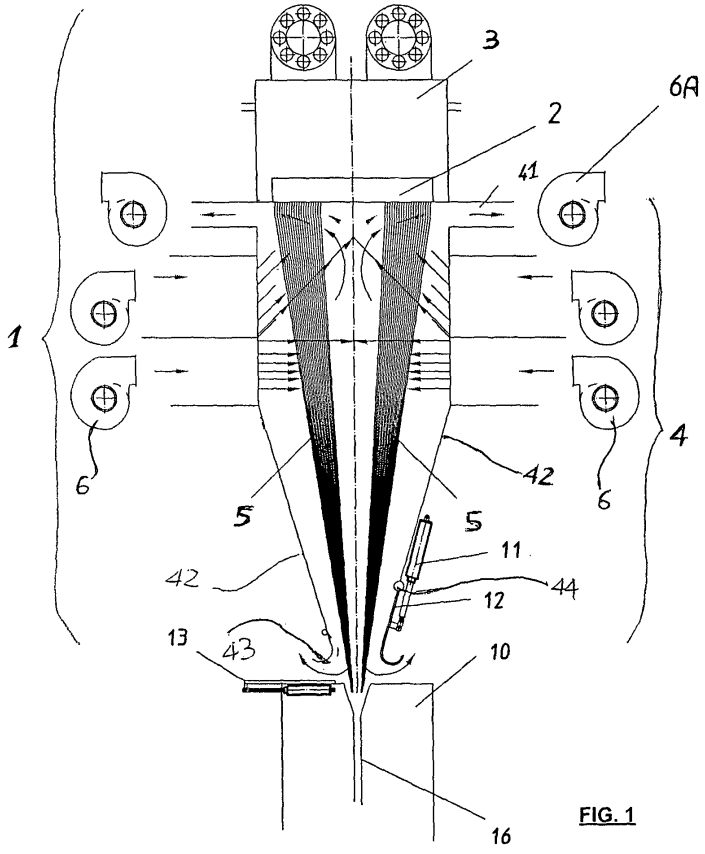

FIG. 1

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Description

[0001] The present invention relates to an apparatus for the production of synthetic yarns; the invention relates more specifically to an apparatus for the spinning of spunbond filaments stretched in a current of air.

[0002] A typical apparatus for the production of spunbond filaments includes a spinning head (spinneret) fed by extruders, and a cooling chamber where the filaments undergo at least partial cooling. The filaments leaving the spinning head pass through a cooling chamber where they interact with a current of air that removes heat from them. Downstream of the spinning apparatus, in relation to the direction of the fall of the filaments, i.e. downstream of the cooling chamber, a stretching unit and a unit for the depositing of the stretched filaments on a mobile support (for instance a conveyor belt) where the desired nonwoven fabric is formed, are usually provided

[0003] A traditional plant for the production of non-woven fabrics starting from spunbond filaments is described in WO 2007 003377.

[0004] The traditional cooling chambers are generally closed laterally by walls within which is fed one or more flows of a cooling gas, typically air. The direction and volume of each airflow is designed to optimize the cooling effect on the filaments, which leave the spinneret at a temperature close to that of extrusion.

[0005] The traditional apparatus for the production of synthetic yarns present some non negligible drawbacks, specifically evident during the starting step, or in the time immediately following an emergency shutdown of the apparatus.

[0006] Normally, when a traditional apparatus for the production of synthetic yarns is started, it is necessary to wait a certain period of time until the same apparatus reaches the normal operating speed according to the preset parameters. During the transitory plant-starting period, the characteristics of the filaments leaving the spinnerets and their related cooling chambers are generally not satisfactory. This is due mostly to the fact that the spinnerets and the other parts of the apparatus, initially cold, have yet to reach the normal operating temperature, and to the fact that any residues from previous work have to be removed from the spinneret before the filaments assume the desired characteristics. Immediately after starting, for instance in the first minute, the filaments leaving the cooling chamber are not suitable for the production of the final non-woven fabric and have to be discarded. The disposal of the discarded filaments represents a nonnegligible problem in the management of the apparatus and the related plant. The discarded filaments must not be fed to the stretching unit or deposited on the mobile support, therefore they are generally removed manually to the side of the plant, near the exit of the cooling chamber.

[0007] The discarded yarns are usually collected manually by an operator. In practice the task of the operator is to manually grasp the yarns to be discarded as they leave the exit opening of the cooling chamber and to redirect them into containers. This operation involves safety risks for the operator, because the quantity of filaments produced in the actual apparatus in a unit of time is considerable and generally so great that the operator is swamped by voluminous masses of filaments that tend to become entangled. There is therefore the risk that the discarded filaments becoming entangled, hinder the movements of the operator, who could remain "trapped" in the masses of filaments. The risk increases when the operator is not sufficiently fast in re-directing the discarded filaments towards the related containers.

[0008] When the transitory starting period is finished, i.e. when the characteristics of the filaments leaving the cooling chamber satisfy the desired qualitaty standard, the operator cuts the discarded filaments, i.e. separates the part of all the filaments to be discarded from the new part leaving the cooling chamber, and redirects the new filaments toward the stretching chamber or unit for the succeeding treatment provided by the apparatus.

[0009] There is an analogous problem when an apparatus that is working normally is stopped. The feeding of the filaments to the stretching chamber or unit and to the underlying mobile support for collection of the filaments has to be interrupted to prevent blocking the stretching unit and/or damaging the conveyor belt. It is necessary to divert the filaments leaving the cooling chamber to nearby collection areas. Also in this case, therefore, the problem arises of how to manage the great masses of filaments leaving the spinneret and the cooling chamber all through the period the apparatus is stopped. According to the known art, the operator diverts the residual filaments manually toward containers or collection areas.

[0010] The necessity arises therefore to provide an apparatus in which the disposal of the discarded filaments or the residual filaments is simple and without risks for the operators and in which such operation can be effected in a short time.

[0011] One purpose of the present invention is to resolve the aforementioned problems by supplying an apparatus for the production of synthetic yarns and the related method for its operation, that allows the management of the discarded and the residual filaments during the steps of starting and stopping to be simplified, making the intervention of the operator safe and quick at the same time.

[0012] A further purpose of the present invention is to resolve the aforementioned problems by supplying an apparatus for the production of synthetic yarns that allows the times of starting and stopping to be minimized in relation to the traditional solutions available.

[0013] Such purpose is achieved by the present invention that relates to an apparatus for the production of synthetic yarns, characterized according to Claim 1.

[0014] The apparatus includes a spinneret to extrude a plurality of filaments and a cooling chamber to cool the extruded filaments by flows of cooling air. A stretching unit of the filaments is provided downstream of the cool-

ing chamber. Advantageously, the apparatus includes means of collecting the filaments upstream of the stretching unit and maintaining them in tension.

[0015] The spinneret is preferably a linear spinneret. Advantageously, the cooling chamber is provided with at least one wall that can be opened to create an alternative path for the falling filaments. In other words, a portion of the wall of the cooling chamber is movable to provide an opening through which it is possible to divert the path of the filaments in a transverse direction, a path that is normally vertical or almost vertical during the normal operation of the apparatus. In practice, the opening wall intercepts an opening through which it is possible to divert the filaments in a transversal direction toward the means of collection, thus significantly facilitating the disposal of the filaments themselves during the transitory starting of the apparatus.

[0016] Preferably the opening wall is provided in correspondence of the final part of the cooling chamber, in relation to the direction of advancement of the filaments, i.e. corresponding to the exit opening of the cooling chamber, that is also the lower portion of the chamber.

[0017] According to one embodiment of the apparatus of the invention, the opening wall is a wall hinged to the remaining part of the side wall of the cooling chamber. Alternatively, the opening wall could consist of a removable portion of the wall of the cooling chamber. In this configuration the opening wall makes available a substantially horizontal or slightly tilted path of the filaments. The opening of the wall can be manual, or can be motorized, and can for instance be controlled automatically by one or more actuators operated by a control unit.

[0018] The dimensions and the shape of the opening wall can vary according to the dimensions of the apparatus and the cooling chamber. What matters is that the passage left free by the open wall is sufficiently large to allow an operator to easily access the yarns in movement in the cooling chamber.

[0019] In relation to the traditional solutions, the apparatus according to the present invention has the advantage of allowing the controlled collection of the discarded filaments during the starting step, i.e. during the initial transitory period, when the quality of the produced filaments is not satisfactory. At least one collection unit can be positioned in correspondence of the opening wall, at the side of the cooling chamber, to extract the discarded filaments diverted through the passage made available by the open wall. The collection unit can in turn feed the discarded filaments to special containers or to collection areas of specifically set aside near the apparatus for the accumulation of large volumes of woven filaments.

[0020] The collection unit is adjustable to maintain the speed of advancement of the taut filaments almost constant. Such unit can be mechanical or pneumatic (for instance, a suction unit).

[0021] The starting of the apparatus according to the present invention is simple. First, the opening wall is operated and kept open. Subsequently, the first filaments to be discarded begin to be "ejected" from the spinneret, passing through the upper portion of the cooling chamber. An operator intervenes to divert the path of the discarded filaments, for instance grasping them by hand or with special tools. The operator directs the filaments towards the collection unit, which intervenes to draw them at substantially constant speed and accumulate them in the related containers, or in the special collection areas. Advantageously, the movements that the operator has to make are simple and require little time. For instance, for an apparatus having a spinneret of around 4 meters length three movements of the operator's arm are enough to divert all the falling filaments in the cooling chamber toward the collection unit.

[0022] Once diverted, the discarded filaments are moved almost horizontally, rubbing over a side portion of the cooling chamber, in correspondence of the hinge of the opening wall, while being drawn out by the collection unit or units.

[0023] The management of the discarded filaments is simple. When the transitory starting period of the apparatus is finished, i.e. when the quality of the filaments advancing is satisfactory in respect of the desired parameters, the operator intervenes to cut the filaments while these are drawn out by the collection unit. The extremities of the filaments that the spinneret feeds continuously are directed by the operator toward a stretching unit positioned under the cooling chamber, for subsequent treatments known in the art. The opening wall is closed to restore the initial configuration of the cooling chamber and the apparatus can be considered to be running normally.

[0024] Advantageously, the operator can operate around the cooling chamber without risking being obstructed by the discarded filaments, which have been accumulated in the containers or in the special collection areas. The quantity of discarded filaments are ready for disposal or recycling.

[0025] The person skilled in the art will understand that the opening wall also allows the management of the apparatus in the event of a sudden stop to be simplified. In this case, in fact, the operator intervenes to divert the residual filaments toward the collection unit or units, preventing the same filaments from forming unwanted or harmful agglomerations on leaving the cooling chamber.

[0026] The starting of the apparatus is characterized according to Claim 8.

[0027] Preferably, the apparatus includes a stretching unit endowed with a stretching duct located below the cooling chamber. Advantageously, the apparatus includes also a sliding shutter movable between a first position, corresponding to which the stretching duct is closed, and an open position, corresponding to which the stretching duct is accessible to the filaments that leave the cooling chamber. The actuation of the sliding shutter can be manual or automatic, motorized.

[0028] During the plant-starting step, or when it is necessary to stop the plant in a short time, for instance in an

emergency, the sliding shutter is closed to prevent the filaments leaving the cooling chamber and being deposited on the mobile support fed by the stretching unit, for instance a conveyor belt, or to prevent the filaments clogging the stretching duct. Preferably, therefore, the step of closing the sliding shutter is simultaneous with the step of diverting the initial vertical path of the filaments through the side opening defined by the opening wall.

[0029] During normal operation of the apparatus, on the other hand, the sliding shutter remains open to allow the filaments leaving the cooling chamber to enter the stretching unit.

[0030] The apparatus according to the present invention and the related method for starting and stopping, allows the management of the discarded filaments and the residual filaments to be enormously simplified, improving at the same time the working conditions of the operator and minimizing the starting/stopping times. Furthermore, the risks of damaging the conveyor belt on which unsatisfactory filaments are never deposited for production, are reduced.

[0031] The invention will now be described in greater detail with reference to the enclosed drawings, which are by way of example and not limiting, where:

- Fig. 1 is a schematic view in section of an apparatus according to the present invention for the production of synthetic yarns, in a first configuration;
- Fig. 2 is a schematic view, in section, of the apparatus shown in figure 1, in a second configuration.

[0032] With reference to Fig. 1, the apparatus 1 for the production of synthetic yarns according to the present invention includes at least one spinneret 2, fed by one or more extruders 3 and a cooling chamber 4. The extruders 3 feed the spinneret or spinnerets 2 with a traditional polymer of the type used for the production of "spun bond" filament, for instance polyamide. In this way continuous filaments 5 are formed that advance vertically in the cooling chamber 4.

The cooling chamber 4 is positioned below the spinneret 2 and it extends between the same spinneret 2 and a stretching unit 10 positioned downstream of the cooling chamber 4 in relation to the direction of advancement of the filaments 5, the stretching unit is endowed with a stretching duct 16 in which the filaments 5 are drawn. Regulating the intensity of the cooling and the strength of draught of the stretching unit 10 the diameter of the stretched filaments is modified to the desired value.

[0033] The filaments 5, stretched, leave the stretching unit 10 and are deposited on a mobile support downstream of the unit 10, for instance a conveyor belt (not shown) positioned below the exit opening of the stretching duct 16. It will be clear to the person skilled in the art that varying, for instance, the type of the polymer fed by the extruders 3, the degree of stretching of the filaments 5 and the speed of fall onto the conveyor belt, the characteristics of the non-woven spunbond fabric that is being formed are modified.

[0034] The cooling chamber 4 is shaped to direct flows of a cooling gas, preferably air, toward the filaments leaving the spinneret 2. The arrows in figure 1 show a possible configuration of the jets of air, which are fed by fans 6 or by similar means. The direction of the individual jets of air is suitably regulated by tilting internal walls of the cooling chamber 4, the volume of the jets is regulated instead by controlling the operation of the fans 6.

[0035] The structure of the cooling chamber 4 can be, in its entirety, known to the art. What matters for the aims of the present invention is that, independently of its general structure, the cooling chamber 4 is provided with an opening portion to provide the vertically falling filaments 5 with an alternative path to their "normal operation" path toward the stretching unit 10.

[0036] A traditional radial type cooling chamber is described, for instance, in the American patent US 3,705,227 in the name Fintel. The cooling air is fed through a duct. The cooling chamber includes inside deflectors shaped to initially direct the flow of cooling air inside the volume Individualized by the filaments advancing, in the lower portion. The cooling chamber is constricted in the lower portion. The cooling air is drawn into the upper portion of the cooling chamber by an aspirator and it crosses the cone of filaments once more, this time in exit.

[0037] Another traditional cooling chamber is described in the international patent application PCT n. WO 2006/024435, in the name of Diolen Industrial Fibers B.V.. Two cooling zones are provided inside the chamber. A first zone is that immediately under the spinneret. The cooling fluid is initially fed to this zone, in transverse direction, to cool the filaments leaving the spinneret. The second zone of cooling is provided under the first zone, or downstream of the first zone of cooling in relation to the direction of fall of the filaments. The cooling fluid, after having interacted with the warm filaments leaving the spinneret, is drawn toward the second cooling zone in the lower portion of the chamber. The cooling fluid undergoes a thermal treatment before reaching the second area of cooling. In other words, after the fluid has abandoned the first zone of cooling, it undergoes a cooling before being communicated toward the second zone to interact with the filaments that are about to leave the cooling chamber.

[0038] Other traditional cooling chambers are described in the patent applications US 2003/0178742 and US 2003/0161904 in the name of Reifenhauser.

[0039] The cooling chambers according to the known art can easily be modified, by adding a laterally opening wall, in accordance with the present invention.

[0040] In the cooling chamber 4 of the apparatus 1 according to the present invention, the air is preferably introduced in the lower portion of the same chamber 4. The heated air, the air that has subtracted heat from the filaments 5 in vertical advancement, is aspirated from the upper portion of the cooling chamber 4, for instance

through exit conduits 41 connected to aspirators 6A.

[0041] The cooling chamber 4 can have a circular cross-section, as in the case in which the spinneret 2 is circular, or can have a rectangular transversal section, for instance in the case in which the spinneret 2 is linear type. Preferably, as shown in the figures 1 and 2, the apparatus 1 is endowed with one or more linear spinnerets 2 and the cooling chamber is therefore also extended in depth, or in the direction perpendicular to the plan of the sketch. The longitudinal section of the cooling chamber 4 can vary according to necessity, but preferably comprises a lower portion 42 convergent toward the stretching unit 10.

[0042] When the apparatus 1 is working normally, the filaments 5 are continuous filaments that leave the spinneret 2 (or spinnerets 2), pass through the cooling chamber 4 and converge toward the related opening of exit 43. The continuous filaments 5 continue to advance through the stretching unit 10 and from this they are deposited on the mobile support, where they interlace and form a spun bond type non-woven fabric.

[0043] When the apparatus 1 is started, a certain period of time intervenes before normal operation is reached. During such period of time, the apparatus operates in transitory starting period.

[0044] The filaments 5 that leave the spinneret 2 during the transitory starting period, as usually happens in the apparatus of this type, are not suited for the production of the fabrics, i.e. they don't have the desired quality characteristics and, therefore, have to be rejected. The starting step, or transitory, finishes when the filaments 5 that leave the spinneret 2 present the quality characteristics required for the production of the non-woven fabrics.

[0045] The apparatus 1 according to the present invention allows the disposal of the discarded filaments 5 produced during the transitory starting period to be managed in a simple and effective way.

[0046] Figure 2 show the apparatus 1 during the starting step, i.e. in a different configuration from that of normal operation shown in figure 1. Advantageously, independently of its general structure, the cooling chamber 4 is provided with an exit to make available to the filaments 5 an alternative path that doesn't make them converge toward the stretching unit 10 fallen. The exit for instance includes a portion of opening wall 12 that provides an opening 12A through which it is possible to divert the filaments 5 in a transverse direction in relation to the vertical direction of advance during the normal operation.

[0047] The opening wall (or portion of wall) 12 can be a removable portion of the cooling chamber 4, but preferably is formed by a hinged side wall beside the cooling chamber 4. The opening of the opening wall 12 can be manual or motorized with operation commanded by actuators.

[0048] In the embodiment shown in the figures 1 and 2, the opening wall 12 is a portion of the side wall that delimits the cooling chamber 4, bound in a hinged way to the remaining portion of the chamber 4 by the hinge 44. The driving of the opening wall 12 can be assisted or commanded by the actuator 11, for instance a mechanical, pneumatic or oleo-pneumatic system.

[0049] The position of the opening wall 12 can vary along the height of the cooling chamber 4, but preferably such wall 12 is provided in proximity of the exit portion 42 of the chamber 4, i.e. the lower portion that converges toward the stretching duct 16 of the unit 10. When the wall 12 is opened, as shown in figure 2, the discarded filaments 5 are diverted laterally, in a transverse direction in relation to the direction of fall from the spinneret 2. This prevents the filaments 5 not suited for the production being deposited on the mobile support, or clogging the stretching channel or conduit 16 during the starting of the apparatus 1.

[0050] The invention provides furthermore means of collection of the filaments, or of draught, to the exit of the opening 12A. The means of collection include at least one collection or suction unit, 15, having the function of collecting the filaments diverted by the cooling chamber 4 and holding them in tension (or rather ejecting them) and to accumulate them in containers or areas predisposed for the purpose.

[0051] In this way the technician employed to start the apparatus 1 is no longer forced to quickly remove the discarded filaments manually.

[0052] The apparatus 1 shown in figure 2 includes at least one collection (or suction) unit 15, for instance mechanical or pneumatic type, having the function of drawing out the discarded filaments 5A diverted through the opening 12A and placing them in special containers or special collection areas for the discards (not shown). Preferably the unit 15 ejects the filaments 5A at a substantially constant speed. For instance, the collection unit 15 can be similar or equivalent to the stretching unit 10, i.e. can be provided with a of pneumatic action aspiration duct, in which the filaments 5 are drawn diverted from the cooling chamber 4. Alternatively, the collection unit can be of a mechanical type, for instance opposed rollers that draw the filaments 5 between the rollers themselves. The working conditions of the operator are therefore improved in relation to what happened in the traditional apparatus.

[0053] Preferably the means of collection 15 are adjustable, i.e. the force with which the diverted filaments 5 are drawn from the cooling chamber 4 is adjustable. The apparatus 1, in its preferred embodiment, provides that the driving of the means of collection 15 is controlled by feedback to maintain the speed of collection of the discarded filaments 5 as constant as possible.

[0054] The starting of the apparatus 1 is simple and require less time than that needed by the traditional apparatus. An operator intervenes to collect the first filaments 5 that leave the spinneret 2 and, making them pass through the opening 12A made free by the opening wall 12, feeds them to the collection unit 15 (for instance feeds them to the related aspiration duct), which provides to redirect the filaments into the containers or collection

areas, away from the operator. The operator can collect the filaments 5 manually in a few seconds, for instance with hands protected by gloves, or with special grasping utensils. For instance, if the spinneret 2 is 5 meters long, three movements of the arm are enough for the operator to direct all the filaments 5 toward the collection unit, every movement being devoted to the taking of a part of the filaments 5. During the disposal, the filaments 5 rub on the hinge 44 toward the collection unit 15 and are indicated by the reference number 5A.

[0055] The person skilled in the art will understand that the dimensions and the shape of the wall 12 can vary according to the requirements. What matters is that the opening 12A allows the operator to easily access, by hand or with a tool, the filaments 5 advancing in the cooling chamber.

[0056] When the transitory starting period is finished and the filaments 5 that leave the spinneret 2 have the desired characteristics, the operator intervenes to cut the bundle of filaments 5A between the hinge 44 and the collection unit 15, interrupting therefore the continuity of the filaments 5. The part of the filaments 5 downstream of the cut are drawn in by the unit 15 and eliminated into the containers or the collection areas. The part upstream of the cut is positioned by the operator in front of the channel 16 of the stretching unit 10, which provides to aspirate or to draw the filaments 5, now suited for the production, and to feed them to the mobile support, positioned under the same unit 10.

[0057] Once the starting has been completed, the wall 12 is closed again to re-establish the normal configuration of the cooling chamber 4, shown in figure 1.

[0058] The apparatus 1 has the advantage of allowing quick and simple disposal of the discarded filaments 5 produced during the transitory starting period, when the components of the apparatus 1 are not yet operating normally and the quality of the filaments 5 is unsatisfactory. The discarded filaments 5 are collected not in contact with the operator, who is able to operate in a safe environment and doesn't risk being struck by masses of filaments that are tangled, as is possible in the traditional apparatus. The movements demanded of the operator to direct the filaments 5 toward the collection unit 15, and to cut the filaments and to direct them toward the stretching unit 10, are few, they require few seconds, and no particular effort or ability are necessary. Furthermore, the discarded filaments collected in the special containers are ready to be recycled or disposed of as refuse.

[0059] According to a form of preferred embodiment of the present invention, the stretching unit 10 of the apparatus 1 is provided with means for closing on command the stretching channel. Preferably, such means are a wall or a safety sliding shutter 13 movable to open/close the channel 16. The sliding shutter 13 can be controlled manually, but is preferably motorized. When the sliding shutter is in closed position (shown in figure 2), the access to the filaments 5 in the channel 16 is denied. When the sliding shutter is in opening position (shown in figure 1), the access to the filaments 5 in the channel 16 is possible.

[0060] During the normal operation of the apparatus 1, the sliding shutter or wall 13 is open and the filaments 5, continuous, pass through the channel 16.

[0061] During the transitory starting period, or in situations of emergency that require the sudden and rapid shutdown of the apparatus 1, the sliding shutter 13 is brought ino closed position, to prevent the filaments 5 clogging the channel 16 or being deposited on the conveyor belt or the equivalent mobile support.

[0062] The sliding shutter 13 therefore allows the mobile support, for instance a conveyor belt, to be safeguarded from possible damage caused by the filaments 5 in emergency situations or in the steps of starting the apparatus 1.

Claims

1. Apparatus (1) for the production of synthetic filaments (5), comprising at least one spinneret (2) to extrude a plurality of filaments (5), a cooling chamber (4) for said filaments (5) and a stretching unit (10) of said filaments (5), **characterized by** comprising furthermore means (15) of collecting said filaments (5) upstream of the stretching unit (10), maintaining them in tension.

2. Apparatus (1) according to Claim 1, **characterized by** the said means (15) of collecting the filaments comprising a collection container, a device for drawing out the filaments, selected from among mechanical and pneumatic devices, and a means of regulating the speed of collection of the said filaments.

3. Apparatus (1) according to Claim 1 or Claim 2, **characterized by** said cooling chamber (4) being provided with at least one opening wall (12) to make available to the filaments (5) a transverse path in relation to their initial direction of advance, in the direction of said means of collection (15).

4. Apparatus (1) according to Claim 3, **characterized by** said opening wall (12) comprising a wall hinged to the side wall of the cooling chamber (4).

5. Apparatus (1) according to any of the preceding Claims 1-4, comprising furthermore means of closing the entry to the duct (16) of the stretching unit (10).

6. Apparatus (1) according to Claim 5, wherein said means of closing the duct (16) comprises a sliding shutter (13) movable between a first position, in correspondence of which said duct (16) is closed, and an open position, in correspondence of which said duct (16) is accessible to the filaments (5) that leave the cooling chamber (4).

7. Apparatus (1) according to Claim 6, **characterized by** said sliding shutter (13) being controlled manually or automatically.

8. Method for the production of synthetic filaments by extrusion, cooling and stretching of the same by the apparatus according to any of Claims 1-7, **characterized by** the fact that during the steps of starting and/or stopping said apparatus the following steps are performed:

- to laterally divert the initial path of the filaments (5) advancing in the cooling chamber (4), upstream of the stretching unit (10);
- to collect said filaments (5) through collection devices (15) external to the cooling chamber (4) maintaining the filaments in tension.

9. Method according to Claim 8, wherein the speed of collection of the filaments in said collection devices (15) is regulated.

10. Method according to Claim 8 or 9, wherein during the step of deviation of the path of the filaments (5) at least one portion (12) of the side wall of the cooling chamber (4) of the apparatus (1) is opened to direct the filaments (5) toward said collection devices (15).

11. Method according to any of Claims from 8 to 10, comprising furthermore the step of closing the duct (16) of the stretching unit (10) of said apparatus (1) to temporarily prevent the filaments (5) leaving the cooling chamber (4) to enter the stretching unit (10) up to the end of a transitory step of collection of the filaments (5) through the collection devices (15).

12. Method according to Claim 11, wherein said step of closing of the duct (16) precedes or is simultaneous with the step of laterally diverting the initial vertical path of the filaments (5) advancing in the cooling chamber (4).

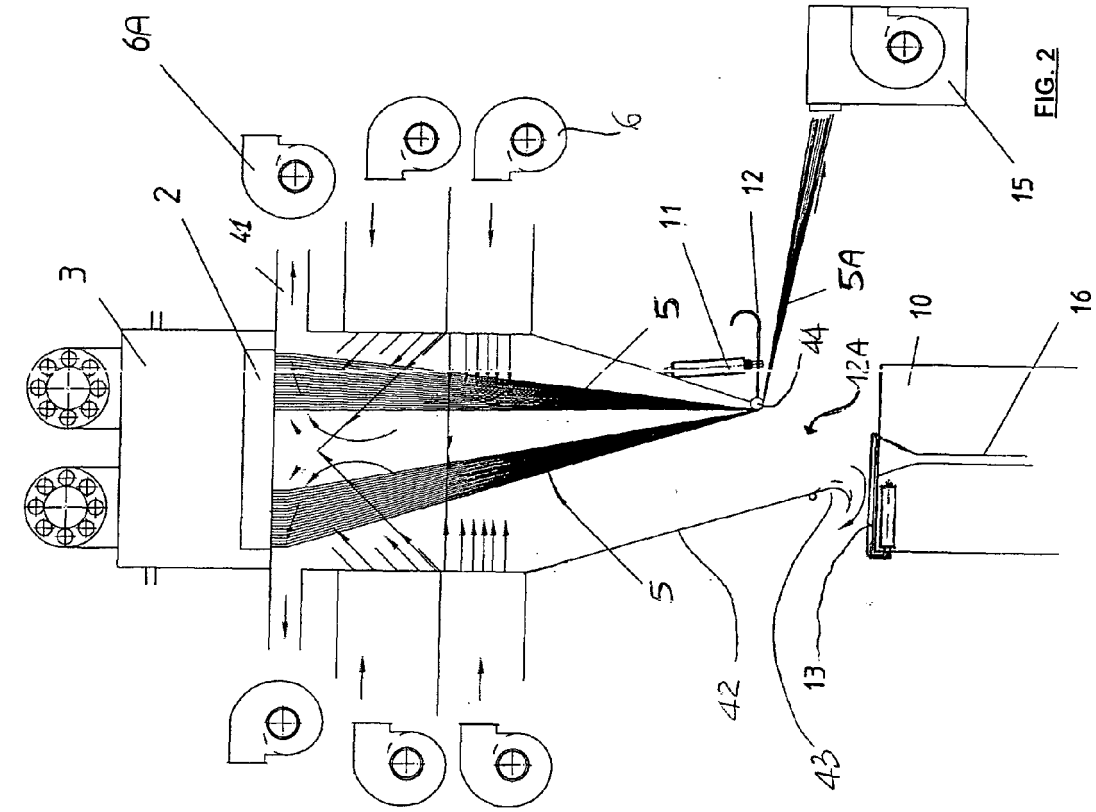
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FIG. 2

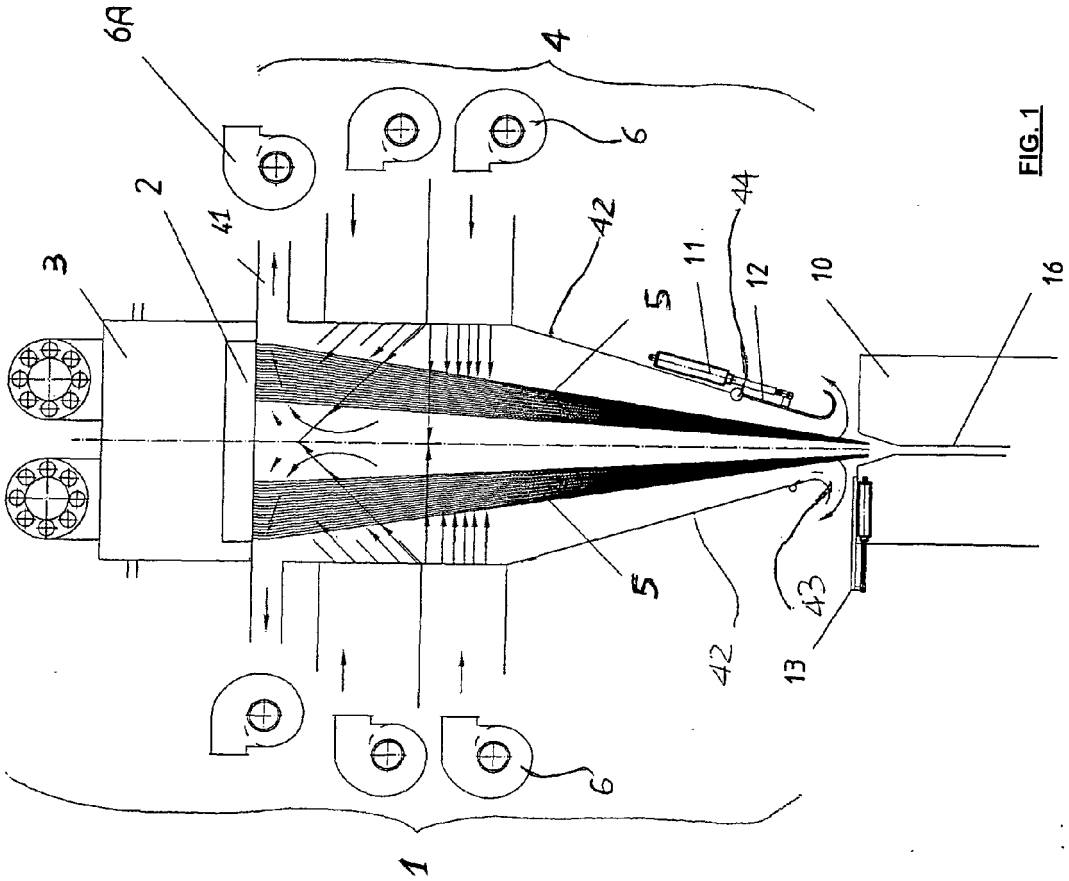
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FIG. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5479

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	DE 101 17 087 A1 (BARMAG BARMER MASCHF [DE]) 11 October 2001 (2001-10-11) * column 1, line 45 - column 2, line 35 * * column 3, line 55 - column 4, line 35 * * column 5, line 29 - line 40 * * figures *	1,2,8,9 3-7, 10-12	INV. D01D5/02 D01D5/098 B65H54/88
X	GB 1 134 991 A (DU PONT) 27 November 1968 (1968-11-27) * the whole document *	1,2,8,9	
X	US 3 807 270 A (WIRZ A) 30 April 1974 (1974-04-30) * column 1, line 56 - column 2, line 26 * * column 3, line 31 - line 66 * * column 4, line 65 - column 5, line 23 * * figure 1 *	1,2,8,9	
A	US 2 667 964 A (EDWIN MILLER CLARENCE) 2 February 1954 (1954-02-02) * column 1, line 1 - column 2, line 15 *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

D01D
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 January 2008	Fiocco, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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)

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 42 5479

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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23-01-2008

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