A meltblown method for melt spinning fine non-woven fibers and a device for carrying out said method. According to the invention, a polymer melt is extruded, in order to form several fiber strands, through several nozzle bores of a spinning nozzle and twisted on the outlet side of the nozzle bores by means of a cold blow flow. According to the invention, the blow flow is fed to the fiber strands in an acceleration path wherein the fiber stands and the blow flow are accelerated in such a manner that the fiber strands are twisted in order to form continuous fine fibers. According to the inventive device, the inventive acceleration path is formed between the upper edges and the lower edges of the two blow nozzle openings below the spinning nozzle.
DEVICE AND METHOD FOR MELT SPINNING FINE NON-WOVEN FIBERS

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application is a continuation of international application PCT/EP 2004/014403, filed 17 Dec. 2004, and which designates the U.S. The disclosure of the referenced application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a melt-blown method for melt spinning fine non-woven fibers, as well as to a device for carrying out said method.

[0003] In the production of non-woven microfibers a plurality of fiber strands are extruded from a polymer melt through nozzle holes of a spinneret and then drawn with a blowing stream into microfibers. Such fibers exhibit an average fiber diameter of usually <10 μm. In the state of the art such methods are called melt-blown methods. The blowing stream is preferably produced from hot air that is blown with a high expenditure of energy on the fiber strands. The blowing stream leads to drawing and bursting of the fiber strands so that fine non-woven fibers of finite length are produced.

[0004] DE 33 41 590 A1 and corresponding U.S. Pat. No. 4,526,733 disclose such a method, where a fluid, which is not heated up, is used as the blowing stream. In principle, such relatively cold blowing streams exhibit the advantage that there is no need to heat up the fluid. This method could also produce fine fibers made of thermoplastic polymers, which exhibit a fineness of less than 10 μm.

[0005] Irrespective of whether the prior art melt-blown method is carried out with a hot blowing medium or with a cold blowing medium, as disclosed in the DE 33 41 590 A1, the fiber strands are usually torn into fine fibers. In addition to the disadvantageous formation of fuzz, such fibers lead, upon being deposited to form a non-woven fabric, to irregularities in the physical properties due to the conglomerated fiber pieces. In particular, such non-woven fabrics can tolerate only slight tensile strengths owing to the fine fiber pieces.

[0006] DE 199 29 709 A1 discloses another method for producing fine non-woven fibers. In this method the fiber strands are split into fine fibers by means of a gas stream. The prior art method, which is referred to as the Nanova method in professional circles, is based on generating a pressure effect on the fiber strand subject to the action of a gas stream and a nozzle unit. Said pressure effect causes the fiber strand to burst so that a plurality of fine, essentially endless fibers is produced. At the same time the hydrostatic pressure, prevailing in the interior of the fibers, is greater than the gas pressure that envelops the fiber strands and by means of which the bursting of the fiber strands is achieved. Then the fibers are guided—subject to the action of the gas stream—to a depositing area and are deposited as a non-woven fabric.

[0007] All of the state of the art melt-blown methods run the risk that the individual fibers will conglutinate before the final solidification and lead to undesired points of discontinuity in the non-woven fabric.

[0008] Therefore, an object of the invention is to provide a melt-blown method for melt spinning fine non-woven fibers of the type described in the introductory part. According to this method, a high quality microfiber could be produced at a relatively low expenditure of energy.

[0009] Another goal of the invention is to provide non-woven fibers for producing a non-woven fabric, which exhibits improved physical properties.

[0010] In addition, an object of the invention is to improve a melt-blown method and a melt-blown device for melt spinning fine non-woven fibers in such a manner that a microfiber is produced that exhibits maximum uniformity and continuity in order to attain, during their subsequent manufacture into a non-woven fabric, a uniform distribution of the fibers during the depositing process.

SUMMARY OF THE INVENTION

[0011] The above objectives and others are realized according to the invention by providing, in one embodiment, a method for melt spinning fine non-woven fibers, comprising extruding a polymer melt through several nozzle holes of a spinneret in order to form several fiber strands, and immediately after emerging from the nozzle holes, acting on the fiber strands with a cold blowing stream that, subject to the action of an overpressure, flows through at least one blowing nozzle orifice onto the fiber strands and draws the fiber strands, wherein the blowing stream is guided to the fiber strands inside an acceleration section, in which the fiber strands and the blowing stream are accelerated in such a manner that the fiber strands are drawn to form infinite microfibers. The present invention also provides a non-woven fiber and a resulting non-woven fabric produced according to the method.

[0012] The invention is based on the knowledge that in the conventional melt-blown methods, the blowing stream is accelerated, upon impinging on the fiber strand, to a maximum velocity. Therefore, the meeting of the blowing stream and the fiber strand results in a more or less sudden elongation of the fiber strands. This elongation leads to drafting and—optionally upon exceeding a maximum spinning draft—to tearing of the fibers. In order to avoid such overstressing of the fibers, the blowing stream is fed, according to the invention, to the fiber strands inside an acceleration section. In the acceleration section the blowing stream and the fiber strands are then accelerated together in such a manner that the fiber strands are drawn to form endless micro fibers. In this way overstressing the fiber strand while drawing can be avoided in an advantageous way. The maximum velocity of the blowing stream is not reached until the end of the acceleration section and leads to the desired total drawing of the fiber strands.

[0013] Since the blowing stream and the fiber strands are accelerated inside the acceleration section, the blowing stream can be fed to the fiber strands at a relatively low expenditure of energy. Thus, it has been demonstrated that merely an overpressure in a range below 1,000 mbar is sufficient to provide the fiber strands with the desired spinning draft. Consequently the consumption of the blowing stream can also be reduced to a minimum.

[0014] The blowing stream is preferably air that exhibits a natural air temperature in a range between 15° C. and 110°
C. Thus, it is possible to quickly establish peripheral zones for the fibers, a feature that benefits in particular the stability of the fibers for drawing. In addition, the microfibers cool better. In this respect it is important that the air does not heat up. Therefore, the temperature that accepts the air without cooling or heating owing to the environmental conditions is called here the natural air temperature.

[0015] The blowing stream is produced preferably from the surrounding air at an ambient temperature. Said surrounding air is drawn in from the environment below the spinneret. At an average consumption of approximately 600 m³/h*m of surrounding air and at a maximum overpressure of 1 bar in a conventional spinning device, the blowing stream can be provided at a low cost.

[0016] Owing to the alternative method, with which the fiber strands are extruded at a mass flow of the polymer melt through the nozzle hole of the spinneret of 1.0 g/min. to 10 g/min. per nozzle hole, all of the current types of polymers, for example polypropylene or polyamide, may be extruded. Preferably a throughput of >3 g/min. is set per nozzle hole. Therefore, the hole diameter may lie in a range between 0.2 and 1.0 mm.

[0017] Therefore, it is especially advantageous for the polymer melt to be heated inside the spinnerets just before emerging from the nozzle holes, so that the freshly extruded fiber strand exhibits a relatively high melting temperature that may be, for example, above 550 °C for a polypropylene fiber. Depending on the type of polymer, the polymer melt is heated preferably to a range between 300 °C and 400 °C. In order to obtain a constant optimal setting as a function of the type of polymer, the capillary diameter of the nozzle holes and the desired fiber fineness, the length of the acceleration section for accelerating the blowing stream and the fiber strands ranges from 2 mm to 30 mm.

[0018] Thus, the fiber strands can be fed directly from the nozzle hole into the acceleration section or not until the fiber strands have passed through a short extrusion zone of a maximum 2 mm, in which the fiber strands may emerge from the nozzle hole without any influence of the blowing stream.

[0019] In order to generate high draft forces on the fiber strands, a preferred alternative of the method provides that the fiber strands and the blowing stream are fed, upon passing through the acceleration section, into a free space, where an atmosphere prevails that is in essence equal to an ambient pressure. The expansion of the blowing stream into the free space produces zones of turbulence, which improves the blowing stream’s attack on the fiber surface. So-called whiplash effects may also occur with the result that the fibers continue to be drawn.

[0020] In order to intensify such effects, additional zones of air turbulence may be generated by air conductors inside the free space. This in turn also generates special effects in the fibers, such as thick and thin points.

[0021] However, there is also the possibility of providing an additional air stream inside the free space for the purpose of cooling. This alternative of the method is especially advantageous to implement in those cases, in which the blowing stream exhibits relatively high air temperatures.

[0022] The method, according to the invention, is suitable for processing all current types of polymers, such as polypropylene, polyethylene, polyester or polyamide, and to process into non-woven fibers with microfiber cross sections ranging up to 0.5 μm. In particular, good results could be attained with a polypropylene material, where the fiber fineness of the infinite microfibers was in a range between 1 μm and 30 μm.

[0023] The microfiber, produced with the method according to the invention, is suitable, as an infinite fiber, in particular for depositing in order to form a non-woven fabric.

[0024] The inventive device for carrying out the inventive method provides that an acceleration section is formed between the upper edges and the bottom edges of the two blowing nozzle orifices, which are arranged below the spinneret. Thus, there is no need for any additional aids in order to achieve an acceleration section, which is designed directly below the nozzle holes. The device, according to the invention, is characterized in particular in that a plurality of fiber strands can be drawn uniformly with relatively close spacing to form microfibers without the adjacent fibers conglutinating. Therefore, the device, according to the invention, is suitable for producing a large number of high quality microfibers of high uniformity.

[0025] According to an advantageous further development of the inventive device, the upper edge of the two blowing nozzle orifices is assigned to an entry throat; and the bottom edges of the two blowing nozzle orifices are assigned to an exit throat in order to achieve a defined acceleration section. The exit throat exhibits a free flow cross section that is smaller than the flow cross section of the entry throat. Thus, after the fibers have passed through the entry throat, they may be accelerated continuously by means of the blowing stream, emerging from the blowing nozzle orifices, as far as up to the exit throat.

[0026] Depending on the fiber fineness and the type of polymer, the exit throat is set to a slit width ranging from 2 to 8 mm. The slit width is defined by the smallest distance between the bottom edges that are opposite each other and belong to the blowing nozzle orifices.

[0027] The entry throat, which exhibits a larger slit width, can be formed advantageously directly on a level with the underside of the spinneret, so that the extruded fiber strands can enter directly into the acceleration section. However, there is the possibility of forming the entry throat at a short distance from the underside of the spinneret, so that the fiber strands do not reach the acceleration section until after passing through a short extrusion zone ranging from 0 to 2 mm.

[0028] The length of the acceleration section is defined by the distance of the entry throat from the exit throat. Depending on the type of fiber and the fiber fineness this length may range from 2 mm to 20 mm.

[0029] A preferred design of the inventive device exhibits an inflow channel for each blowing orifice for the air supply. Said inflow channel is formed between the bottom edge and the upper edge of the respective blowing nozzle. Therefore, the upper edge and bottom edge are aligned or formed in such a manner that the inflow channel exhibits in the direction of the blowing orifice a tapering flow cross section on the end of the bottom edge and the upper edge respectively. Thus, a continuous acceleration of the supplied air as
far as up to the entry into the acceleration section can be achieved so that a small supply of energy is necessary to generate the blowing stream.

[0030] The air that is made available is held advantageously in reserve in a pressure chamber that is connected to the blowing orifices.

[0031] According to an especially advantageous further development of the inventive device, the pressure chamber is connected to a suction unit in order to provide air as inexpensively as possible. This suction unit takes in the surrounding air and conveys it directly into the pressure chamber.

[0032] A free space is formed below the bottom edges of the blowing orifices in order to facilitate an intensive draft of the fiber strands during the expansion of the blowing stream upon emerging from the acceleration section.

[0033] The free space may contain additional aids for guiding, cooling and/or drawing the fibers. This gives the inventive device a high degree of flexibility that makes it possible to produce microfibers of any type and for any application.

[0034] The non-woven fiber, which is made of a polymer material and produced according to the method of the invention, is characterized in that, despite the microfiber cross sections ranging from 0.5 μm to 30 μm, the fibers exhibit an infinite length. This makes it possible to provide infinite microfibers, produced by a melt-blown method, in order to produce non-woven fabrics.

[0035] Thus, the inventive non-woven fabric, which is formed from the non-woven fibers of the invention, is characterized in particular by a high uniformity both in the machine direction and in the cross direction. Therefore, such non-woven fabrics are especially suitable for barrier products, where, on the one hand, permeability to air is desired, but, on the other hand, such a non-woven fabric exhibits a blocking effect with respect to liquids. Therefore, the inventive non-woven fabric is especially suitable for hygienic products, medical products and filter applications.

[0036] The inventive non-woven fabric is characterized in particular by a higher stretching ability as compared to conventional melt-blown non-woven fabrics. Therefore, the inventive non-woven fabric can be used advantageously in products, where minor deformations occur during production or use. In particular for such applications a suitable non-woven fabric is one, where the infinite microfibers, which are made of a polypropylene, are deposited to form a weight per unit area in a range between 1.5 g/m² and 50 g/m² and lead to an elongation at break of at least 60% or can tolerate a maximum tensile stress at an elongation of at least 40%.

[0037] The high strength and deformability of the non-woven fabrics make it possible to produce in an advantageous manner composite non-woven fabrics that exhibit a plurality of layers. In the composite non-woven fabric of the invention, at least one of the layers is made of a non-woven fabric exhibiting the infinite microfibers of the invention.

[0038] Both the inventive non-woven fabric and the composite non-woven fabric are especially suitable for hygienic products, such as diapers, sanitary napkins, medicinal products, such as wound dressings, filter products, or household products, such as cleaning cloths or dust cloths.

[0039] Therefore, for the above applications in particular composite non-woven fabrics, wherein at least one other layer is made of a spun bond non-woven fabric, are preferably used.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0041] FIG. 1 is a schematic representation of a view of one embodiment of the inventive device for carrying out the inventive method;

[0042] FIG. 2 is a schematic representation of a view of a detail of the spinneret underside of another embodiment of the inventive device;

[0043] FIG. 3 is a schematic representation of a view of a detail of another embodiment of the inventive device;

[0044] FIG. 4 is a schematic representation of a longitudinal sectional view of another embodiment of the inventive device;

[0045] FIG. 5 is a diagram of the elongation as a function of the weight per unit of area of a non-woven fabric, according to the invention; and

[0046] FIG. 6 is a diagram of the tensile strength as a function of the weight per unit of area of a non-woven fabric, according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0047] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the present invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0048] FIG. 1 is a schematic representation of a view of a first embodiment of the inventive device for carrying out the inventive method.

[0049] The embodiment exhibits a spinneret 1, which is connected to a melt source (not illustrated here) by means of a melt feed 2. Usually an extruder is used as the melt source. Said extruder melts a thermoplastic material and feeds said material as the polymer melt under pressure to the spinneret. The underside of the spinneret 1 exhibits a plurality of nozzle holes 5, which are connected inside the spinneret 1 to the melt feed 2. The nozzle holes 5 are configured on the underside of the spinneret 1 in a specific arrangement, preferably in a series of rows with one or more rows next to one another. A fiber strand can be extruded out of the polymer melt emerging from each of the nozzle holes 5.

[0050] Underneath the spinneret 1 there is a blower 3, which exhibits two blowing nozzles 4.1 and 4.2, which lie
opposite each other and are located a short distance underneath the spinneret 1. Each of the blowing nozzles 4.1 and 4.2 contains a blowing nozzle orifice 7.1 and 7.2, which is formed between a respective upper edge 9.1 or 9.2 and the respective bottom edge 10.1 or 10.2. The upper edge 9.1 and/or 9.2 and the bottom edge 10.1 and/or 10.2 are designed in the shape of plates and extend with their free end essentially parallel to the nozzle holes 5 of the spinneret 1. Thus, the upper edges 9.1 and 9.2, which lie opposite each other, form an entry throat, and the bottom edges 10.1 and 10.2, which lie opposite each other, form an exit throat for the fiber strands 6. The entry throat and the exit throat are designed in such a manner that between the upper edges 9.1 and 9.2 and the bottom edges 10.1 and 10.2 there is an acceleration section 15, in which a blowing stream, emerging from the blowing nozzle orifice 7.1 and 7.2, is accelerated together with the fiber strands 6.

The upper edges 9.1 and 9.2 of the blowing nozzles 4.1 and 4.2 are usually arranged in such a manner with respect to the spinneret 1 that, on the one hand, no significant heat losses can occur at the spinneret 1 and, on the other hand, no blowing air can escape outside the acceleration section. The design (which is not shown in FIG. 1) of the transition from the spinneret 1 to the upper edges 9.1 and 9.2 shall be explained in detail below.

Each of the blowing nozzles 4.1 and 4.2 is assigned a pressure chamber 8.1 and 8.2, in which is stored a blowing medium, which is held under an overpressure. Preferably air is used as the blowing medium. However, it is also possible to use a gas. The pressure chambers 8.1 and 8.2 may be connected jointly or separately to a pressure source, for example a compressed air ductwork system. Below the blower 3 there is a free space 12 that extends from the bottom edges 10.1 and/or 10.2 of the blowing nozzles 4.1 and 4.2 as far as to a depositing belt 13. The depositing belt 13 serves to deposit the drawn microfibers 11 to form a non-woven fabric 14. To this end, the depositing belt 13 is connected to a drive in order to carry away in a continuous mode the non-woven fabric 14 after the microfibers 11 have been deposited. The arrows show the direction of movement of the depositing belt 13.

The embodiment (shown in FIG. 1) of the inventive device is shown in an operating situation. When in operation, the spinneret 1 is fed continuously a polymer melt, which is made, for example, of polypropylene. The spinneret 1 is designed so that it can be heated in order to hold the melt temperature of the polymer melt in a range above 300°C, preferably in a range between 300 and 400°C. Then the polymer melt is extruded through the nozzle holes 5 to form a respective fiber strand 6. After the fiber strands 6 emerge from the nozzle holes 5, they arrive in the acceleration section 15 and are brought together with a blowing stream. Thus, the fiber strands 6 and the blowing stream are accelerated continuously inside the acceleration section 15 as far up as to an exit throat. In this way the fiber strands 6 are increasingly stretched. The result is then following the expansion of the blowing stream in the free space, said fiber strands form microfibers with a fiber cross section in a range between 0.5 μm and 30 μm. Then the microfibers 11 are deposited continuously as the non-woven fabric 14 on the depositing belt 13.

A cold blowing medium, preferably cold air, is used as the blowing medium for taking off and stretching the fiber strands 6. This process allows the fiber strands to cool down until they are deposited, so that no additional cooling of the fibers is necessary. At air temperatures of, for example 25°C, in particular the free space 12 between the blower 3 and the depositing belt 13 can be held extremely small so that the blowing stream significantly improves the depositing of the microfibers so as to form a non-woven fabric. In addition, the stability of the fiber guide is enhanced in that, when the cold blowing air meets the freshly extruded fiber strands, rapid cooling of the peripheral zones of the fiber strands 6 takes place. However, the stretchability remains essentially preserved owing to the molten core areas of the fiber strands 6.

In order to attain maximum draft forces by means of the blowing stream, the blowing nozzles 4.1 and 4.2 are formed preferably in such a manner that the blowing stream already flows out of the blowing nozzle orifices in the direction of travel of the fibers. To this end, FIG. 2 is a cross sectional view of another embodiment of the inventive device. This cross sectional view shows only a part of the spinneret underside with the underlying blowing nozzle orifices of the blowing nozzles.

The detail in FIG. 2 shows the emergence situation of a fiber strand 6 at the spinneret 1 in a cross sectional view. To this end, the spinneret 1 exhibits a nozzle hole 5. The spinneret 1 has a number of heating elements 19 in order to heat the polymer melt, conveyed inside the spinneret 1.

Below the spinneret 1 there are blowing nozzles 4.1 and 4.2 with blowing nozzle orifices 7.1 and 7.2. The blowing nozzle orifice 7.1 is placed between the upper edge 9.1 and the bottom edge 10.1. The upper edge 9.1 and the bottom edge 10.1 are designed as mold plates, which between themselves form the inflow channel 18.1. The inflow channel 18.1 exhibits a flow cross section that tapers off in the direction of the blowing nozzle orifice 7.1 so that the blowing air, supplied inside the inflow channel 18.1, is accelerated continuously as far as up to the blowing nozzle orifice 7.1. At the same time the inflow channel 18.1 is shaped by the upper edge 9.1 and the bottom edge 10.1 in such a manner that the blowing stream, emerging from the blowing nozzle orifice 7.1, is fed in the direction of travel of the fibers. It has proven to be especially advantageous if the upper edge 9.1 in relation to the bottom edge 10.1 exhibits such a physical curvature that its theoretical imaginary extension that projects beyond the free end strikes in the middle of an exit throat 17, which is formed by the bottom edges 10.1 and 10.2, which lie opposite each other. At the same time, the continuous decrease in the distance between the upper edge 9.1 and the bottom edge 10.1 continues as far as up to the middle of the exit throat 17. This design of the blowing nozzle 4.1 makes it possible to improve the accelerating effect for drawing off the fiber strand.

The blowing nozzle orifice 7.2 of the blowing nozzle 4.2 on the opposite side of the spinneret 1 is identical (as the mirror-image) to the first blowing nozzle orifice 7.1 of the blowing nozzle 4.1. The inflow channel 18.2 between the formed plates of the upper edge 9.2 and the bottom edge 10.2 is configured with a tapering flow cross section. Thus, with respect to a more detailed description reference is made to the aforesaid.

The upper edges 9.1 and 9.2 are spaced apart so as to lie opposite each other below the underside of the
spinneret 1 and form an entry throat 16. The slit width of the entry throat 16 is labeled with the capital letter E in FIG. 2 and defined by the distance between the two upper edges 9.1 and 9.2. The slit width E is essentially constant over the entire spinning width of the spinneret 1.

[0060] Below the upper edges 9.1 and 9.2 the bottom edges 10.1 and 10.2 are arranged so as to lie opposite each other in relation to the exit throat 17. The slit width of the exit throat 17 is labeled with the capital letter A in FIG. 2 and is defined by the narrowest distance between the two bottom edges 10.1 and 10.2. The slit width A of the exit throat 17 is also in essence constant over the entire spinning width of the spinneret 1. The slit width A of the exit throat 17 is designed smaller than the slit width E of the entry throat 16. Between the entry throat 16 and the exit throat 17 there is an acceleration section 15. In particular, through the inflow channels 18.1 and 18.2, which belong to the blowing nozzles 4.1 and 4.2 and which empty directly into the acceleration section 15, the fiber strands 6 together with the blowing air is guided from the entry throat 16 with increasing velocity along the acceleration section 15 as far as up to the exit throat 17 and blown into the free space 12, which is formed below the exit throat 17. The distance between the entry throat 16 and the exit throat 17, which defines directly the exit cross section of the blowing nozzle orifices 7.1 and 7.2 and gives the length of the acceleration section 15, may range from 2 mm to 30 mm as a function of the type of polymer and fiber fineness. The split width of the exit throat 17 varies from 2 mm to 8 mm. Even if the nozzle holes 5 exhibit a capillary diameter of 0.6 mm, microfibers exhibiting a fiber fineness in a range between 1 and 30 μm could be produced with the device of the invention.

[0061] On the side of the blowing nozzles 4.1 and 4.2 that faces the spinneret 1, a sealant 23.1 and 23.2 is disposed between the spinneret 1 and the upper edges 9.1 and 9.2. The sealants 23.1 and 23.2 form, on the one hand, in relation to the spinneret 1 an insulating layer in order to avoid heat losses and, on the other hand, a seal with respect to the blowing air, conveyed in the acceleration section 15. The sealants 23.1 and 23.2 are made preferably of insulating materials.

[0062] In the embodiment of the inventive device, depicted in FIG. 2, there is space between the underside of the spinneret 1 and the acceleration section 15. The result of this space is that the fiber strands 6 do not enter the acceleration section until after they have passed through a short extrusion zone. Such a reverse movement leads to an additional stability with respect to the travel of the fiber strands.

[0063] However, it is also possible to let the extruded fiber strands 6 pass into the acceleration section 15 directly after leaving the nozzle holes 5. Such an embodiment of the inventive device is depicted as a schematic representation in a sectional view in FIG. 3. The design of the spinneret 1 as well as of the blowing nozzles 4.1 and 4.2 is in essence identical to the above embodiment, according to FIG. 2, so that reference is made to the above description, and only the differences are explained.

[0064] The entry throat 16 between the upper edges 9.1 and 9.2 is constructed directly on a level with the underside of the spinneret 1. The result is that upon leaving the nozzle hole 5, the fiber strands 6 enter directly into the acceleration section 15 and make contact with the blowing stream and thus acquire from the spinneret 1 a different take-off behavior.

[0065] On the side of the blowing nozzles 4.1 and 4.2 that faces the spinneret 1, there is one respective air gap 24.1 and 24.2 between the spinneret 1 and the upper edges 9.1 and 9.2. The air gaps 24.1 and 24.2 are dimensioned so closely that in essence no blowing air can pass through, but a sufficient layer of air remains in order to insulate it from the spinneret 1.

[0066] In order to improve and increase the drawing of the microfibers 11, the free space 12 in the embodiment, depicted in FIG. 3, has a number of conductors 20, which result in the formation of a plurality of turbulence zones and, thus, effect an intensification of the drawing process. However, this enables the production of even preferably microfibers with special effects, such as thin points.

[0067] FIG. 4 shows a schematic representation of a longitudinal sectional view of another embodiment of the device of the invention. The embodiment, according to FIG. 4, is in essence identical to the embodiment according to FIG. 1, so that only the differences are explained below, and otherwise reference is made to the above description.

[0068] In the embodiment, depicted in FIG. 4, the blower 3 exhibits a suction unit 21 below the spinneret 1. The suction unit 21 is connected to the pressure chambers 8.1 and 8.2. The suction unit 21 takes in the surrounding air from below the spinneret 1 and feeds it to the pressure chambers 8.1 and 8.2. In this way, the blowing stream for drawing the fiber strands can be produced advantageously from the surrounding air. Thus, the surrounding air exhibits a room temperature that may range, as a function of the surroundings, from 15°C to 40°C. Thus, the result is that the blowing stream can be provided and produced at a very low cost.

[0069] The embodiment, depicted in FIG. 4, exhibits an injector 22 in order to further improve the guide of the fibers below the blowing nozzles 4.1 and 4.2 in the free space 12.

[0070] Therefore, when the fiber strands pass through the injector 22, the surrounding air pending in the free space 12 from the surrounding, is directly involved without any outside assistance in the guiding and cooling of the fibers. However, it is also possible for climate-controlled air to be drawn into the free space 12. Then, as the conditioned air, the climate-controlled air can be predetermined with respect to the air temperature, humidity and air quantity so that specific cooling conditions at the fibers can be set. However, such mechanisms are used preferably in those cases, in which the blowing stream must be produced from a relatively warm air.

[0071] In principle, the inventive method and the inventive device for carrying out the inventive method are suitable for use with polymer melts of all current polymers, such as polyester, polyamide, polypropylene or polyethylene.

[0072] In one example of the method, a polymer, which is made of a polypropylene, is melted to form a melt and extruded through a nozzle hole having a capillary diameter of 0.6 mm and a melt throughput of 6 g/min. per nozzle hole. The number of nozzle holes was 36. The pressure chambers 8.1 and 8.2 were supplied with air at room temperature and
an overpressure of 260 mbar. Therefore, the configuration of the device, depicted in FIG. 2, was used in order to draw
the extruded fiber strands so as to form microfibers. After extruding and drawing, the PP microfibers were deposited to
form a non-woven fabric with a weight per unit of area of 50
g/m². An analysis of a non-woven fabric sample revealed a
fiber fineness of the microfiber in a range between 2.5 and
25.1 µm. The average fiber cross section of the microfibers
was 5.2 µm. The subsequent determination of the elongation
at break of a non-woven fabric sample, which was 40 mm
long, yielded a value of 63% in the machine direction and
70% in the cross direction. At the same time a maximum
tensile strength of 29 N in the machine direction and 17 N
in the cross direction could be determined. Therefore, in
comparison with conventional melt-blown non-woven fab-
rics with finite fiber pieces, an approximately 300% improve-
ment in the physical properties could be determined.

[0073] In a series of experiments the polypropylene fibers
were deposited to form non-woven fabric that exhibited a
variety of different weights per unit of area. The results are
plotted in the diagram in FIG. 5 and FIG. 6. The diagram,
shown in FIG. 5, shows the relationship between the fiber
weight per unit of area of the non-woven fabric and the attained
elongation at break. The capital letters MD and CD design-
nate the orientation of the non-woven material, where MD
(machine direction) stands for the machine direction and CD
cross direction) stands for the cross direction in the non-
oven fabric. As the weight per unit of area decreases, the
elongation at break increases, an effect that indicates in
particular the high strength of the infinite microfibers. Com-
pared to the conventional melt-blown non-woven materials,
an increase of up to 300% with respect to the elongation at
break could be determined.

[0074] FIG. 6 shows a diagram of the tensile strength of the
non-woven fabric as a function of the weight per unit of
area. Here, too, a significant increase over the conventional
melt-blown non-woven fabrics could be determined. The
maximum tensile strength was above 5 N for non-woven
materials with a weight per unit of area of about 10 g/m² and
above 25 N for non-woven materials with a weight per unit
of area of about 50 g/m irrespective of the direction of pull.
Therefore, such non-woven materials are especially suitable
for applications, where deformations, such as in hygienic
materials, must be tolerated, or where deformations occur
during production. The microfiber characteristics of the
non-woven fabric, according to the invention, result, on the
one hand, in an air and/or vapor permeability with a simul-
taneous low penetration tendency. Thus, the non-woven
materials can be used preferably as barrier products, such as
in the hygiene sector for diapers and sanitary napkins.
However, applications in medical technology, such as
wound dressings, are also possible.

[0075] The non-woven fabrics, made of such fibers, may
be included in an especially advantageous manner in com-
posite materials. The suction capability and blocking effect
of such non-woven fabrics may be used advantageously in
a composite non-woven fabric in order to form a barrier
layer.

[0076] The significantly high elongation and tensile
strength of the inventive melt-blown method also lead to
improved processing. Even applications with small de-
formation, such as in hygienic products, are possible without
any problems.

That which is claimed:
1. A melt-blown method for melt spinning fine non-woven
fibers, comprising:
extruding a polymer melt through several nozzle holes of
a spinneret in order to form several fiber strands; and
immediately after emerging from the nozzle holes, acting
on the fiber strands with a cold blowing stream that,
subject to the action of an overpressure, flows through
at least one blowing nozzle orifice onto the fiber strands
and draws the fiber strands,
wherein the blowing stream is guided to the fiber strands
inside an acceleration section, in which the fiber strands
and the blowing stream are accelerated in such a
manner that the fiber strands are drawn to form endless
microfibers.

2. The method as claimed in claim 1, wherein the over-
pressure of the blowing stream is set to a value of less than
or equal to about 1,000 mbar.

3. The method as claimed in claim 1, wherein the blowing
stream is produced from air that exhibits a natural air
temperature in a range between about 15° C. and about 120°
C.

4. The method as claimed in claim 3, wherein the blowing
stream is produced from the surrounding air at an ambient
temperature, the surrounding air being drawn in from the
environment below the spinneret.

5. The method as claimed in claim 1, wherein the fiber
strands are extruded at a mass flow of the polymer melt
through the nozzle holes of the spinneret in the range of
about 1.0 g/min. to about 10 g/min. per nozzle hole.

6. The method as claimed in claim 5, wherein the mass
flow is greater than about 3 g/min. per nozzle hole.

7. The method as claimed in claim 1, wherein before
emerging from the nozzle holes, the polymer melt is heated
to a temperature in a range between about 300° C. and about
400° C.

8. The method as claimed in claim 1, wherein a length of
the acceleration section for accelerating the blowing stream
and the fiber strands ranges from about 2 mm to about 30
mm.

9. The method as claimed in claim 8, wherein the accel-
eration section adjoins directly the mouth of the nozzle holes
without any spacing.

10. The method as claimed in claim 8, wherein the accel-
eration section adjoins directly the mouth of the nozzle
holes at a short distance in the range of a maximum of about
2 mm.

11. The method as claimed in claim 1, wherein after
passing through the acceleration section, the fiber strands
and the blowing stream are fed into a free space, the free space exhibiting a pressure that is approximately equal to the ambient pressure.

12. The method as claimed in claim 11, wherein additional zones of air turbulence, acting on the fibers, are generated by at least one air conductor inside the free space.

13. The method as claimed in claim 1, wherein the fibers are cooled and guided by means of an air stream, supplied below the acceleration section.

14. The method as claimed in claim 1, wherein a fiber fineness of the endless microfibers lies in a range between about 0.5 \( \mu \text{m} \) and about 30 \( \mu \text{m} \).

15. The method as claimed in claim 1, wherein the microfibers are deposited to form a non-woven fabric.

16. A device for melt spinning fine non-woven fibers, the device comprising:

- a spinneret, the underside of which exhibits a plurality of nozzle holes configured in rows;
- and a blower, which exhibits two blowing nozzle orifices, which lie opposite each other, each of the blowing nozzle orifices being formed between an upper edge and a bottom edge, both of which extend substantially parallel to the nozzle holes, wherein an acceleration section is formed between the upper edges and the bottom edges of the two blowing nozzle orifices below the spinneret, and wherein in the acceleration section the fiber strands and the blowing stream are accelerated in such a manner that the fiber strands are drawn into endless microfibers.

17. The device as claimed in claim 14, wherein an exit throat is formed between the bottom edges of the two blowing nozzle orifices, and an entry throat is formed between the upper edges of the two blowing nozzle orifices, wherein the exit throat exhibits a free flow cross section that is smaller than a flow cross section of the entry throat.

18. The device as claimed in claim 15, wherein an exit throat exhibits a slit width in a range between about 2 mm and about 8 mm.

19. The device as claimed in claim 17, wherein the entry throat is constructed on a level with the bottom side of the spinneret.

20. The device as claimed in claim 17, wherein the entry throat is constructed at a short distance from the bottom side of the spinneret.

21. The device as claimed in claim 17, wherein the entry throat and the exit throat define the length of the acceleration section, which lies in a range between about 2 mm and about 30 mm.

22. The device as claimed in claim 14, wherein the bottom edge and the upper edge, which are assigned to one of the blowing orifices, form between themselves an inflow channel for the air feed, and wherein the inflow channel in the direction of the blowing orifice exhibits a tapering flow cross section.

23. The device as claimed in claim 16, wherein the blowing orifices are connected to at least one pressure chamber, in which the air is held under overpressure.

24. The device as claimed in claim 23, wherein the pressure chamber is connected to a suction unit, by means of which surrounding air is drawn in and conveyed into the pressure chamber.

25. The device as claimed in claim 16, wherein a free space is formed below the bottom edges of the blowing nozzles.

26. The device as claimed in claim 25, wherein the free space exhibits additional aids for at least one of guiding, cooling, or drawing the fibers.

27. Non-woven fibers made of a polymer material and produced by means of a melt-blown method as claimed in claim 1, the microfibers comprising an endless length, whereby a fiber fineness of the endless microfibers lies in a range between about 0.5 \( \mu \text{m} \) and about 30 \( \mu \text{m} \).

28. A non-woven fabric made of non-woven fiber, the fibers produced by means of a melt-blown method as claimed in claim 1 and exhibiting an endless length, whereby a fiber fineness of the endless microfibers lies in a range between about 0.5 \( \mu \text{m} \) and about 30 \( \mu \text{m} \).

29. The non-woven fabric as claimed in claim 28, wherein the endless microfibers are deposited to form a weight per unit of area in a range between about 1.5 g/m\(^2\) and about 50 g/m\(^2\) and lead to an elongation at break of at least about 60%.

30. A composite non-woven fabric, comprising several layers of non-woven fabric, wherein at least one of the layers is made of a non-woven fabric exhibiting the endless microfibers as claimed in claim 24.

31. The composite non-woven fabric as claimed in claim 30, wherein the non-woven fabric of the layer exhibits a weight per unit of area in a range between about 1.5 g/m\(^2\) and about 50 g/m\(^2\) and exhibits an elongation at break of at least about 60%.

32. The composite non-woven fabric as claimed in claim 30, wherein at least one other layer is made of a spun bond non-woven fabric.