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Description

The present invention relates to an apparatus and a method for extruding thermoplastic fibres as outlined in the preambles of claim 1 and 24.

An apparatus and a method of this type is disclosed in GB-A-609 167. The known apparatus contains a die head with a centrally disposed high velocity gas bore adapted to receive a gas stream and terminating in a circular nozzle opening for emitting the gas as a gas jet. The circular nozzle opening is surrounded by a second nozzle opening of annular shape adapted to emit the same gas as emitted from the central opening.

The molten thermoplastic material is delivered to outlet openings arranged within the bore spaced from and upstream of the circular nozzle opening.

The known method comprises the forming of thin film of the molten thermoplastic material between the gas stream and the walls of the bore before the fibres are formed between the central jet and the annular jet during escape into the quenching medium outside the die head.

Various further melt blowing processes have been described in "Superfine Thermoplastic Fibres" by Wente, Industrial and Engineering Chemistry, Volume 48, Number 8, Pages 1342 to 1346, August 1956, "Manufacture Of Superfine Organic Fibres", Naval Research Laboratory Report, Number 111437, 1954 and US-A-3 676 242 to Prentice. Apparatuses suitable for use in such processes are described in "An Improved Device For The Formation Of Superfine, Thermoplastic Fibres", by K.D. Lawrence et al, Naval Research Laboratory Report, Number 5265, February 11, 1959, and in US-A-3 981 650 to Page.

Nonwoven mats produced by these and other currently known melt blowing processes and the apparatuses used therefor employ an extruder to force a hot melt of thermoplastic material through a row of fine orifices and directly into converging high velocity streams of heated gas, usually air arranged on alternate sides of the extrusion orifices. Fibres of the thermoplastic material are attenuated within the gas stream, the fibres solidifying at a point where the temperature is low enough.

It therefore remains a need for an apparatus and a method for extruding thermoplastic fibres allowing an enlarged throughput rate.

The present invention provides the potential to at least double the throughput rate realized by currently used melt blowing processes and apparatuses used therefor.

The apparatus and method of the present invention also permit the formation of composite webs of two or more different polymers.

The present invention further provides enhancement of quenching of fibres or filaments formed by the method of the present invention due to the closer proximity of the fibres to the quenching air or water vapor used in the process.

The present invention additionally provides more quiescent exit conditions for extruded thermoplastic material, resulting in less flow disturbance in the downstream region.

The present invention also permits the entanglement of filaments or fibres in the initial shear region in which turbulence scales are smaller.

These advantages are provided by an apparatus as claimed in claim 1 and by a method as claimed in claim 24.

Preferred embodiments of the present invention are hereinafter described by reference to the figures wherein:

Figure 1 is a somewhat schematic side elevational view of a thermoplastic flow diagram showing a die head having a structure and operation according to the principles of the present invention;

Figure 2 is a side elevational view, in section, of an embodiment of the die tip of the present invention;

Figures 3a-f illustrate bottom views of die tips of the present invention including thermoplastic material extrusion openings and centrally disposed high velocity gas delivery means;

Figure 4 is a schematic representation of the formation of filament streams in the shear layers of a gaseous jet;

Figure 5 is a side elevational view, in section, of an alternative embodiment of a die tip according to the present invention;

Figure 6 shows an elevational view, in section, of an embodiment of a die tip according to the present invention provided with an auxiliary duct;

Figure 7 illustrates in section a side elevational view of an embodiment of a die tip according to the present invention provided with a means for adjusting the slots; and

Figure 8 is a somewhat schematic side elevational view of an embodiment of a die head provided with two thermoplastic material chambers.

Best Modes For Carrying Out The Invention:

One embodiment of the present invention is illustrated in Figure 1 in which a die head or extrusion head 10 is provided with a chamber 12 for containing a polymeric, generally a thermoplastic material. The thermoplastic material may be supplied to chamber 12, generally under pressure, by delivery means or devices 36 such as a supply hopper and an extruder screw or the like. The thermoplastic material may be rendered fluid or molten by one or more heaters 39 placed appropriately, such as surrounding the chamber 12, surrounding the hopper and/or between the hopper and the chamber. As shown in Figures 1 and 3a-f, chamber 12 is provided with outlet passages 14 and 16 which permit the flow of molten thermoplastic material from the chamber to a plurality of thermoplastic extrusion outlets, openings or orifices 18 and 20 or a single such opening 19 located in a preferably circular die tip and arranged surrounding a centrally placed means for delivering a generally inert gas as, for example, air, at a high velocity, with an opening such as a nozzle 22 or the like from a source of inert gas 23. Like the thermoplastic material, the air emanating from the high velocity nozzle may be heated by a heater (not shown), appropriately placed, such as in or surrounding the source of inert gas 23 or nozzle 22 itself. Alternatively, chamber 12 may be provided with a single outlet (shown in phantom in Figure 1) which branches or forks into two or more passages. As used herein in referring to the inert gas or a jet of inert gas, "high velocity" generally describes jets having velocities of about 91 to over 610 m/sec (about 300 to over 2,000 feet/second). Also as used to describe the present invention, the terms "central" or "centrally", as applied to the gas delivery means or jets, generally includes all situations in which the gas delivery means is surrounded by or arranged between thermoplastic extrusion openings or a portion thereof.

According to the present invention, there may be as few as a single thermoplastic extrusion opening 19 surrounding or at least two thermoplastic extrusion openings 18 and 20 placed around an opening comprising the high velocity gas delivery means or air nozzle 22. However, as is more common among melt blown die tips, the high velocity gas delivery means 22 has the form of an elongated opening or slot and a series or individual thermoplastic extrusion openings or slits 18 and 20 are arranged in rows on opposite sides of the gas delivery means 22 as in Figures 3a and 3b. The openings 18 and 20 are arranged such that their longitudinal axes form an included angle with the longitudinal axis of the high velocity gas delivery nozzle of about 30 degrees to less than about 90 degrees. As indicated by the embodiment shown in Figure 2, typically this angle is about 60 degrees.

Some of the arrangements of the centrally placed gas jet and thermoplastic extrusion openings of the present invention, as viewed from the bottom, are shown in Figures 3a-f. One preferred arrangement is shown in Figure 3a in which two series of holes 18 and 20 are arranged in rows substantially parallel to and on opposite sides of nozzle 22, formed as a linear, elongated opening or slot. Each of the openings in series 18 may be arranged opposite to a corresponding hole in series 20. Alternatively, the holes in the two series may have a staggered or skewed relationship with respect to one another. Figure 3b depicts an arrangement in which two thermoplastic extrusion openings 18 and 20 take the form of elongated linear openings or slits placed parallel to and on opposite sides of the elongated linear gas nozzle or slot 22. The arrangement shown in Figure 3c provides for the inert gas to be emitted from capillary gas nozzles 22 arranged within an elongated slit 19 from which the polymeric material flows. Although nozzles 22 are arranged here linearly along a plane passing through the center and parallel to the elongated edges of the slit, other arrangements, such as an alternating or zigzag arrangement of the air nozzles, are also possible.

Figure 3d illustrates an extrusion arrangement in which an inert gas nozzle 22, having a circular cross section, is arranged concentrically within a cylindrical opening so that the inner surface of the cylindrical opening and the outer surface of the inert gas nozzle form an annular extrusion opening 19. In this embodiment and the arrangement shown in Figure 3e, the central air nozzle 22 may have a diameter of up to about 51 mm (two inches). The embodiment shown in Figure 3e includes a plurality of thermoplastic polymer extrusion openings 18 and 20 arranged in spaced relationship to one another and to the inert gas nozzle around the circumference of the inert gas nozzle. Finally, Figure 3f illustrates a plurality of capillary gas nozzles 22 arranged centrally within a thermoplastic extrusion opening 19 having a circular cross section.

The die head arrangement of the present invention permits molten thermoplastic material to be transferred from chamber 12 through the passages or conduits 14 and 16 to the extrusion openings 19 or 18 and 20, whereupon, as shown in Figure 4, the molten extrudate emerges and contacts the shear layers of the at least one jet of high velocity gas which is being continuously emitted in a stream from the one or more centrally placed nozzles 22. As used herein, the shear layers are considered to be those layers or portions of the inert gas jet located in the peripheral regions of the jet. This arrangement results in a plurality of streams, preferably two streams, in the preferred embodiments shown in Figures 3a and 3b of molten extrudate being first attenuated in the peripheral portions or shear layers of the jet or jets, thereby forming filaments or fibers which are mixed and directed to a forming or collecting foraminous surface 37, such as a roll, (shown in Figure 8) or a moving wire placed in the vicinity of the die heads, where the fibers form a matrix or mat 38.

Since, with the exception of the embodiment shown in Figure 3d in which the annular extrusion opening 19 extends around the circumference of the nozzle opening 22, at least two streams of thermoplastic material extrudate are formed by the extrusion head of the present invention, which streams may be ultimately attenuated to form fine filaments or fibers in the nonwoven mat, the present invention provides the potential to more than double the throughput rate of fiber formation compared to existing processes and apparatus used therefor. In addition, since the filaments formed by the die head of the present invention are attenuated in the shear layers of the high velocity gas stream, these filaments are closer to the air entrained from the atmosphere surrounding the apparatus and quenching becomes much more effective than conventional apparatus in which air jets converge on a centrally emitted stream of thermoplastic material.

Figures 2 and 5 illustrate in section several configurations of the exit portion of the high velocity gas delivery nozzle 22. Thus, the wall sections 24 of the outlet portion of the nozzle 22 may be straight and may be arranged substantially parallel to one another, as shown in Figures 5 to 7 or may be arranged to form an included angle with respect to each other, as is shown in Figure 2. Typically, with this latter arrangement, the included angle formed by the wall sections of the tip of the high velocity gas outlet nozzle is about 60 degrees. With the other preferred wall configurations in which the wall sections 24 are substantially parallel, the tip of the nozzle has a slightly different configuration. As illustrated, the tip of the nozzle has a contoured or gradually curving and tapering configuration in which the outlet nozzle walls 26, which are arranged in approximately parallel relationship, taper through a gradual S-shaped configuration 27 to a more constricted nozzle tip 28 in which the walls are approximately parallel or arranged at a slight angle to one another.

Another embodiment of the present invention provides a means for introducing an additive to the air stream or jet which merges with the streams of molten extrudate. Thus, as illustrated in Figure 6, a conduit, such as a tube or duct 30, may be placed concentrically within and spaced from the walls 24 of the high velocity gas delivery nozzle. As is illustrated in Figure 6, the additive delivery conduit may take the form of a duct 30, the outlet end of which is recessed from the outer portion or exit plane 32 formed by the outer surfaces of the high velocity gas delivery nozzle. Alternatively, as is shown in phantom in Figure 6, the additive delivery conduit may take the form of a duct 34, the outlet end of which extends from the outer portion or beyond the exit plane of the high velocity gas delivery nozzle. The end of the duct may also be arranged with the outlet end having a position between those shown in solid line or in phantom in Figure 6, particularly one in which the outlet end of the duct is flush with plane 32. A means may also be provided to move the duct between the two positions illustrated.

The additive which is introduced into the air stream through the duct may be any gaseous, liquid (such as surfactants or encapsulated liquids), or particulate material (such as a superabsorbent material, i.e., a material capable of absorbing many times its weight of liquid, preferred being materials such as carboxymethyl cellulose and the sodium salt of a cross linked polyacrylate; wood pulp or staple fibers, as, for example, cotton, flax, silk or jute), which is intended to form part of the fibers or the finished web. The additive material may be fed from a source located within the extrusion head or remote therefrom. Although the velocities of the inert gas flowing through the high velocity gas delivery nozzle 22 and the mixture of gas and particles flowing through the duct 30 or 34 should be optimized, there is no need that they be the same. The material may be fed to the duct by any conventional means using gas as a conveying medium. Alternatively, the additive and a suitable fluidizing gas may be mixed and, in some instances, supplied to the duct 22 directly, thus eliminating the use of a duct.

In accordance with another aspect of the present invention, composite webs of two or more different thermoplastic materials may be formed. Thus, the present invention provides for the introduction of molten extruded thermoplastic material to the shear layers of at least one rapidly moving stream or jet of an inert gas from, with the exception noted above, two or more extrusion openings or sets of openings, such as 18 and 20, placed surrounding or on alternate or opposite sides of the high velocity gas delivery nozzle 22. The thermoplastic material which is extruded from these openings may be the same material or, alternatively, materials which differ from one another in their chemical and/or physical properties.Designated as first, second, ...n thermoplastic materials, where n represents a plurality, the materials may be of the same or different chemical composition or molecular structure and, when of the same molecular structure, may differ in molecular weight or other characteristics which results in differing physical properties. In those situations in which thermoplastic materials are used which differ from one another in some respect, such as in physical properties, the extrusion or die head will be provided with multiple chambers, one for each of the thermoplastic materials, such as first, second, ...n thermoplastic materials, where n represents a plurality. That is, as illustrated in Figure 8, the die head is provided with a first chamber 12a for the first thermoplastic material and a second chamber 12b for the second thermoplastic material, etcetera. In contrast to the arrangement illustrated in Figure 1, where a single chamber 12 is provided with conduits or passages 14 and 16 which provide communication between the single chamber and each of the first and the second thermoplastic extrusion outlet openings 18 and 20, when a first chamber 12a and a second chamber 12b are employed for first and second thermoplastic materials, respectively, each chamber is provided with passages to only one extusion outlet opening or set of openings. Thus, the first thermoplastic material chamber 12a communicates with the first extrusion outlet opening 18 by means of the first thermoplastic material passage 14a, while the second thermoplastic material chamber 12b communicates with the second thermoplastic extrusion opening 20 through the second thermoplastic material passage 16b.

The extrusion head may be cast either as a single piece or may be formed in multiple component parts, preferably in two generally symmetrical portions 42 and 44 which are suitably clamped, bolted or welded together. Each of these portions may also be formed from separate parts which may also be suitably clamped, bolted or welded together. Depending upon the particular arrangement of the component elements of the system, when two or more chambers for thermoplastic material are employed, the die head may be provided with a suitable insulating material placed so as to reduce the thermal influences of air surrounding the apparatus or regions of the apparatus. Accordingly, insulation may, for example, be placed between the chambers and, perhaps, the thermoplastic material conduit means 14a and 16b. This permits, when suitable means are provided therefor, separate and independent control of appropriately placed heaters, such as 39a and 39b (Figure 8) and, as a result, the temperatures of the thermoplastic materials supplied separately to the orifices 18 and 20. Thus, the first thermoplastic material having one set of properties may be maintained at a first temperature and the second thermoplastic material with a different set of properties may be maintained at a second temperature, etcetera. Similarly, the temperature of the gas and the polymers may be different. In addition, the heaters themselves and, perhaps, the means of delivering or supplying the thermoplastic material, may also be insulated. There may also be provided multiple (such as first and second) thermoplastic supply or delivery means for the first and second thermoplastic materials, unlike the apparatus shown in Figure 1 in which a single thermoplastic material supply means and chamber are used. Like the apparatus containing a single thermoplastic material chamber, however, the apparatus of the present invention which uses two thermoplastic material chambers, includes delivery means which delivers thermoplastic material from a source thereof to the chambers under pressure. In the embodiment with multiple (first and second) thermoplastic material chambers, separate controls may be provided for supplying the thermoplastic material at different pressures.

In both the single piece and multiple part embodiments of the die head, the thermoplastic chambers may be formed by any suitable means, such as by appropriately coring or drilling the die head, and the openings and passages or conduits may be drilled.

It should also be noted that, although the discussion herein of the present invention has been directed to a common extrusion or die head containing all or most of the enumerated elements, most of these elements may be located remote from the die head employing suitable communicating means. Such structures may also include separate thermoplastic extrusion openings and centrally placed high velocity gas delivery nozzle(s), all with associated conduit means. The openings and outlets are arranged with the orientations and configurations previously described and shown in the drawings.

Both the high velocity gas delivery nozzle 22 and the extrusion openings 18 and 20 may have dimensions which vary widely depending upon the material being extruded and the concomitant parameters employed, as well as the arrangement of the component parts of the die head. Preferred widths of the air nozzle 22 at its effluent end contiguous to the extrusion surface, however, lie in the range of about 0,25 to about 3,2 mm (about 0.01 inch to about 1/8 inch) but may be larger to permit unimpededflow of a particulate additive, such as where an additive introduction duct 30, 34 or the like is employed. The preferred width of the polymer extrusion openings is about 0,13 mm to about 1,3 mm (about 0.005 inch to about 0.05 inch) at their effluent ends contiguous to the polymer extrusion surface. The latter dimension is most preferably about 0,38 mm (0.015 inch). The dimensions of the thermoplastic extrusion openings may also be made somewhat larger, however, to accommodate the centrally arranged high velocity gas delivery nozzles 22, as shown in Figures 3c, 3d and 3f.

The present invention also contemplates an embodiment in which the size of each of the first and second thermoplastic material slot openings is adjustable. This may be accomplished by suitable adjustment means as, for example, slot adjustment struts 46 as shown in Figure 7.

As discussed above, a nonwoven mat formed from fibers of a polymeric or thermoplastic material may be formed according to the present invention by extruding and collecting multiple streams of thermoplastic material, that is, extruding a first stream of a molten thermoplastic material from one or more first thermoplastic material extrusion openings and concurrently extruding the same or a different molten thermoplastic material from one or more second thermoplastic extrusion openings, which first and second thermoplastic extrusion openings are arranged at least partially surrounding or on opposite sides of the high velocity gas nozzle. The extruded thermoplastic material is attenuated to fibers or filaments by a jet or stream of high velocity inert gas passing between the first and second streams of extruded thermoplastic material. The fibers form as the first and second thermoplastic material-containing streams merge with the shear layer of the inert gas stream, as shown in Figure 4. The fibers are then directed onto a collecting surface, such as a hollow foraminous forming roll or a moving wire belt 37 located about 25,4 to about 406,4 mm (about 1 to about 16 inches) from the die head. The fibrous web or mat 38 is formed largely when the fibers are deposited on the collecting surface. According to the method and apparatus of the present invention, some entanglement of the fibers may occur in the initial shear region where the streams of thermoplatic material merge with the inert gas stream and where the turbulence scales are generally smaller as well as further downstream at the confluence of the two streams of fibers.

The materials suitable for use in the present invention as polymeric or thermoplastic materials include any materials which are capable of forming fibers after passing through a heated die head and sustaining the elevated temperatures of the die head and of the attenuating air stream for brief periods of time. This would include thermoplastic materials such as the polyolefins, particularly polyethylene and polypropylene, polyamides, such as polyhexamethylene adipamide, polyomegacaproamide and polyhexamethylene sebacamide, polyesters, such as the methyl and ethyl esters of polyacrylates and the polymethacrylates and polyethylene terephthalate, cellulose esters, polyvinyl polymers, such as polystyrene, polyacrylonitrile and polytrifluorochloroethylene.

Any gas which does not react with the thermoplastic material under the temperature and pressure conditions of the melt blowing process is suitable for use as the inert gas used in the high velocity gas stream which attenuates the thermoplastic materials into fibers or microfibers. Air has been found to be quite suitable for such purposes.

The fibers may generally be formed in any configuration and diameter commensurate with the shape of the extrusion orifices.

The process of the present invention is capable of forming coarse fibers, that is, fibers having diameters generally up to about 100 microns and, in some instances, higher, but is generally directed to the formation of fine fibers, known also as microfibers or microfilaments. The microfibers produced by the present invention frequently have diameters in the range of about 1 to about 20 microns; however, microfibers may be formed having diameters down to as fine as 0.1 micron. Among the limiting factors which determine the ability of a given thermoplastic material or polymer to attentuate to a fine fiber are the parameters of the extrusion system, the nature of the polymeric material, such as the material's molecular weight, melting point, surface tension and viscosity-temperature characteristics, and the pressures and flow rates of air. Optimum conditions for any particular thermoplastic material may be achieved by varying such operating parameters as air temperature, nozzle temperature, air velocity or pressure, and the polymer feed rate or ram pressure. These and other variables may be easily determined by one familiar with melt blowing processes. Ample guidance, however, is provided by Wente in "Superfine Thermoplastic Fibers", Industrial And Engineering Chemistry, Volume 48, Number 8, Pages 1342-1346 (1956); "Manufacture of Superfine Organic Fibers", Naval Research Laboratory Report Number 11,437 (1954); Lawrence et al, "An Improved Device For The Formation Of Superfine Thermoplastic Fibers", Naval Research Laboratory Report Number 5265 (1959); and U. S. Patents 4,041,203; 4,100,324; 3,959,421; 3,715,251; 3,704,198; 3,692,618; 3,676,242; 3,595,245; 3,542,615; 3,509,009; 3,502,763; 3,502,538; 3,341,394; 3,338,992; and 3,276,944; British Specification 1,217,892; and Canadian Patent 803,714.

Generally, the operating conditions may be summarized as follows. The air temperature suitable for attentuating microfibers may be as low as ambient temperature. However, it is ordinarily on the order of at least 93,3 °C (200 degrees F) above the melting point of the thermoplastic material, although under certain conditions some materials, such as the polyolefins, particularly polyethylene, and polystyrene, require air temperatures on the order of 148,9 °C (300 degrees F) above the melting or softening points of the thermoplastic materials. When polypropylene is chosen as the polymeric material, a temperature in the range of about 204,4 to about 371,1 °C (about 400 to about 700 degrees F) is generally used.

The time during which the thermoplastic material remains and becomes attenuated in the heated, high velocity inert gas stream is relatively short and there is, therefore, relatively little chance of degradation of the thermoplastic material occurring when elevated temperatures are employed. However, generally the thermoplastic material remains in a heated portion of the die head for a longer period of time than when it is in the high velocity inert gas stream and the susceptibility to degradation increases with both the residence time in the die head and the temperature at which the thermoplastic material is maintained. Therefore, when polymer degradation is being sought, this may be achieved by control of the residence time of the polymer in the die head and the delivery system upstream. Generally, a thermoplastic material extrusion opening or polymer nozzle temperature may be used which is about equal to or as much as 93,3 °C (200 degrees Fahrenheit) above the air temperature, depending upon the residence time within the heated portion of the die head. The temperature of the polymer nozzle is not normally controlled, however, to achieve or maintain a particular temperature. Rather, the temperature of the thermoplastic material extrusion openings is determined in large part from the heat given up by the thermoplastic material passing through the openings and the surrounding air, both that passing through the high velocity gas delivery nozzle and ambient air. In some instances, in order to maintain the polymer nozzles within a certain temperature range, insulation may be placed around the polymer nozzles, the high velocity gas delivery nozzle, or both.

The velocity of the heated inert gas stream, which depends at least in part on the gas pressure, also varies considerably depending upon the nature of the thermoplastic material. Thus, with some thermoplastic materials, such as the polyolefins, particularly polyethylene, air pressures on the order of 0,07 to 1,76 bar (1 to 25 psi) may be suitable whereas other thermoplastic materials may require 3,52 bar (50 psi) for fibers of the same diameter and length. Consistant with such variables, the air pressure generally is in the range of 0,07 to about 4,22 bar (1 to about 60 psig).

As suggested above, one of the advantages realized with the present invention, as compared to known melt-blowing apparatus and methods which employ a single thermoplastic extrusion material opening or set of openings, is the increase in throughput rates. Whereas a standard single row or set of openings will frequently be operated at a rate of 0,054 kg/mm/h (3 pounds/inch/hour) with a maximum rate on the order of 0,45 kg/mm/h (25 pounds/inch/hour), the present invention permits a comparable operating rate of 0,11 kg/mm/h (6 pounds/inch/hour) up to a rate of about 0,9 kg/mm/h (50 pounds/inch/hour).

Claims

1. A thermoplastic material extrusion mechanism for producing thermoplastic fibres comprising a die head (10) and including therein:
   a centrally disposed high velocity gas delivery means adapted to continuously form at least one gas stream, said gas delivering means containing at least one centrally disposed nozzle (22) for emitting said gas as a gas jet into a quenching medium outside of said die head (10);
   at least one chamber (12,12a,12b) for said thermoplastic material;
   thermoplastic material delivery means containing at least one outlet opening (18,19,20) for directing molten thermoplastic material emitted from said thermoplastic material delivery means toward said gas; and
   thermoplastic material conduit means (14,16) communicating said at least one chamber (12,12a,12b) with said thermoplastic material outlet opening (18,19,20), **characterized in that**
   said at least one central gas jet is the single fibre forming means, and said at least one thermoplastic material outlet opening (18,19,20) is arranged adjacent and at least partly surrounding said at least one centrally disposed high velocity gas nozzle (22) causing extrusion of said thermoplastic material into the initial shear layer of said at least one central gas jet when leaving said nozzle (22) in close proximity to said quenching medium.

2. The mechanism according to claim 1 **wherein** said thermoplastic material delivery means comprises at least one first thermoplastic material extrusion opening (18) and at least one second thermoplastic extrusion opening (20).

3. The mechanism according to claim 1 **wherein** said mechanism further includes a means (36) for supplying said thermoplastic material to said at least one chamber (12,12a,12b).

4. The mechanism according to claim 2 **wherein** two chambers (12a,12b) are provided.

5. The mechanism according to claim 4 **wherein** said two chambers (12a,12b) comprise a first chamber adapted to contain a first thermoplastic material and a second chamber adapted to contain a second thermoplastic material.

6. The extrusion mechanism according to claim 5 **wherein** a first conduit means (14a) is provided between said first chamber (12a) and

said at least one first thermoplastic material extrusion opening (18) and a second conduit means (16b) is provided between said second chamber (12b) and said at least one second thermoplastic material extrusion opening (20).

7. The extrusion mechanism according to claim 1 **wherein** said mechanism further includes a heater (39,39a,39b) for raising the temperature of said thermoplastic material.

8. The extrusion mechanism according to claim 5 **wherein** said mechanism includes means for delivering said first thermoplastic material at a first pressure to said first chamber (12a) and means for delivering said second thermoplastic material at a second pressure to said second chamber (12b).

9. The extrusion mechanism according to claim 5 **wherein** said mechanism includes a first heating device (39a) for raising the temperature of said first thermoplastic material to a first temperature and a second heating device (39b) for raising said second thermoplastic material to a second temperature.

10. The extrusion mechanism according to claim 1, further including a means (30,34) for introducing an additive to the gas passing through said high velocity gas delivery means.

11. The extrusion mechanism according to claim 10 **wherein** said means for introducing an additive to the pressurized gas comprises an additive delivery duct (30,34).

12. The extrusion mechanism according to claim 11 **wherein** said high velocity gas delivery means has an exit plane (32) and the outlet end of said additive delivery duct (34) extends outwardly from the exit plane (32) of said high velocity gas delivery means.

13. The extrusion mechanism according to claim 11 **wherein** said high velocity gas delivery means has an exit plane (32) and the outlet end of said additive delivery duct (30) is recessed within the exit plane (32) of said high velocity gas delivery means.

14. The extrusion mechanism according to claim 2 further including means (46) to adjust the width of said first and said second thermoplastic material extrusion openings (18,20).

15. The extrusion mechanism according to claim 2 **wherein** said centrally disposed high velocity gas delivery means has a longitudinal axis which forms an included angle of between about 30 degrees to less than about 90 degrees with each of said first and said second thermoplastic material extrusion openings (18,20).

16. The extrusion mechanism according to claim 2 **wherein** said centrally disposed high velocity gas delivery means comprises a slot having two elongated edges.

17. The extrusion mechanism according to claim 16 **wherein** said at least one first thermoplastic opening (18) comprises a first row of apertures arranged parallel to one of the elongated edges and on one side of said slot and said at least one second thermoplastic opening (20) comprises a second row of apertures arranged parallel to the other of the elongated edges and on the opposite side of said slot.

18. The extrusion mechanism according to claim 16 **wherein** said at least one first thermoplastic opening (18) comprises a first slit arranged parallel to one of the elongated edges and on one side of said slot and at least one second thermoplastic opening (20) comprises a second slit arranged parallel to the other of the elongated edges and on the opposite side of said slot.

19. The extrusion mechanism according to claim 1 **wherein** said thermoplastic opening (19) comprises a slit and said centrally disposed high velocity gas delivery means comprises a plurality of capillary gas nozzles (22) arranged within said slit.

20. The extrusion mechanism according to claim 1 **wherein** said centrally disposed high velocity gas delivery means comprises a nozzle (22) of circular cross section, said nozzle arranged concentrically within a cylindrical opening, the inner surface of said cylindrical opening and the outer surface of said nozzle defining an annular extrusion opening (19).

21. The extrusion mechanism according to claim 1 **wherein** said centrally disposed high velocity gas delivery means comprises a nozzle (22) of circular cross section and said thermoplastic material delivery means comprises a plurality of thermoplastic material extrusion openings (18,20) arranged around the nozzle (22) in spaced relationship to each other and to said nozzle.

22. The extrusion mechanism according to claim 1 **wherein** said thermoplastic material delivery means comprises an extrusion opening (19) having a circular cross section and said centrally disposed high velocity gas delivery means comprises a plurality of capillary gas nozzles (22) arranged within said extrusion opening (19).

23. The extrusion mechanism according to claim 1 **wherein** said thermoplastic material delivery means comprises at least one first themoplastic material extrusion opening (18) and at least one second thermoplastic material extrusion opening (20), said at least one chamber comprises a first chamber (12a) adapted to contain a first thermoplastic material and a second chamber (12b) adapted to contain a second thermoplastic material, said thermoplastic material conduit means comprises a first conduit means (14a) provided between said first chamber (12a) and said at least one first thermoplastic material extrusion opening (18) and a second conduit means (16b) provided between said second chamber (12b) and said at least one second thermoplastic extrusion opening (20), said high velocity gas delivery means comprises a slot (22) having two elongated edges and said at least one first thermoplastic opening (18) comprises a first row of apertures arranged parallel to one of the elongated edges and on one side of said slot (22) and said at least one second thermoplastic opening (20) comprises a second row of apertures arranged parallel to the other of the elongated edges and on the opposite side of said slot (22), and said mechanism further includes means (36a) for delivering said first thermoplastic material to said first thermoplastic chamber (12a) at a first pressure, means (36b) for delivering said second thermoplastic material to said second thermoplastic material chamber (12b) at a second pressure, a first heating device (39a) to raise the temperature of said first thermoplastic material to a first temperature, and a second heating device (39b) to raise the temperature of said second thermoplastic material to a second temperature.

24. A method of producing fibres by extruding a thermoplastic material comprising the steps of:
providing a gas stream and forming said gas stream into at least one centrally positioned high velocity gas jet directed into a quenching medium;
forming at least one stream of a molten thermoplastic material from a thermoplastic material delivery means,
merging said at least one molten thermoplastic material stream with the gas and quenching said molten thermoplastic material forming thereby fibre streams of said thermoplastic material,
characterized by extruding said thermoplastic material adjacent and at least partly surrounding said at least one high velocity gas jet into the initial shear layer of said gas jet in close proximity to said quenching medium to attenuate said thermoplastic material into fibres only by means of said at least one centrally disposed gas jet.

25. The method according to claim 24 wherein said at least one stream of a molten thermoplastic material comprises at least one first thermoplastic material stream and at least one second thermoplastic material stream and said thermoplastic material delivery means comprises at least one first thermoplastic material extrusion opening from which said at least one first thermoplastic material stream is extruded and at least one second thermoplastic material extrusion opening from which said at least one second thermoplastic material stream is extruded concurrently with said at least one first thermoplastic material stream such that said at least one first and second thermoplastic material streams merge with the shear layers of said at least one high velocity gas jet and form thereby at least one first thermoplastic fiber stream and at least one second thermoplastic fiber stream, respectively.

26. The method according to claim 25 wherein a first thermoplastic material is extruded from said at least one first thermoplastic material extrusion opening and a second thermoplastic material is extruded from said at least one second thermoplastic material opening, said first and said second thermoplastic materials differing from each other in physical properties.

27. The method according to claim 24 wherein said at least one high velocity gas jet includes a fluidized additive.

28. The method according to claim 27 wherein said fluidized additive includes a superabsorbent material.

29. The method according to claim 27 wherein said fluidized additive comprises wood pulp fibers.

30. The method according to claim 27 wherein said fluidized additive comprises staple fibers.

31. The method according to claim 27 wherein said fluidized additive is a liquid.

32. The method according to claim 27 wherein said fluidized additive is a gaseous additive.

33. The method according to claim 25 wherein said first and said second thermoplastic material streams merge with the shear layers of said high velocity gas jet forming an angle with said high velocity gas jet of about 30 degrees to less than about 90 degrees.

34. The method according to claim 25 wherein said first and second fiber streams formed in step (c) are directed onto a collecting surface, forming thereby a melt blown, nonwoven mat.

Revendications

1. Mécanisme d'extrusion de matière thermoplastique pour fabriquer des fibres thermoplastiques, comprenant une tête-filière (10) et comportant :
un moyen d'arrivée de gaz à vitesse élevée, disposé centralement, adapté pour former de façon continue au moins un flux de gaz, ledit moyen d'arrivée de gaz contenant au moins une tuyère (22) disposée centralement pour émettre ledit gaz en un jet de gaz dans un milieu de trempe à l'extérieur de ladite tête-filière (10) ;
au moins une chambre (12, 12a, 12b) pour ladite matière thermoplastique ;
un moyen d'arrivée de matière thermoplastique contenant au moins une ouverture de sortie (18, 19, 20) pour diriger la matière thermoplastique en fusion, émise par ledit moyen d'arrivée de matière thermoplastique, vers ledit gaz ; et
des moyens à conduit (14, 16) pour la matière thermoplastique faisant communiquer au moins ladite chambre (12, 12a, 12b) avec ladite ouverture de sortie (18, 19, 20) de matière thermoplastique, caractérisé en ce que
au moins ledit jet de gaz central est l'unique moyen de formation de fibres, et au moins ladite ouverture de sortie (18, 19, 20) de matière thermoplastique est disposée de façon adjacente à au moins ladite tuyère à gaz (22) à vitesse élevée, disposée centralement tout en l'entourant au moins partiellement, ce qui entraîne l'extrusion de ladite matière thermoplastique dans la couche de cisaillement initiale dudit jet de gaz central lorsqu'il quitte ladite tuyère (22) tout près dudit milieu de trempe.

2. Mécanisme selon la revendication 1, dans lequel ledit moyen d'arrivée de matière thermoplastique comprend au moins une première ouverture (18) d'extrusion de matière thermoplastique et au moins une seconde ouverture (20) d'extrusion de matière thermoplastique.

3. Mécanisme selon la revendication 1, dans lequel ledit mécanisme comprend en outre un moyen (36) pour amener ladite matière thermoplastique dans ladite chambre (12, 12a, 12b).

4. Mécanisme selon la revendication 2, dans lequel deux chambres (12a, 12b) sont prévues.

5. Mécanisme selon la revendication 4, dans lequel les deux chambres précitées (12a, 12b) comprennent une première chambre adaptée pour contenir une première matière thermoplastique et une seconde chambre adaptée pour contenir une seconde matière thermoplastique.

6. Mécanisme d'extrusion selon la revendication 5, dans lequel un premier conduit (14a) est placé entre ladite première chambre (12a) et lesdites premières ouvertures (18) d'extrusion de matière thermoplastique et un second conduit (16b) est placé entre ladite seconde chambre (12b) et lesdites secondes ouvertures (20) d'extrusion de matière thermoplastique.

7. Mécanisme d'extrusion selon la revendication 1, dans lequel ledit mécanisme comprend en outre un dispositif de chauffage (39, 39a, 39b) pour élever la température de ladite matière thermoplastique.

8. Mécanisme d'extrusion selon la revendication 5, dans lequel ledit mécanisme comprend un moyen pour amener ladite première matière thermoplastique à une première pression dans ladite première chambre (12a) et un moyen pour amener ladite seconde matière thermoplastique à une seconde pression dans ladite seconde chambre (12b).

9. Mécanisme d'extrusion selon la revendication 5, dans lequel ledit mécanisme comprend un premier appareil de chauffage (39a) pour élever la température de ladite première matière thermoplastique jusqu'à une première température et un second appareil de chauffage (39b) pour élever ladite seconde matière thermoplastique jusqu'à une seconde température.

10. Mécanisme d'extrusion selon la revendication 1, comprenant en outre un moyen (30, 34) pour introduire un additif au gaz qui passe à travers ledit moyen d'arrivée de gaz à vitesse élevée.

11. Mecanisme d'extrusion selon la revendication 10, dans lequel ledit moyen pour introduire un additif au gaz sous pression comprend une conduite d'amenée (30, 34) de l'additif.

12. Mécanisme d'extrusion selon la revendication 11, dans lequel ledit moyen d'arrivée de gaz à vitesse élevée a un plan de sortie (32) et l'extrémité de sortie de ladite conduite d'amenée (34) de l'additif s'étend vers l'extérieur depuis le plan de sortie (32) dudit moyen d'arrivée de gaz à vitesse élevée.

13. Mécanisme d'extrusion selon la revendication 11, dans lequel ledit moyen d'arrivée de gaz à vitesse élevée a un plan de sortie (32) et l'extrémité de sortie de ladite conduite d'amenée (30) de l'additif est logée à l'intérieur du plan de sortie (32) dudit moyen d'arrivée de gaz à vitesse élevée.

14. Mécanisme d'extrusion selon la revendication 2, comprenant en outre un moyen (46) pour régler la largeur de ladite première et de ladite seconde ouvertures (18, 20) d'extrusion de matière thermoplastique.

15. Mécanisme d'extrusion selon la revendication 2, dans lequel ledit moyen d'arrivée de gaz à vitesse élevée, disposé centralement, a un axe longitudinal qui forme un angle allant de 30 degrés environ à moins de 90 degrés environ avec chacune de ladite première et de ladite seconde ouvertures (18, 20) d'extrusion de matière thermoplastique.

16. Mécanisme d'extrusion selon la revendication 2, dans lequel ledit moyen d'arrivée de gaz à vitesse élevée, disposé centralement comprend une rainure ayant deux bords allongés.

17. Mécanisme d'extrusion selon la revendication 16, dans lequel ladite première ouverture. (18) de thermoplastique comprend une première rangée d'ouvertures disposées de façon parallèle à l'un des bords allongés et sur un côte de ladite rainure et ladite seconds ouverture (20) de thermoplastique comprend une seconde rangée d'ouvertures disposées de façon parallèle à l'autre des bords allongés et sur le côté opposé de ladite rainure.

18. Mécanisme d'extrusion selon la revendication 16, dans lequel ladite première ouverture (18) de thermoplastique comprend une première fente disposée parallèlement à l'un des bords allongés et sur un côté de ladite rainure et au moins la seconde ouverture (20) de thermoplastique comprend une seconde fente disposée parallèlement à l'autre des bords allongés et sur le côté opposé de ladite rainure.

19. Mécanisme d'extrusion selon la revendication 1, dans lequel ladite ouverture (19) de thermoplastique comprend une fente et ledit moyen d'arrivée de gaz à vitesse élevée, disposé centralement, comprend une pluralité de tuyères capillaires à gaz (22) disposées à l'intérieur de ladite fente.

20. Mécanisme d'extrusion selon la revendication 1, dans lequel ledit moyen d'arrivée de gaz à vitesse élévée, disposé centralement, comprend une tuyère (22) de section circulaire, ladite tuyère étant disposée de façon concentrique à l'intérieur d'une ouverture cylindrique, la surface intérieure de ladite ouverture cylindrique et la surface extérieure de ladite tuyère définissant une ouverture d'extrusion annulaire (19).

21. Mécanisme d'extrusion selon la revendication 1, dans lequel ledit moyen d'arrivée de gaz à vitesse élevée, disposé centralement, comprend une tuyère (22) de section circulaire et ledit moyen d'arrivée de matière thermoplastique comprend une pluralité d'ouvertures (18, 20) d'extrusion de matière thermoplastique disposées autour de la tuyère (22) en étant espacées les unes des autres et de ladite tuyère.

22. Mécanisme d'extrusion selon la revendication 1, dans lequel ledit moyen d'arrivée de matière thermoplastique comprend une ouverture d'extrusion (19) ayant une section circulaire et ledit moyen d'arrivée de gaz à vitesse élevée, disposé centralement, comprend une pluralité de tuyères capillaires à gaz (22) disposées à l'intérieur de ladite ouverture d'extrusion (19).

23. Mécanisme d'extrusion selon la revendication 1, dans lequel ledit moyen d'arrivée de matière thermoplastique comprend au moins une première ouverture (18) d'extrusion de matière thermoplastique et au moins une seconde ouverture (20) d'extrusion de matière thermoplastique, ladite chambre comprend une première chambre (12a) adaptée pour contenir une pre-

mière matière thermoplastique et une seconde chambre (12b) adaptée pour contenir une seconde matière thermoplastique, lesdits moyens à conduit de matière thermoplastique comprennent un premier moyen à conduit (14a) placé entre ladite première chambre (12a) et ladite première ouverture (18) d'extrusion de matière thermoplastique et un second moyen à conduit (16b) placé entre ladite seconde chambre (12b) et ladite seconde ouverture (20) d'extrusion de matière thermoplastique, ledit moyen d'arrivée de gaz à vitesse élevée comprend une rainure (22) ayant deux bords allongés et ladite première ouverture (18) de thermoplastique comprend une première rangée d'ouvertures disposées parallèlement à l'un des bords allongés et sur un côté de ladite rainure (22) et ladite seconde ouverture (20) de thermoplastique comprend une seconde rangée d'ouvertures disposées parallèlement à l'autre des bords allongés et sur le côté opposé de ladite rainure (22), et ledit mécanisme comprend en outre un moyen (36a) pour amener ladite première matière thermoplastique dans ladite première chambre (12a) de thermoplastique à une première pression, un moyen (36b) pour amener ladite seconde matière thermoplastique dans ladite seconde chambre (12b) de matière thermoplastique à une seconde pression, un premier appareil de chauffage (39a) pour élever la température de ladite première matière thermoplastique à une première température, et un second appareil de chauffage (39b) pour élever la température de ladite seconde matière thermoplastique à une seconde température.

24. Procédé de fabrication de fibres par extrusion d'une matière thermoplastique, comprenant les étapes de:
émission d'un flux de gaz et formation dudit flux de gaz en au moins un jet de gaz à vitesse élevée, placé centralement, dirigé dans un milieu de trempe ;
formation d'au moins un flux d'une matière thermoplastique en fusion depuis un moyen d'arrivée de matière thermoplastique,
fusion dudit flux de matière thermoplastique en fusion avec le gaz et trempe de ladite matière thermoplastique en fusion, en formant de cette manière des flux de fibres de ladite matière thermoplastique,
caractérisé par l'extrusion de ladite matière thermoplastique, adjacente audit jet de gaz à vitesse élevée et l'entourant au moins partiellement,
dans la couche de cisaillement initiale dudit jet de gaz tout près dudit milieu de trempe pour affiner ladite matière thermoplastique en fibres uniquement au moyen dudit jet de gaz disposé centralement.

25. Procédé selon la revendication 24, dans lequel ledit flux d'une matière thermoplastique en fusion comprend au moins un premier flux de matière thermoplastique et au moins un second flux de matière thermoplastique, et ledit moyen d'arrivée de matière thermoplastique comprend au moins une première ouverture d'extrusion de matière thermoplastique par laquelle ledit premier flux de matière thermoplastique est extrudé et au moins une seconde ouverture d'extrusion de matière thermoplastique par laquelle ledit second flux de matière thermoplastique est extrudé en même temps que ledit premier flux de matière thermoplastique de telle sorte que ledit premier et second flux de matière thermoplastique fusionnent avec les couches de cisaillement dudit jet de gaz à vitesse élevée et forment de cette manière au moins un premier flux de fibres thermoplastiques et au moins un second flux de fibres thermoplastiques, respectivement.

26. Procédé selon la revendication 25, dans lequel une première matière thermoplastique est extrudée par ladite première ouverture d'extrusion de matière thermoplastique et une seconde matière thermoplastique est extrudée par ladite seconde ouverture de matière thermoplastique, ladite première et ladite seconde matières thermoplastiques différant l'une de l'autre par des propriétés physiques.

27. Procédé selon la revendication 24, dans lequel au moins ledit jet de gaz à vitesse élevée comprend un additif fluidifié,

28. Procédé selon la revendication 27, dans lequel ledit additif fluidifié comprend une matière superabsorbante.

29. Procédé selon la revendication 27, dans lequel ledit additif fluidifié comprend des fibres de pâte à papier.

30. Procédé selon la revendication 27, dans lequel ledit additif fluidifié comprend des fibres en brins.

31. Procédé selon la revendication 27, dans lequel ledit additif fluidifié est un liquide.

32. Procédé selon la revendication 27, dans lequel ledit additif fluidifié est un additif gazeux.

33. Procédé selon la revendication 25, dans lequel ledit premier et ledit second flux de matière thermoplastique fusionnent avec les couches de cisaillement dudit jet de gaz à vitesse élevée en formant un angle avec ledit jet de gaz à vitesse élevée compris entre 30 degrés environ et moins de 90 degrés environ.

34. Procédé selon la revendication 25, dans lequel lesdits premier et second flux de fibres formés dans l'étape (c) sont dirigés sur une surface réceptrice, en formant de cette façon une nappe non tissée, soufflée par fusion.

Ansprüche

1. Vorrichtung zum Exrudieren eines thermoplastischen Materials zum Herstellen thermoplastischer Fasern, mit einem Formkopf (10) und einer zentral angeordneten Ausgabevorrichtung für Hochgeschwindigkeitsgas zum kontinuierlichen Formen mindestens eines Gasstroms, wobei die Gasausgabevorrichtung mindestens eine zentral angeordnete Düse (22) enthält, um das Gas als Gasstrahl in ein Kühlmedium außerhalb des Formkopfes (10) ausströmen zu lassen; mit mindestens einer Kammer (12, 12a, 12b) für das thermoplastische Material; mit einer Ausgabevorrichtung für das thermoplastische Material, die mindestens eine Auslaßöffnung (18, 19, 20) aufweist, um das aus der Ausgabevorrichtung für das thermoplastische Material ausströmende geschmolzene thermoplastische Material gegen das Gas zu richten; und mit einer Leitungseinrichtung (14, 16) für das thermoplastische Material, die die mindestens eine Kammer (12, 12a, 12b) mit der Auslaßöffnung (18, 19, 20) für das thermoplastische Material verbindet,
dadurch gekennzeichnet,
daß der mindestens eine zentrale Gasstrahl das einzige faserbildende Mittel darstellt, und daß die mindestens eine Auslaßöffnung (18,19, 20) für thermoplastisches Material in der Nähe der mindestens einen zentral angeordneten Hochgeschwindigkeitsgasdüse (22) und diese mindestens teilweise umgebend angeordnet ist, um das Extrudieren des thermoplastischen Materials in die anfängliche Scherschicht des mindestens einen zentralen Gasstrahls zu bewirken, wenn dieser die Düse (22) in unmittelbarer Nähe des Kühlmittels verläßt.

2. Vorrichtung nach Anspruch 1,
wobei die Ausgabevorrichtung für das thermoplastische Material mindestens eine erste Extrudieröffnung (18) für das thermoplastische Material und mindestens eine zweite Extrudieröffnung (20) für das thermoplastische Material aufweist.

3. Vorrichtung nach Anspruch 1,
wobei die Vorrichtung weiterhin eine Einrichtung (36) zum Zuführen des thermoplastischen Materials zu der mindestens einen Kammer (12, 12a, 12b) enthält.

4. Vorrichtung nach Anspruch 2,
wobei zwei Kammern (12a, 12b) vorgesehen sind.

5. Vorrichtung nach Anspruch 4,
wobei die zwei Kammern (12a, 12b) eine erste Kammer zur Aufnahme eines ersten thermoplastischen Materials und eine zweite Kammer zur Aufnahme eines zweiten thermoplastischen Materials umfassen.

6. Extrudiervorrichtung nach Anspruch 5,
wobei eine erste Leitungseinrichtung (14a) zwischen der ersten Kammer (12a) und der mindestens einen ersten Extrudieröffnung (18) für das thermoplastische Material vorgesehen ist, und daß zweite Leitungseinrichtungen (16b) zwischen der zweiten Kammer (12b) und der mindestens einen zweiten Extrudieröffnung (20) für das thermoplastische Material vorgesehen sind.

7. Extrudiervorrichtung nach Anspruch 1,
wobei die Einrichtung weiterhin eine Heizung (39, 39a, 39b) zum Anheben der Temperatur des thermoplastischen Materials aufweist.

8. Extrudiervorrichtung nach Anspruch 5,
wobei die Vorrichtung eine Einrichtung zum Ausgeben des ersten thermoplastischen Materials unter einem ersten Druck in die erste Kammer (12a) und eine Einrichtung zum Ausgeben des zweiten thermoplastischen Materials unter einem zweiten Druck zur zweiten Kammer (12a) aufweist.

9. Extrudiervorrichtung nach Anspruch 5,
wobei die Vorrichtung eine erste Heizeinrichtung (39a) zum Anheben der Temperatur des ersten thermoplastischen Materials auf eine erste Temperatur und eine zweite Heizeinrichtung (39b) zum Aufheizen des zweiten thermoplastischen Materials auf eine zweite Temperatur aufweist.

10. Extrudiervorrichtung nach Anspruch 1,
wobei ferner eine Einrichtung (30, 34) zum Einbringen eines Additivs in das die Ausgabe-

vorrichtung für das Hochgeschwindigkeitsgas durchströmende Gas vorgesehen ist.

11. Extrudiervorrichtung nach Anspruch 10, wobei die Einrichtung zum Einbringen eines Additivs in das unter Druck stehende Gas einen Ausgabekanal (30,34) für das Additiv enthält.

12. Extrudiervorrichtung nach Anspruch 11, wobei die Ausgabevorrichtung für das Hochgeschwindigkeitsgas eine Ausgangsebene (32) hat, und das Auslaßende des Ausgabekanals (34) für das Additiv sich von der Ausgangsebene (32) der Ausgabeeinrichtung für das Hochgeschwindigkeitsgas nach außen erstreckt.

13. Extrudiervorrichtung nach Anspruch 11, wobei die Ausgabevorrichtung für das Hochgeschwindigkeitsgas eine Ausgangsebene (32) aufweist, und das Auslaßende des Ausgabekanals (30) für das Additiv bezüglich der Ausgangsebene (32) der Ausgabevorrichtung des Hochgeschwindigkeitsgases nach innen zurückversetzt ist.

14. Extrudiervorrichtung nach Anspruch 2, wobei weiterhin eine Einrichtung (46) zum Einstellen der Breite der ersten und zweiten Extrudieröffnungen (18, 20) für das thermoplastische Material vorgesehen ist.

15. Extrudiervorrichtung nach Anspruch 2, wobei die zentral angeordnete Ausgabevorrichtung für das Hochgeschwindigkeitsgas eine Längsachse aufweist, die mit jeder der ersten und zweiten Extrudieröffnungen (18, 20) für das thermoplastische Material einen Einschlußwinkel zwischen etwa 30° bis weniger als etwa 90° aufweist.

16. Extrudiervorrichtung nach Anspruch 2, wobei die zentral angeordnete Ausgabevorrichtung für das Hochgeschwindigkeitsgas einen Schlitz mit zwei langgestreckten Kanten aufweist.

17. Extrudiervorrichtung nach Anspruch 16, wobei die mindestens eine erste Öffnung (18) für das thermoplastische Material eine erste Reihe von Löchern aufweist, die parallel zu einer der langgestreckten Kanten und an einer Seite des Schlitzes angeordnet ist, und daß die mindestens eine zweite Öffnung (20) für das thermoplastische Material eine zweite Reihe von Löchern aufweist, die parallel zur anderen der langgestreckten Kanten und an der gegenüberliegenden Seite des Schlitzes angeordnet ist.

18. Extrudiervorrichtung nach Anspruch 16, wobei die mindestens eine erste Thermoplastöffnung (18) einen ersten Spalt aufweist, der parallel zu einer der langgestreckten Kanten und an einer Seite des Schlitzes angeordnet ist, und die mindestens eine zweite Thermoplastöffnung (20) einen zweiten Spalt aufweist, der parallel zur anderen der langgestreckten Kanten und an der gegenüberliegenden Seite des Schlitzes angeordnet ist.

19. Extrudiervorrichtung nach Anspruch 1, wobei die Thermoplastöffnung (19) einen Spalt aufweist und die zentral angeordnete Ausgabevorrichtung für Hochgeschwindigkeitsgas eine Mehrzahl von kapillaren Gasdüsen (22) aufweist, die innerhalb des Spaltes angeordnet sind.

20. Extrudiervorrichtung nach Anspruch 1, wobei die zentral angeordnete Ausgabevorrichtung für Hochgeschwindigkeitsgas eine Düse (22) mit einem kreisförmigen Querschnitt enthält, wobei die Düse konzentrisch mit einer zylindrischen Öffnung angeordnet ist, und wobei die innere Oberfläche der zylindrischen Öffnung und die äußere Oberfläche der Düse eine ringförmige Extrusionsöffnung (19) bilden.

21. Extrudiervorrichtung nach Anspruch 1, wobei die zentral angeordnete Ausgabevorrichtung für Hochgeschwindigkeitsgas eine Düse (22) mit einem kreisförmigen Querschnitt aufweist, und wobei die Ausgabevorrichtung für thermoplastisches Material eine Mehrzahl von Extrudieröffnungen (18, 20) für thermoplastisches Material umfassen, die zueinander und zur Düse beabstandet um die Düse (22) angeordnet sind.

22. Extrudiervorrichtung nach Anspruch 1, wobei die Ausgabevorrichtung für thermoplastisches Material eine Extrudieröffnung (19) mit einem kreisförmigen Querschnitt umfaßt, und wobei die zentral angeordnete Ausgabevorrichtung für Hochgeschwindigkeitsgas eine Mehrzahl von kapillaren Gasdüsen (22) enthält, die innerhalb der Extrudieröffnung (19) angeordnet sind.

23. Extrudiervorrichtung nach Anspruch 1, wobei die Ausgabevorrichtung für thermoplastisches Material mindestens eine erste Extrudieröffnung (18) für thermoplastisches Material und mindestens eine zweite Extrudieröffnung (20) für thermoplastisches Material aufweist, wobei die mindestens eine Kammer eine erste, zur Aufnahme eines ersten thermoplastischen Materials ausgebildete Kammer (12a) und eine zweite, zur Aufnahme eines zweiten thermoplastischen Materials ausgebildete Kammer (12b) umfaßt, wobei die Leitungseinrichtung für thermoplastisches Material eine erste, zwischen der ersten Kammer (12a) und der mindestens einen ersten Extrudieröffnung (18) für thermoplastisches Material vorgesehene Leitungseinrichtung (14a) und eine zweite, zwischen der zweiten Kammer (12b) und der mindestens einen zweiten Thermoplast-Extrudieröffnung (20) vorgesehene zweite Leitungseinrichtung (16b) umfaßt, wobei die Ausgabevorrichtung für Hochgeschwindigkeitsgas einen Schlitz (22) mit zwei langgestreckten Kanten umfaßt, und die mindestens eine erste Thermoplastöffnung (18) eine erste Reihe von Löchern aufweist, die parallel zu einer der langgestreckten Kanten und an einer Seite des Schlitzes (22) angeordnet sind, und wobei die mindestens eine zweite Thermoplastöffnung (20) eine zweite Reihe von Löchern umfaßt, die parallel zur anderen der langgestreckten Kanten und an der gegenüberliegenden Seite des Schlitzes (22) verläuft, und wobei die Vorrichtung weiterhin eine Einrichtung (36a) zum Fördern des ersten thermoplastischen Materials zur ersten Thermoplastkammer (12a) bei einem ersten Druck, eine Einrichtung (36b) zum Fördern des zweiten Thermoplastmaterials zur zweiten Kammer (12b) für Thermoplastmaterial unter einem zweiten Druck, eine erste Heizeinrichtung (39a) zum Anheben der Temperatur des ersten Thermoplastmaterials auf eine erste Temperatur, und eine zweite Heizeinrichtung (39b) aufweist, um die Temperatur des zweiten Thermoplastmaterials auf eine zweite Temperatur anzuheben.

24. Verfahren zum Herstellen von Fasern durch Extrudieren eines thermoplastischen Materials, das enthält die Verfahrensschritte:
des Bereitstellens eines Gasstromes und des Formens des Gasstromes in mindestens einen zentral angeordneten Hochgeschwindigkeitsgasstrahl, der in ein Kühlmedium gerichtet ist;
des Bildens mindestens eines Stromes eines geschmolzenen thermoplastischen Materials aus einer Ausgabevorrichtung für thermoplastisches Material;
des Zusammenführens des mindestens einen Stroms des geschmolzenen thermoplastischen Materials mit dem Gas und des Abkühlens des geschmolzenen thermoplastischen Materials, wodurch ein Faserstrom aus diesem thermoplastischen Material gebildet wird, gekennzeichnet durch das Extrudieren des thermoplastischen Materials benachbart zum mindestens einen Hochgeschwindigkeitsgasstrahl und diesen zumindest teilweise umgebend in die anfängliche Scherschicht des Gasstrahles hinein in unmittelbarer Nähe zum Kühlmedium, um das thermoplastische Material nur mit Hilfe des mindestens einen zentral angeordneten Gasstrahls in Fasern zu zerteilen.

25. Verfahren nach Anspruch 24,
wobei der mindestens eine Strom eines geschmolzenen thermoplastischen Materials mindestens einen ersten Thermoplastmaterialstrom und mindestens einen zweiten Thermoplastmaterialstrom umfaßt, und wobei die Ausgabevorrichtung für das thermoplastische Material mindestens eine erste Extrudieröffnung für thermoplastisches Material, aus der der mindestens eine erste thermoplastische Materialstrom extrudiert wird, und mindestens eine zweite Extrudieröffnung für thermoplastisches Material umfaßt, aus der der mindestens eine zweite Thermoplastmaterialstrom gleichzeitig mit dem mindestens einen ersten Thermoplastmaterialstrom extrudiert wird, so daß sich die mindestens eine erste und zweite Thermoplastmaterialströme mit den Scherschichten des mindestens einen Hochgeschwindigkeitsstrahls mischen und dadurch jeweils mindestens einen ersten Thermoplastfaserstrom und mindestens einen zweiten Thermoplastfaserstrom bilden.

26. Verfahren nach Anspruch 25,
wobei ein erstes Thermoplastmaterial aus der mindestens einen ersten Extrudieröffnung für Thermoplastmaterial und ein zweites Thermoplastmaterial aus der mindestens einen zweiten Öffnung für Thermoplastmaterial extrudiert wird, wobei sich die ersten und zweiten thermoplastischen Materialien durch physikalische Eigenschaften voneinander unterscheiden.

27. Verfahren nach Anspruch 24,
wobei der mindestens eine Hochgeschwindigkeitsgasstrahl ein fließfähiges Additiv enthält.

28. Verfahren nach Anspruch 27,
wobei das fließfähige Additiv ein superabsorbierendes Material enthält.

29. Verfahren nach Anspruch 27,
wobei das fließfähige Additiv Holzpulpefasern enthält.

30. Verfahren nach Anspruch 27,
wobei das fließfähige Additiv Stapelfasern ent-

hält.

31. Verfahren nach Anspruch 27, wobei das fließfähige Additiv eine Flüssigkeit ist.

32. Verfahren nach Anspruch 27, wobei das fließfähige Additiv ein gasförmiges Additiv ist.

33. Verfahren nach Anspruch 25, wobei die ersten und zweiten Thermoplastmaterialströme sich mit den Scherschichten des Hochgeschwindigkeitsgasstrahles mischen, wobei sie einen Winkel mit dem Hochgeschwindigkeitsgasstrahl von etwa 30° bis unter etwa 90° bilden.

34. Verfahren nach Anspruch 25, wobei die ersten und zweiten Faserströme, die im Verfahrensschritt (c) gebildet wurden auf eine Sammeloberfläche gerichtet werden und dadurch eine schmelzgeblasene, nicht gewebte Matte bilden.

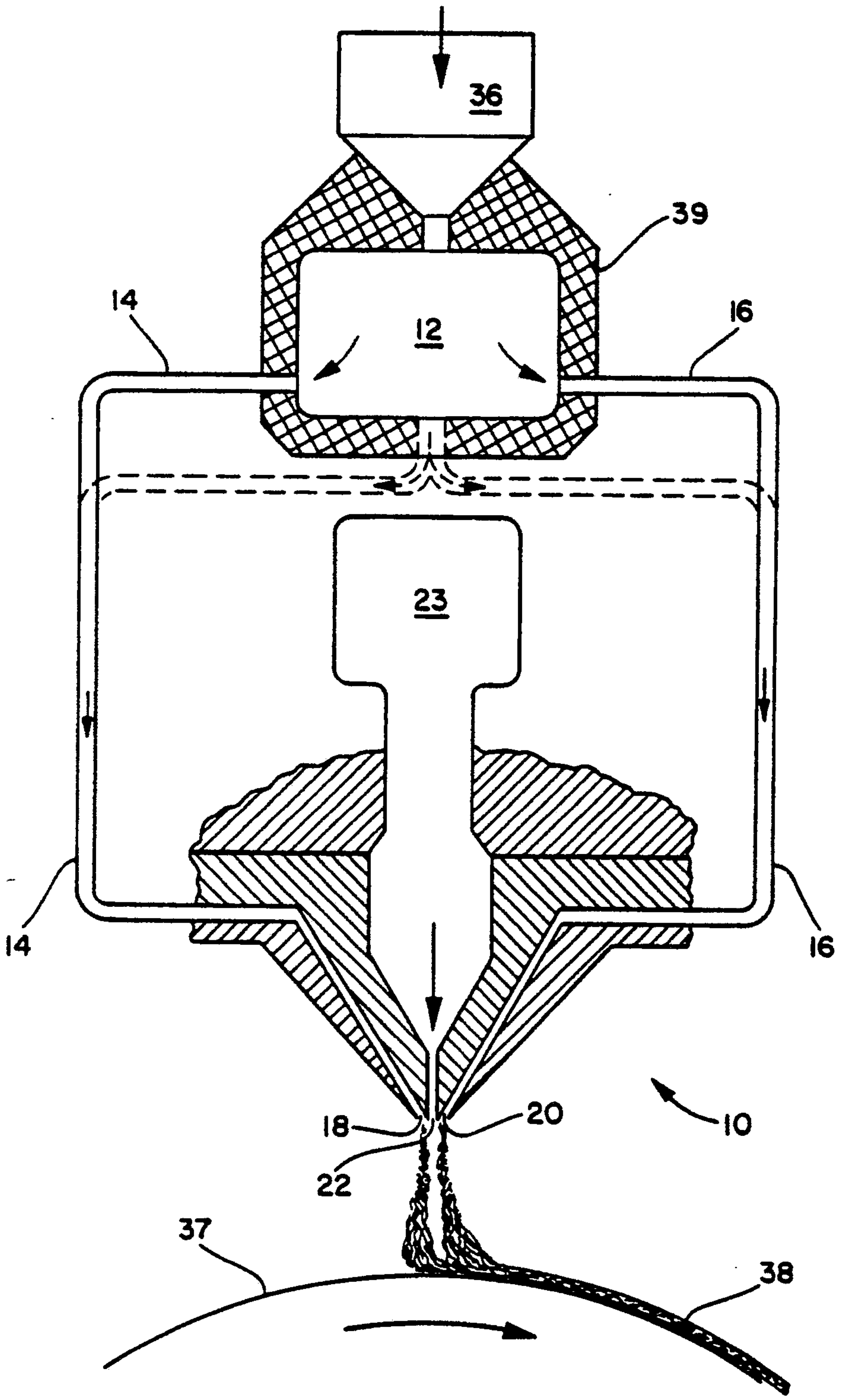

FIG. I

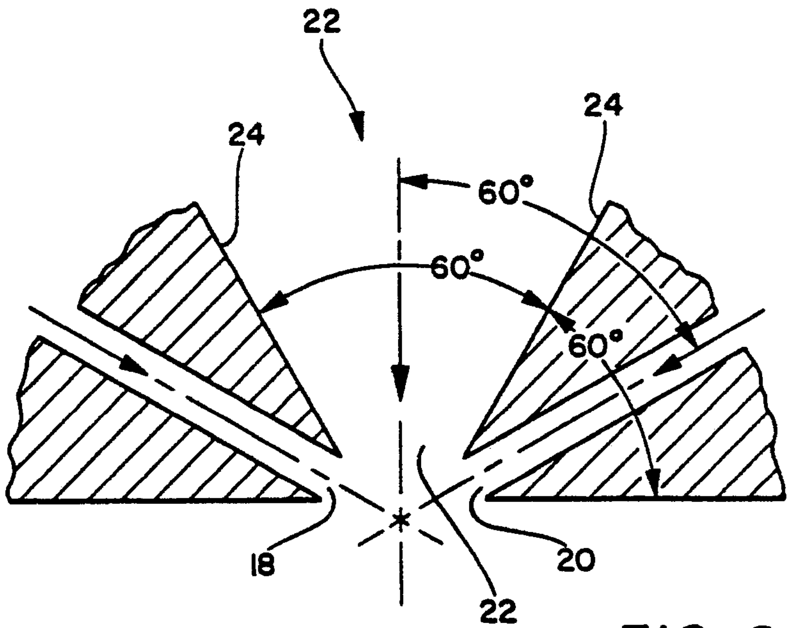

FIG. 2

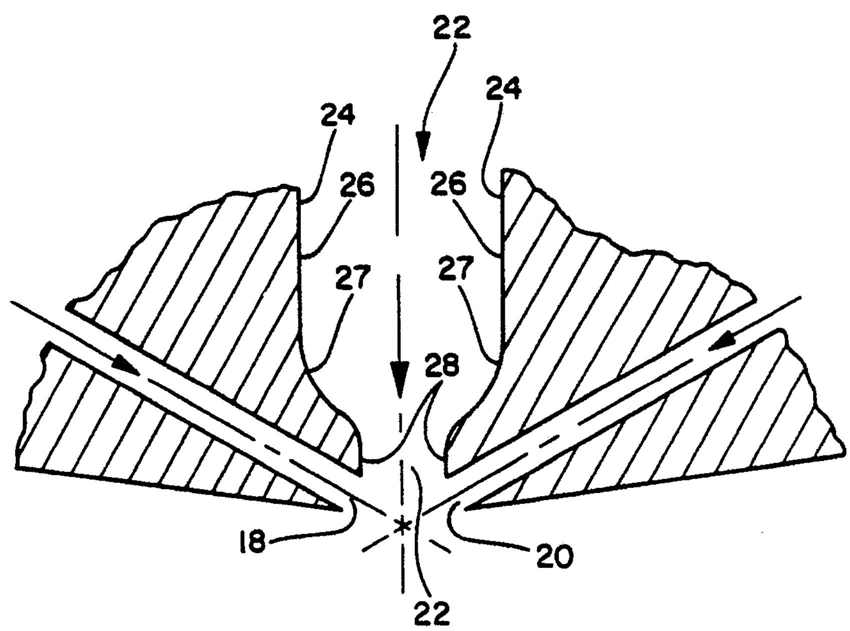

FIG. 5

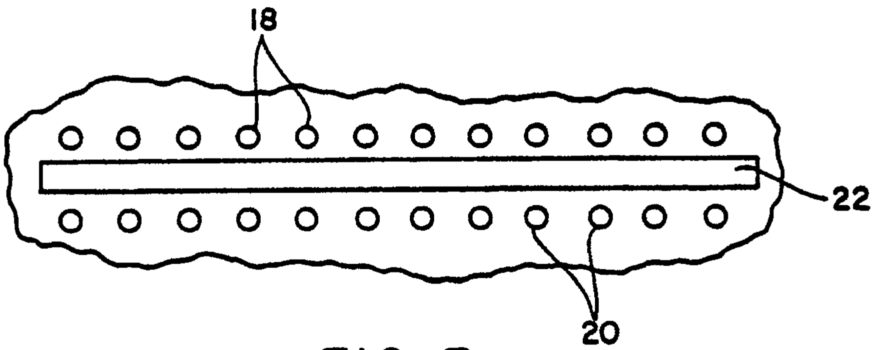

FIG. 3a

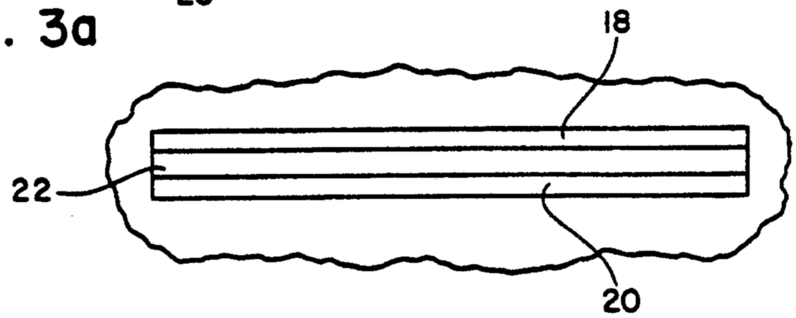

FIG. 3b

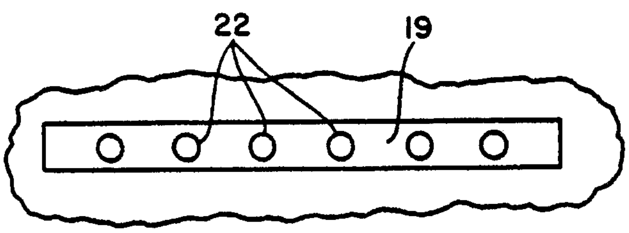

FIG. 3c

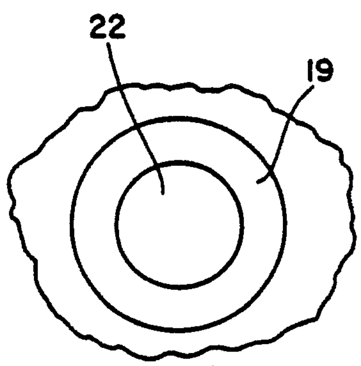

FIG. 3d

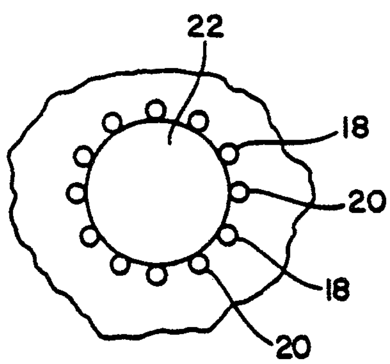

FIG. 3e

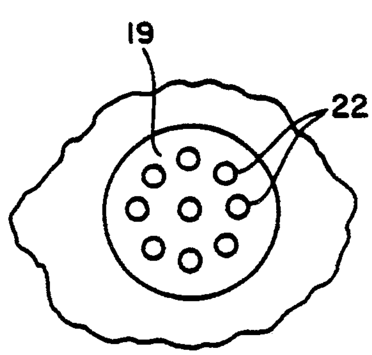

FIG. 3f

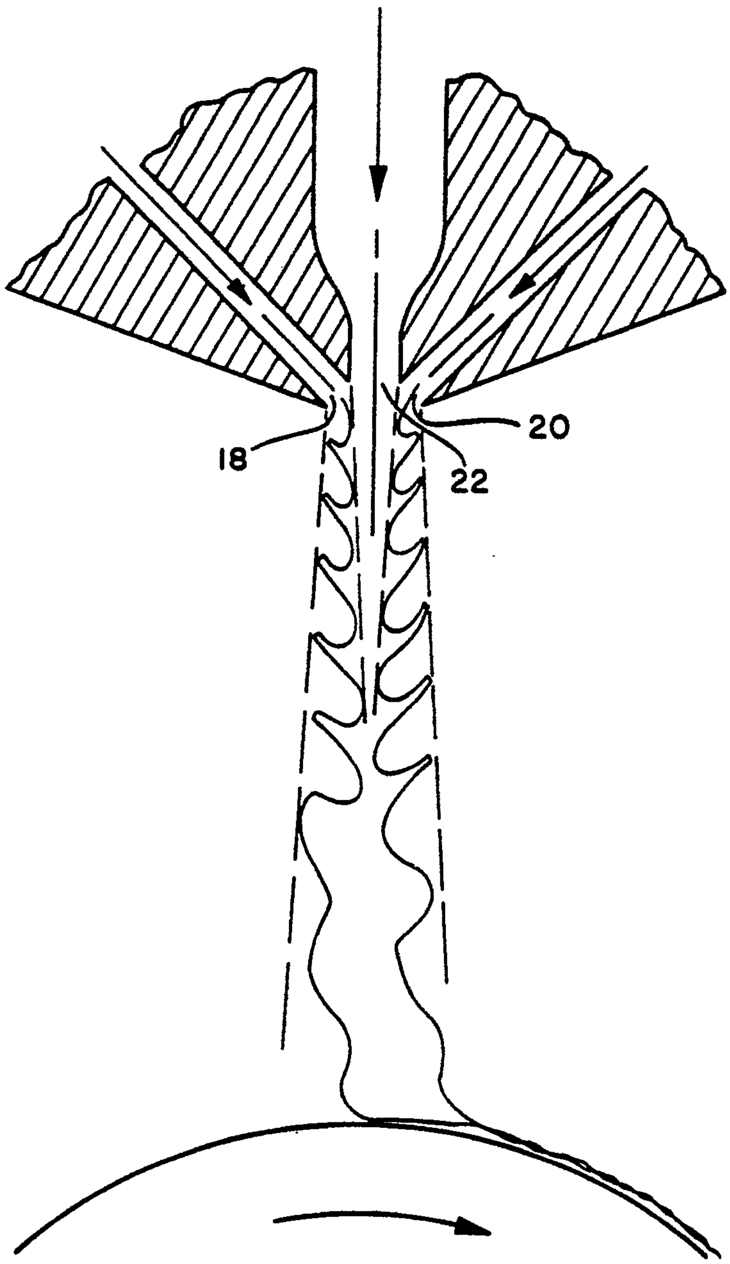

FIG. 4

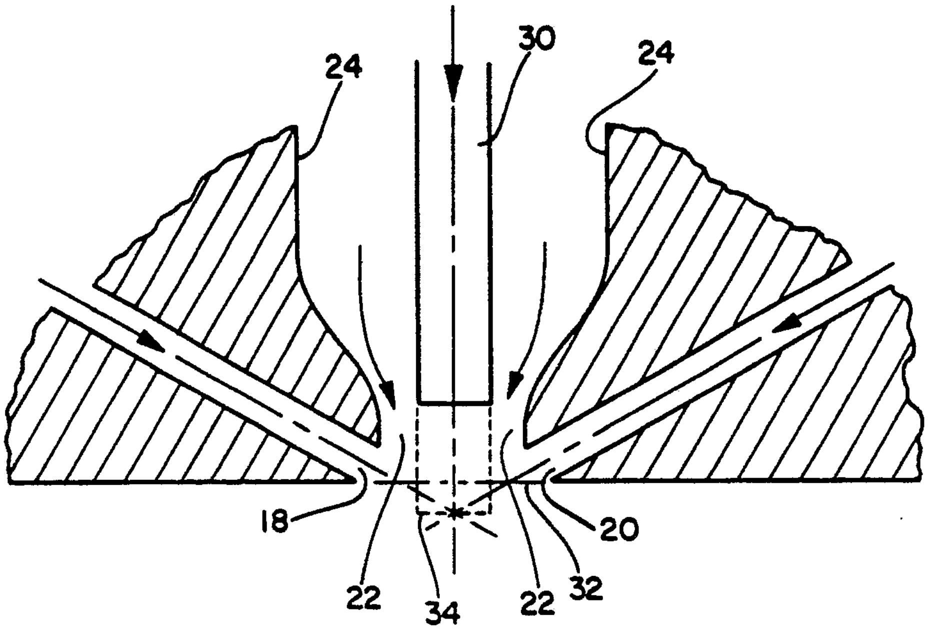

FIG. 6

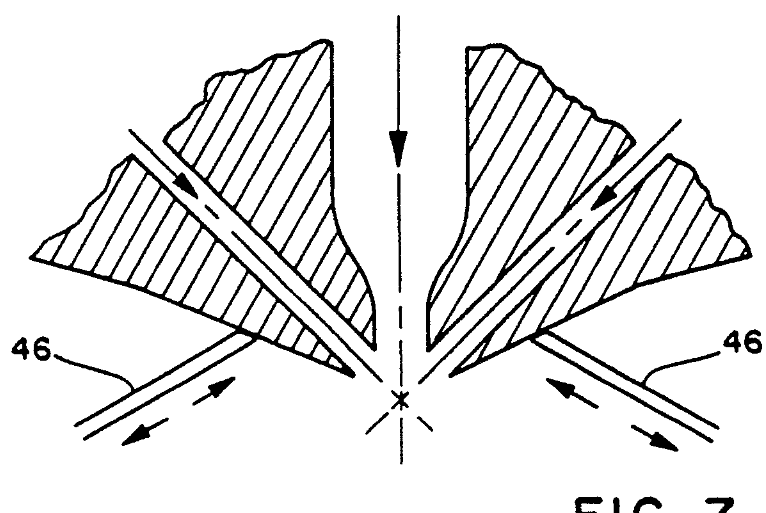

FIG. 7

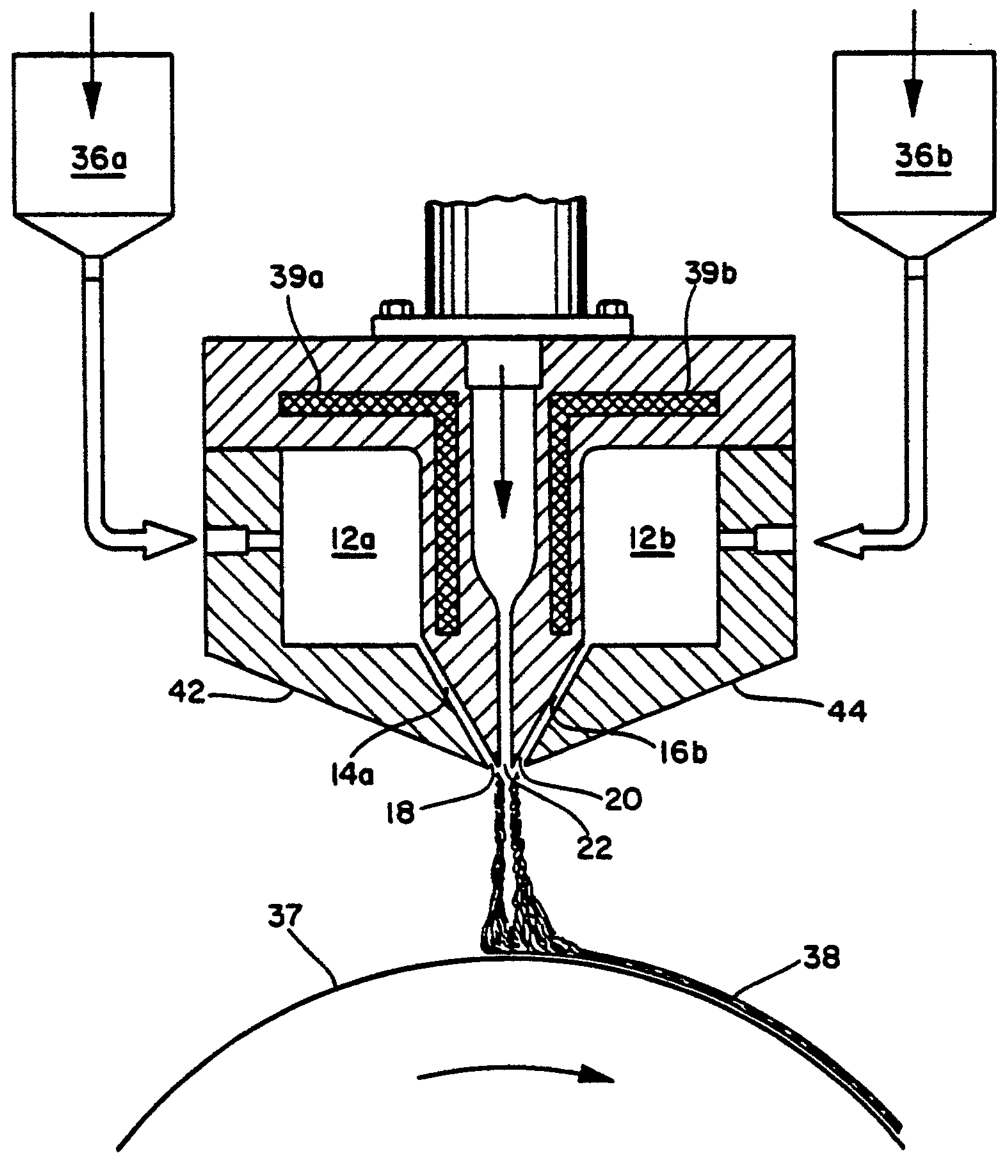

FIG. 8