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(54) **FLASH SPINNING PROCESS START-UP USING TOP AND BOTTOM LEADER SHEETS.**

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(73) Proprietor: **E.I. DU PONT DE NEMOURS AND COMPANY**
1007 Market Street
Wilmington Delaware 19898 (US)

(72) Inventor: **HUDSON, Donald, Andrew, Jr.**
12631 Merry Drive
Chester, VA 23831 (US)

(74) Representative: **Jones, Alan John et al**
CARPMAELS & RANSFORD
43 Bloomsbury Square
London, WC1A 2RA (GB)

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Description

The present invention relates to a process according to the preamble of claim 1 using one or more extrusion-die assemblies to flash spin plexifilamentary extrudates onto a moving conveyor belt, wherein start up is greatly facilitated by the use of two short length rolls of sheet material to sandwich the initial flash spinnings. The start-up sheets provide the initial strength and stability necessary for handling by normal rolls and wind-up mechanisms until the extrusion process can be fully stabilized.

PRIOR ART

Document US-A-3,504,076 discloses improving the properties of nonwoven plexifilamentary webs of polyethylene by using a closed spin-cell in which the gaseous atmosphere is maintained at temperatures of from about 34 ° to about 60 ° C.

Plexifilamentary strands are described by Blades and White in U.S. Patent No. 3,081,519. Each is a yarn-like strand having a surface-area greater than 2m.^{2}/gm. and comprising a continuous three-dimensional integral plexus of synthetic organic, crystalline, polymeric, fibrous elements. Said elements are structurally configured as oriented film-fibrils with average film-thickness of less than 4 microns and with an average electron diffraction orientation angle of less than 90 degrees.

A preferred class of suitable polymers for preparing plexifilamentary strands includes linear and branched chain polyethylene, polypropylene, copolymers of olefins, etc.; but other crystalline polymers such as polyethylene terephthalate and copolymers of ethylene with other monomers can be employed. A particularly preferred polymer is homopolymeric linear polyethylene with an upper limit to the melting range of from about 130-135 ° C., a density between 0.94 and 0.98 gm./cc., and a melt index (ASTM Test Method D-1238-57T, condition E) of 0.1 to 6.0.

A process by which plexifilamentary strands may be obtained is given in U.S. Patent No. 3,227,784 to Blades and White, and with more particularity in U.S. Patent No. 3,227,794 to Anderson and Romano. The method generally comprises: (1) preparing a uniform solution of polymer in a solvent, said solution being at a temperature at least as high as (T_c-45) ° C., wherein T_c is the solvent critical temperature, and at a sufficiently high pressure to Maintain the solution as a single liquid phase: and (2) extruding said solution into a region of substantially reduced pressure and temperature where the solvent evaporates almost instantaneously and cools the polymeric material during the adiabatic expansion to form solidified plexifilamentary strand.

Plexifilamentary strands (hereinafter plexifilaments) are particularly useful in preparing nonwoven fibrous sheets as described in U.S. Patent No. 3,169,899 to Steuber. For this purpose, the extruded material passes horizontally from the extrusion orifice directly to the surface of a rotating or oscillating deflector which opens the plexifilament into a wide network and directs it downward onto a moving belt (or other surface) where it is collected in random, multidirectional, overlapping layers. Apparatus is also provided to create opposite electrostatic charges on the strands and collection belt.

The solvents used in this process have normal boiling points at least about 25 ° C. (preferably 60 ° C. or more) below the polymer's melting temperature, are nonsolvents at or below their normal boiling points, and are usually haloalkanes. Trichlorofluoromethane and methylene chloride are frequently employed at levels of from about 80 to about 90% by weight of the polymer solution. Since these large quantities of solvent form no part of the ultimate sheet product, it is economically desirable that they be reclaimed and reused. This is accomplished by extruding the solution into a closed spin-cell which also contains the sheet-forming apparatus. The atmosphere in such a spin-cell is resultantly substantially 100% solvent vapor, and the solvent is readily reclaimed by withdrawing the vapor, and condensing it to a liquid.

Shah, U.S. 4,666,395 discloses an improved nonwoven-sheet-making apparatus includes an improved rotatable baffle which has a conical section that whose axis is displaced from the axis of rotation of the baffle. In preferred operation, the baffle deflects, spreads and oscillates a fiber stream as it advances from a spinneret to a moving receiver on which the stream fibers are deposited to form a ribbon which is overlapped with like-formed ribbons to form a sheet. The apparatus is particularly useful in making a less ropy more uniform sheet of flash-spun plexifilamentary strands.

Sheets with excellent properties are prepared by extrusion into and collection within the ambient atmosphere, without regard for solvent reclamation. Extrusion into a closed spin-cell containing an atmosphere substantially 100% of vaporized solvent at a spontaneously generated temperature, surprisingly results in lowered sheet opacities, lowered delamination resistance, and variations in these properties across the width of the sheet when wide sheets of overlapping plexifilaments are prepared. This is particularly surprising since the spontaneously generated temperatures within suitable closed spin-cells are at least 30 ° C., and as much as 70 ° C., below the normal crystalline melting temperature for the polymer.

SUMMARY OF THE INVENTION

This invention is an improvement in a process for producing nonwoven plexifilamentary webs comprising: (1) extruding a polymer solution through at least one orifice into a gaseous atmosphere of a closed spin-cell which is held at substantially normal atmospheric pressure, (2) collecting the resulting material on a moving conveyor within the spin-cell to form a continous web of random, multidirectional, overlapping layers and (3) withdrawing the web from the closed spin-cell. The improvement in the present process is given in the characterizing part of claim 1. This provision of top and bottom sheets to sandwich the initial extruded material during start-up eliminates the problems associated with conveying the initial discontinuous webs across the conveyor, out of the spin cell and onto the windup mechanism.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a partially cut-away schematic representation in perspective of a typical spin-cell apparatus suitable for modification in accordance with the present invention.

Fig. 2 is a schematic representation of the apparatus of the present invention in a spin-cell.

DETAILED DESCRIPTION OF THE DRAWINGS

A preferred method of preparing random webs of plexifilaments is initiated by forcing hot pressurized polymer solution into the apparatus of FIG. 1 via transfer line 9 and distributing it to the down-leg 16 of each extrusion position by a suitable manifold 8. At least one valve 7 is ordinarily provided in each down-leg 16. Extrusion of the solution through a plurality of die-assemblies 1 produces a plexifilament 2 which is opened, transversely oscillated, and directed downward onto a moving endless collection belt 4 driven by rolls 5. The plexifilament 2 forms a loose web 3 of random, multidirectional, overlapping layers which can be made wider by the proper lateral spacing of the plurality of die assemblies 1. As the moving web 3 passes along on the collection belt 4, it is condensed to a coherent sheet 11 by, for instance, lightly pressurized calender rolls 6 and then drawn out from closed spin-cell 15 through a suitably vapor-sealed opening 12.

Additionally provided in spin-cell 15 are an exhaust port 10 for the removal of gaseous atmosphere from the spin-cell and auxiliary cooling means represented by pipes 13 for injecting fine droplets 14 of a volatile liquid. Both of these provisions are represented schematically only. More than one exhaust port 10 for reclaiming vaporized solvent may be employed and, ordinarily, a plurality of auxiliary cooling positions 13 are spaced throughout spin-cell 15 to assure a uniform temperature of the closed cell atmosphere at all spin positions.

Not represented in FIG. 1 are drive means for rolls 5 and 6, but suitable direct or indirect sources of power are well known in the art. Likewise omitted for clarity are apparatus for solution preparation, apparatus for solvent reclamation, and means for heating transfer line 9, manifold 8, down-legs 16, and die assemblies 1.

Referring now to FIG. 2, which schematically depicts a start-up apparatus used in the present invention a spin cell 15' is provided with a plurality of die-assemblies 1', which produce plexifilamentary webs 2' directed downward onto a moving collection belt 4' driven by rolls 5'. At start-up, roll 21 unwinds sheet 22 onto moving collection belt 4'. Sheet 22 prevents the first incompletely blown plexifilamentary webs 2' from sticking to moving collection belt 4' and also transports the initially formed discontinuous plexifilamentary webs 2' across rolls such as 23 outside spin cell 15 and onto windup 24. Sheet 25 is unwound from roll 26 to cover plexifilamentary webs 2' and prevents them from wrapping consolidation roll 27, and seal rolls 29. The tail ends of sheets 22 and 25 are not attached to their respective rolls 21 and 26 so that sheets 22 and 25 exit the spin cell 15 when the entire length thereof has been pulled off the roll by the action of moving collection belt 4' and windup 24. The length of the sheets 22 and 25 on start up rolls 21 and 26 is determined by the length of time normally required to start up and stabilize operation of die-assemblies 1' after start up of moving collection belt 4'. The lengths of sheets 22 and 25 are sized so that during start-up the top sheet 25 runs out first and sheet 22 shortly thereafter. Motors (not shown) are provided only for winding sheets 22 and 25 onto rolls 21 and 26 respectively prior to start-up. Prior to start-up a sheet is fed in through a slot 30 located in the wall of spin cell 15 and through the normal sheet exit slot.

Claims

1. A process for starting-up a process for producing nonwoven plexifilamentary webs (2') comprising extruding a polymer solution through at least one orifice into a gaseous atmosphere of a closed spin cell (15'), characterized by feeding a first sheet (22) having a discrete length onto a moving collection belt (4'), collecting the resulting plexifilamentary material on said first sheet (22), applying a second sheet (25) having a discrete length over said plexifilamentary material, removing the assembly of first sheet,

plexifilamentary material and second sheet from said spin cell (15') the length of said first and second sheets being such that at about the time the extrusion of plexifilamentary material reaches equilibrium the sheets are no longer applied to the plexifilamentary material.

2. The process of Claim 1 wherein application of the second sheet (25) to the plexifilamentary material is stopped prior to stopping application of the first sheet (22) to the plexifilamentary material.

Patentansprüche

1. Verfahren zum Anfahren eines Verfahrens zum Herstellen von plexifilamentaren Vliesstoffbahnen (2'), welches das Extrudieren einer Polymerlösung durch wenigstens eine Öffnung in eine gasförmige Atmosphäre einer geschlossenen Spinnzelle (15') aufweist, **dadurch gekennzeichnet**, daß ein erstes Flächengebilde (22)mit einer diskreten Länge auf ein sich bewegendes Sammelband (4') zugeführt wird, das erhaltene plexifilamentare Material auf dem ersten Flächengebilde (22) gesammelt wird, ein zweites Flächengebilde (25) mit einer diskreten Länge auf dem plexifilamentaren Material aufgebracht wird, die Anordnung aus dem ersten Flächengebilde, dem plexifilamentaren Material und dem zweiten Flächengebilde aus der Spinnzelle (15') entnommen wird, und daß die Länge der ersten und zweiten Flächengebilde derart gewählt ist, daß etwa zu dem Zeitpunkt, zu dem das Extrudieren des plexifilamentaren Materials einen Gleichgewichtszustand erreicht, die Flächengebilde nicht mehr auf das plexifilamentare Material aufgebracht sind.

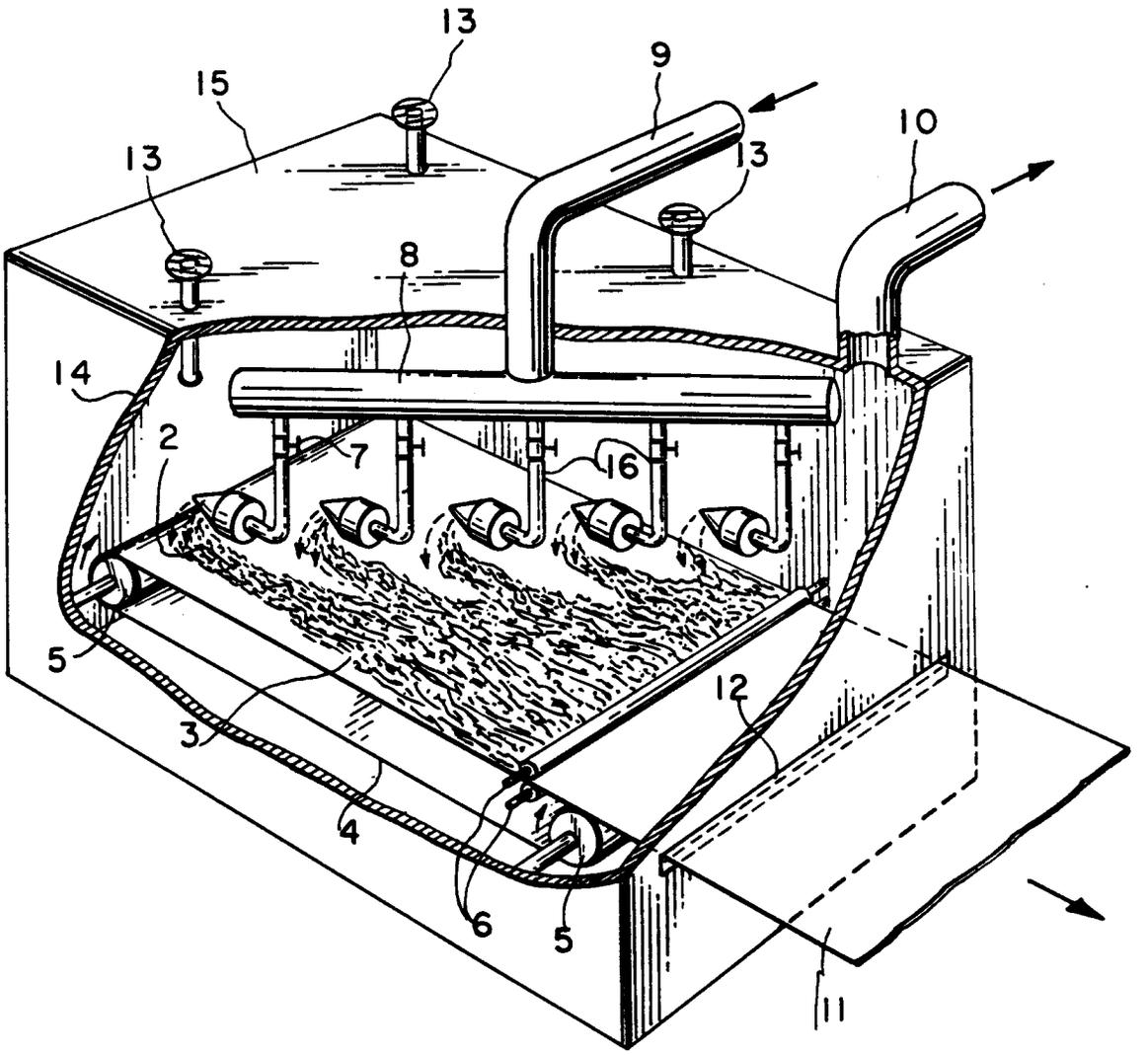
2. Verfahren nach Anspruch 1, bei dem das Aufbringen des zweiten Flächengebildes (25) auf das plexifilamentare Material gestoppt wird, bevor das Aufbringen des ersten Flächengebildes (22) auf das plexifilamentare Material gestoppt wird.

Revendications

1. Un procédé de démarrage d'un processus de fabrication de bande non tissées présentant une structure flexifilamentaire (2'), comprenant l'étape consistant à extruder une solution de polymères à travers au moins un orifice dans une atmosphère gazeuse d'une cellule de filage fermée (15'), caractérisé en ce qu'il comprend les étapes consistants à faire avancer une première feuille (22) présentant une longueur discrète sur une courroie de collecte mobile (4'), à collecter le matériau flexifilamentaire résultant sur ladite première feuille (22), à appliquer une seconde feuille (25) présentant une longueur discrète sur ledit matériau flexifilamentaire, à enlever l'ensemble de la première feuille, du matériau flexifilamentaire et de la seconde feuille de ladite cellule de filage (15'), les longueurs desdites première et seconde feuilles étant telles qu'environ à l'instant où l'extrusion du matériau flexifilamentaire atteint l'équilibre, les feuilles ne soient plus appliquées sur le matériau flexifilamentaire.

2. Le procédé selon la revendication 1, dans lequel on arrête l'application de la seconde feuille (25) sur le matériau flexifilamentaire avant d'arrêter l'application de la première feuille (22) sur le matériau flexifilamentaire.

Fig. 1



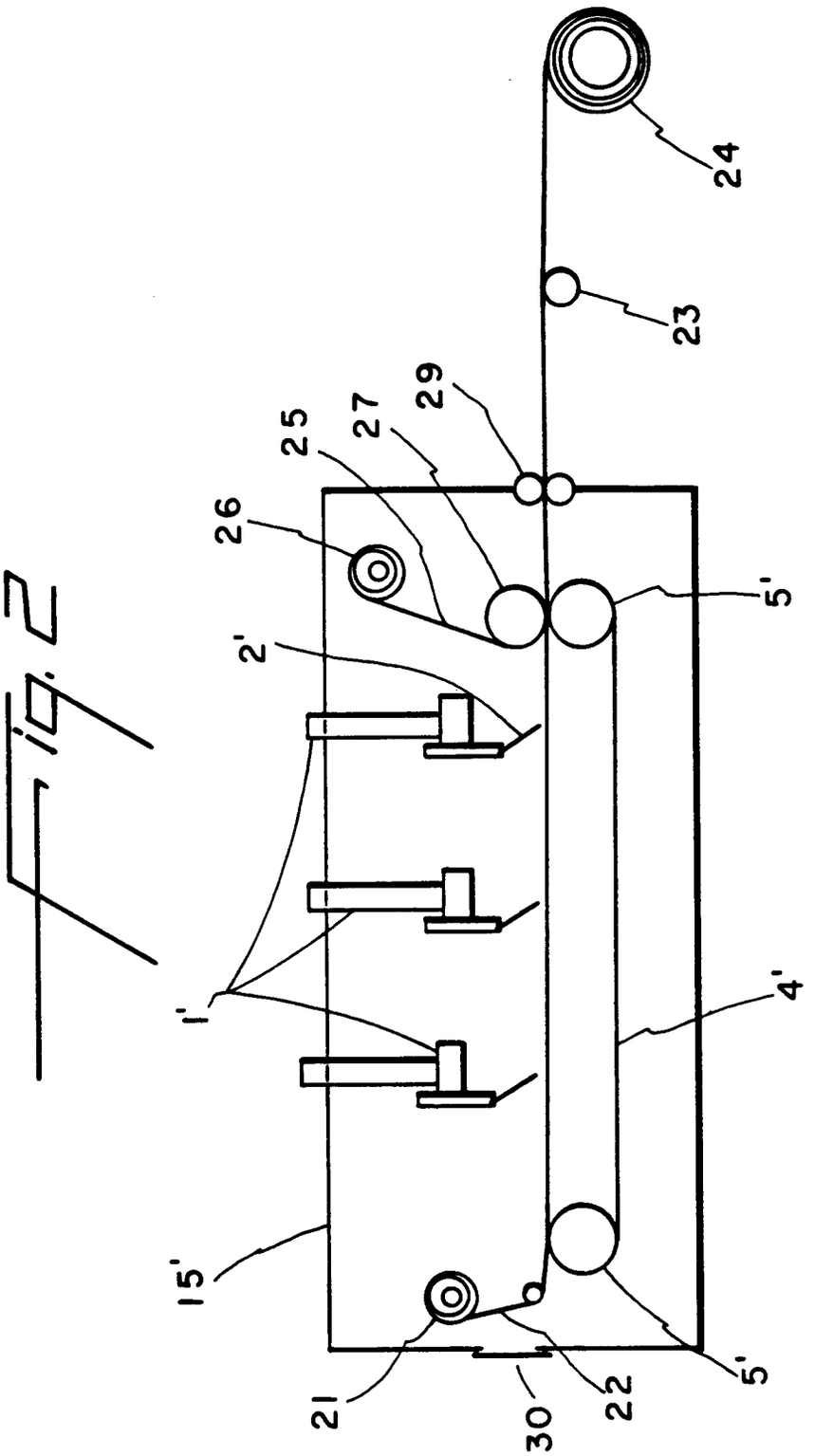


Fig. 2