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(54) **ELASTIC SPUNBONDED NONWOVEN AND ELASTIC NONWOVEN FABRIC COMPRISING THE SAME**

ELASTISCHES SPINNVLIES UND ELASTISCHE VLIESFASER DAMIT

NON TISSÉ FILÉ-LIÉ ÉLASTIQUE ET ÉTOFFE NON TISSÉE ÉLASTIQUE LE COMPRENANT

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a novel elastic spunbonded nonwoven made from multi-component filaments, and having a remarkable elastic recovery, and to an elastic nonwoven fabric comprising at least two superposed layers, one of which being constituted by the said novel elastic spunbonded nonwoven.

PRIOR ART

[0002] Elastic nonwoven fabrics advantageously offer the ability to conform to irregular shapes, and thus enable to increase fit and to allow more freedom and comfort, for example to body movements, than other textile fabrics with more limited extensibility. Elastic nonwoven fabrics are thus widely used in many industrial applications. Elastic nonwoven fabrics are used in the hygienic and personal care industry for making, for example, disposable diapers, child swim pants, child training pants, adult incontinent garments, sanitary napkins, wipes and other personal care products. Elastic nonwoven fabrics are also used in the manufacture of medical products, such as, for example, gowns, linens, bandages, masks, heads wraps and drapes. Others additional applications of elastic nonwoven fabrics include consumer products, like seat covers and car covers.

[0003] The demand for innovative and low cost elastic nonwoven products has increased in the last years. Several techniques can be used to produce nonwoven fabrics, but recently, due to the increasing of a higher cost efficiency requested by the market, methods based on melt spinning continuous filaments of thermoplastic materials have increased their importance. Such nonwoven fabrics, called "spunbonded" nonwovens can advantageously give the required combinations of physical properties, like softness, strength and durability.

[0004] One solution used in the prior art for making elastic spunbonded nonwoven webs consists in melt spinning filaments made of elastomeric polymer, such as, for example, thermoplastic polyurethane (TPU).

[0005] Significant problems have been however encountered with this solution.

[0006] One of these problems is linked to the "sticky" nature of the elastomeric polymer, typically employed in producing elastic nonwoven materials. In fact during the spunbonding process, the large air flow used for drawing the filament can make the filaments stick together and therefore the resulting web uniformity will be negatively affected. Furthermore this bigger filament bundling can give trouble due to the blocking effect when the fabric is wound into rolls.

[0007] Another problem encountered when elastomeric polymers are used for making spunbonded nonwovens is the breakage of the filaments during extrusion and/or drawing for attenuating the filaments. When filaments break they can obstruct the flow of filaments and/or mesh with other filaments, resulting in the formation of a defect in the nonwoven web.

[0008] A further drawback of the use of elastomeric polymers such as TPU for making spunbonded nonwoven is their poor bonding ability, especially thermal-bonding ability, with the most used polyolefin materials.

[0009] In order to overcome these problems, it has been proposed in US patent No 6, 225, 243 and in PCT application WO 00/08243 to produce spunbonded nonwoven webs made of multi-component filaments including at least two components: a first elastic polymeric component, and a second, extensible polymeric component, the first elastic polymeric component having an elasticity that is greater than the elasticity of the second polymeric component. The first elastic polymeric component preferably comprises at least one elastomer that includes an elastic polypropylene ; the second polymeric component preferably comprises at least one polyolefin that is a linear low density polyethylene (LLDPE) having a density greater than 0.90 g/cc.

[0010] This solution disclosed in US patent No 6, 225, 243 and in PCT application WO 00/08243 is however not satisfying in terms of elastic properties, especially in terms of elastic recovery.

[0011] In PCT application WO2005/090659, elastic nonwovens made of extensible conjugate fiber are disclosed. The extensible conjugate fiber has a total heat of melting of less than 80 Joules per gram, and comprises:

a. from 0.001% to about 20% by weight of the total fiber of a first component A which comprises at least a portion of the fiber surface, said first component A comprising a polypropylene homopolymer or a polypropylene copolymer,
b. and a second component B which comprises an elastic propylene-based olefin polymer.

[0012] Japanese patent application JP 11 323716 discloses an extensible spunbonded nonwoven fabric made of filaments of the eccentric sheath-core type. This spunbonded nonwoven fabric is extensible, but does not exhibit very high elastic properties, in particular high recovery.

OBJECTIVE OF THE INVENTION

[0013] The present invention proposes a novel elastic spunbonded nonwoven that overcomes the aforesaid problems

inherent to the use of elastomeric polymers such as TPU, and that enables to achieve very high elastic properties.

SUMMARY OF THE INVENTION

[0014] The above-mentioned objective is achieved by the elastic spunbonded nonwoven of claim 1.

[0015] The first polymeric component (P) can advantageously exhibit very high elastic properties, and in particular one can use an elastic polymeric component with a low melt flow rate that would be practically not spinnable alone.

[0016] For measuring the melt flow rates (MFR1, MFR2) of the first and second polymeric components, standard method ASTM D-1238 can be used.

[0017] The wording "elastic propylene-based olefin copolymer", as used therein, means polypropylene polymers, selected from the group of thermoplastic olefin-based elastomers, that incorporate a low level of a comonomer, such as ethylene or a higher alpha-olefin in the backbone to form an elastomeric copolymer. The term "copolymers" means any polymer comprising two or more monomers, where the monomer present in the polymer is the polymerized form of the monomer. Likewise when catalyst components are described as comprising neutral stable forms of the components, it is well understood that the active form of the component is the form that reacts with the monomers to produce polymers.

[0018] As used herein, the term "polypropylene", "propylene polymer," or "PP" refers to homopolymers, copolymers, terpolymers, and interpolymers, comprising from 50 to 100 weight % of propylene.

[0019] More particularly, "elastic propylene-based olefin copolymer" can be a single semi-amorphous copolymer or a blend of several semi-amorphous polymers, each semi-amorphous polymer comprising propylene and from 10 to 25 weight % of one or more C2 and/or C4 to C10 alpha-olefin co-monomers, preferably ethylene, wherein the copolymer comprises isotactically crystallizable alpha-olefin sequences. The term "crystallizable" describes those polymers or sequences which are mainly amorphous in the undeformed state, but upon stretching or annealing, crystallization occurs.

[0020] Most preferably, the copolymer is an ethylene propylene copolymer, e. g., ethylene propylene thermoplastic elastomer. The copolymer has a substantially uniform composition distribution preferably as a result of polymerization with a metallocene catalyst. Composition distribution is a property of copolymers indicating a statistically significant intermolecular or intramolecular difference in the composition of the polymer.

[0021] Preferably, each semi-amorphous polymers has : a) heat of fusion of 4 to 70 J/g, as determined by Differential Scanning Calorimetry (DSC); b) a Melt Flow Rate of 0.1 to 2000 dg/min, most preferably greater than 2 dg/min and less than 100 dg/min, as measured by ASTM D-1238 at 230°C, and 2.16 kg.

[0022] A semi-amorphous copolymer may be produced in a continuous solution process using a metallocene catalyst.

[0023] Preferably, copolymers having a narrow molecular weight distribution are used. To produce a copolymer having a narrow molecular weight distribution, a single sited metallocene catalyst is advantageously used, which allows only a single statistical mode of addition of the first and second monomer sequences, and the copolymer is advantageously well-mixed in a continuous flow stirred tank polymerization reactor, which allows only a single polymerization environment for substantially all of the polymer chains of the copolymer.

[0024] Preferred semi-amorphous polymers useful in this invention preferably have a molecular weight distribution (Mw/Mn) of less than 5, preferably between 1 and 4.

[0025] As used herein, molecular weight (Mn and Mw) and molecular weight distribution (MWD or Mw/Mn) are determined by gel permeation chromatography using polystyrene standards.

[0026] As used herein, "metallocene" means one or more compounds represented by the formula Cp1nMRnXq, wherein Cp is a cyclopentadienyl ring which may be substituted, or derivative thereof (such as indene or fluorene) which may be substituted; M is a transition metal, for example titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum and tungsten; R is a substituted or unsubstituted hydrocarbyl group or hydrocarboxy group having from one to 20 carbon atoms; X may be a halide, a hydride, an alkyl group, an alkenyl group or an arylalkyl group; and typically, m=I-3; n=0-3; q=0-3.

[0027] A slip agent selected for example from the group consisting of: erucamide, oleylamide, oleamide, and stearamide and used in a concentration from 50 ppm to 10 weight % can be successful added. During the processing of thermoplastic polymers it is often required to modify the rheology or surface properties of polymers by addition of selected slip agents, in order to reduce the friction and polymer tackiness, and facilitate the whole spunbonding process.

[0028] Preferred elastic propylene-based olefin copolymers suitable for the invention include thermoplastic elastic propylene-ethylene copolymers formed by using metallocene polymerization catalysis. Such polymers include those commercially available from ExxonMobil Chemical Co, Huston, TX under the trademark of VISTAMAXX®, e.g. Vistamaxx 2120 or Vistamaxx 2125 for second polymeric component in the sheath and a blend of Vistamaxx 2125 and Vistamaxx 6100 (or Vistamaxx 6102) for first polymeric component in the core.

[0029] Optionally, the elastic spunbonded nonwoven of the invention is further characterized by the following optional features that can be combined or taken alone :

- the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric com-

ponent is an ethylene propylene copolymer;

- the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric component has a molecular weight distribution (Mw/Mn) of less than 5, preferably between 1 and 4 ;
- the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric component comprises at least 80wt% of propylene units ;
- the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric component is a metallocene-catalysed polymer;
- the spunbonded nowoven has a root mean square (RMS) average recovery of at least 85%, said RMS average recovery being calculated from the formula:

$$\text{RMS average recovery} = [1/2(R_{CD}^2 + R_{MD}^2)]^{1/2},$$

wherein R_{MD} and R_{CD} are recovery values (R) measured on a nonwoven specimen respectively in machine direction and cross direction, after 50% elongation and one pull, and calculated from the formula :

$$R = [(Ls-Lr) / (Ls-Lo)]\%,$$

wherein Ls represents the stretched length of the specimen; Lr represents the recovered length of the specimen, Lo represents the original length of the specimen ;

- the spunbonded nonwoven has a RMS recovery, after two successive 50% pulls, of at least 80% ;
- the amount of the first polymeric component is at least 50wt% of the total weight of the filament, and the amount of the second polymeric component is less than 50wt% of the total weight of the filament ;
- the amount of the second polymeric component is less than 40wt% of the total weight of the filament, and preferably equal or less than 30wt% of the total weight the filament.

[0030] Another object of the invention is to propose an elastic nonwoven fabric comprising at least one first elastic spunbonded nonwoven layer as defined above, and at least one additional nonwoven layer.

[0031] More particularly, and optionally, the composite nonwoven is characterized by the following optional features that can be taken alone or combined together:

- the additional nonwoven layer is selected from the group : carded nonwoven ; spunbonded nonwoven, meltblown nonwoven ;
- the additional nonwoven layer can be constituted by a polyolefin-based nonwoven ;
- In one variant, the elastic nonwoven fabric comprises at least two additional carded nonwoven layers (C) and an elastic spunbonded nonwoven layer (W) of the invention, and sandwiched between the two carded layers; More particularly, the elastic nonwoven fabric can further comprise an additional meltblown layer (M) interposed between the elastic spunbonded nonwoven layer (W) and one carded nonwoven layer (C).
- the layers can be bonded together by one of the following bonding technologies: thermal bonding, water needling, mechanical needling, ultrasonic bonding, air trough bonding and chemical bonding ;
- in one variant, the layers are perforated.
- the elastic nonwoven fabric has a CD permanent set after two cycles at 150% elongation less 50%, and preferably less than 40%.
- the elastic nonwoven fabric has a CD elongation@Peak of at least 150 %, and preferably of at least 200 %.

[0032] The wording "polyolefin-based nonwoven layer", as used therein, means any nonwoven layer that is essentially made from a polymer or copolymer that is exclusively or predominantly made up of polyolefin units.

[0033] Preferably, at least one polyolefin-based nonwoven layer is a polypropylene-based nonwoven layer.

[0034] The wording "polypropylene -based nonwoven layer", as used therein, means any nonwoven layer that is essentially made from a polymer or copolymer that is exclusively or predominantly made up of polypropylene units.

[0035] A further object of the invention is a hydroentangled elastic nonwoven fabric comprising at least one first elastic spunbonded nonwoven layer (W) and at least one second nonwoven layer, and wherein the said first elastic spunbonded nonwoven layer (W) comprises a plurality of multi-component filaments, each multi-component filament comprising a first polymeric component (P) and a second polymeric component (P'), and wherein the first polymeric component (P) comprises an elastic propylene-based olefin copolymer, and the second polymeric component (P') comprises an elastic propylene-based olefin and has a melt flow rate MFR2 that is higher than the melt flow rate MFR1 of the first polymeric

component.

[0036] More particularly, in one variant, the layers of the hydroentangled elastic nonwoven fabric are perforated, more especially by means of hydro jets.

BRIEF DESCRIPTION OF DRAWINGS

[0037] Other characteristics and advantages of the invention will appear more clearly on reading the following detailed description which is made by way of non-exhaustive and non-limiting examples, and with reference to the accompanying drawings on which:

- Figures 1A to 1E are different examples of spun filaments cross-sections that are suitable for practising the invention,
- Figure 2 is a schematic drawing of a first example of production line that is used for making a thermo-bonded elastic nonwoven fabric of the invention ;
- Figure 3 is a schematic drawing of a second example of production line that is used for making a hydroentangled elastic nonwoven fabric of the invention,
- Figure 4 is a schematic drawing of a third example of production line that is used for making a hydroentangled elastic nonwoven fabric of the invention,
- Figure 5 is a schematic drawing of a fourth example of production line that is used for making a hydroentangled elastic nonwoven fabric of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0038] The elastic nonwoven of the invention is obtained by a spunbonding process and is made of multi-component filaments F of the sheath/core type wherein the core is made of a first polymeric components P and the sheath is made of second polymeric P', said first and second polymeric components being specific of the invention.

[0039] According to the invention, both the first (P) and the second (P') polymeric components comprise an elastic propylene-based olefin copolymer, but have two different melt flow rates (MFR1; MFR2), the melt flow rate MFR2 of the second polymeric component being higher than the melt flow rate MFR1 of the first polymeric component.

[0040] The elastic propylene-based olefin copolymers that are suitable for the first and second polymeric components are copolymers comprising propylene and from 10 to 25 weight % of one or more C2 and/or C4 to C10 alpha-olefin co-monomers, like for example the ones commercially available from ExxonMobil Chemical Co, Huston, TX under the trademark of VISTAMAXX®.

[0041] More particularly,the elastic propylene-based olefin copolymers that are suitable for the first polymeric components are for example a blend of at least two different propylene-ethylene copolymers commercially available from ExxonMobil Chemical Co, Huston, TX under the trademark of VISTAMAXX® and having two different melt flow rate (MFR1 a and MFR1 b).

[0042] The first and second polymeric components can also include others materials, like pigments or colorants, or opacizers (like TiO_2) antioxidants, stabilizers, fillers, surfactants, waxes, flow promoters or special additives to enhance processability of the composition, like for example slip agents. It is particularly recommended to add slip agents in the second polymeric component.

[0043] Various shapes in cross section for the filaments F can be envisaged (round shape, oval shape, bilobal shape, trilobal shape, etc...).

[0044] The multi-component filaments are bi-component filaments of the core/sheath type. Some non-limiting examples of different cross sections for bicomponent filaments of the core/sheath type that are suitable for the invention are illustrated on figures 1A, 1B, 1C, 1D, 1E.

[0045] As depicted on the particular examples of figure 1A to 1E, at least 50% of the whole surface of the filament F is constituted by the second polymeric component P', and even more preferably 100% of the whole surface of the filament F is constituted by the second polymeric component P'(figures 1B, 1C, 1D, 1E).

[0046] Bicomponent filament of the sheath/core type, like the ones illustrated in figures 1A, 1B, 1C, 1D, and wherein the core is made of the first polymeric component P and the sheath is made of the second polymeric component P are preferably used for a better thermal-bondability of the elastic spunbonded web with other polyolefin layers, as described hereafter. Although the sheath/core configuration is preferred, the invention is however not limited to that particular configuration.

[0047] In other variant of the invention, the filaments can however comprise more than two polymeric components.

[0048] The method applied to produce the elastic nonwoven web according to the present invention is the spunbonding process. Various types of spunbonding processes are described in US patent 3,338,992 to Kenney, US patent 3,692,613 to Dorschner, US patent 3,802, 817 to Matsuki, US patent 4,405,297 to Appel, US patent 4,812,112 to Balk and US patent 5,665,300 to Brignola et al.

Figure 2- Thermo-bonded elastic nonwoven fabric (L1/W/L2)

[0049] One example of a suitable process line for producing an elastic nonwoven fabric of the invention is illustrated in Figure 2. In this example, the process line comprises:

- a spunbonding unit (SU) for producing an elastic spunbonded nonwoven W made of bi-components filaments, preferably of the sheath/core type;
- a first delivering mean 11, in the form of a roll, for delivering a first additional nonwoven layer L1, upstream the area where the spunbonded nonwoven W is being formed ;
- a second delivering mean 15, in the form of a roll, for delivering a second additional nonwoven layer L2, downstream the area where the spunbonded nonwoven W is being formed.

Spunbonding unit (SU)

[0050] The spunbonding unit (SU) comprises two hoppers 1 and 2, containing respectively the first polymeric component (P) and the second (P') polymeric components. These two hoppers 1 and 2 feed in parallel two extruders 3 and 4, for separately melting the two polymeric components. The outputs of the two extruders 3 and 4 are connected to two melt polymer pumps 5, 6 respectively. Said pumps 5, 6 feed a dosed amount of polymers to the bi-component spinning pack 7.

[0051] The bi-component spinning pack 7 usually contains a certain number of plates stacked one on top of the other to distribute the polymers to the lower plate which is the spinnerets plate, having one or more rows of capillary holes and where the bi-component filaments are extruded. Typical spinnerets die systems well known designed for polypropylene can be used, for example with a die hole density of 2000-6000 holes per meter, and a die capillary hole diameter of 0.3 to 0.8 mm. The barrel temperatures of the two extruders are, for example, ranging from a minimum of 170°C to a maximum 260°C, depending on screws speed and design.

[0052] When the two polymers P, P' are extruded through the spinnerets holes a curtain of filaments F' is formed downward and it encounters the quench air which flow is rectified inside the quench boxes 8, by means of a suitable system, like honey-comb structure, well known to those of ordinary skilled in the art.

[0053] During the filaments solidification this system avoids air turbulences which can bring to stick together the filaments in formation. It is recommended to apply the quench air from both sides of the filaments curtain in order to improve the cooling efficiency, as elastic polymers usually show a tendency to stickiness, as well as to keep down the air flow temperature to the minimum reachable. Temperatures below 20°C are considered suitable for the scope, but lower temperatures, in the range of 10°C to 15°C, are recommended when more elastic and soft materials are applied in the sheath arrangement. To this purpose two quench boxes 8 are shown in the Figure 1. Each quench box 8 is connected to a blower which delivers the right low pressure air flow necessary for the filaments cooling.

[0054] After having been cooled the filament curtain enters in a draw unit 9, which in the most preferred case is constituted by a slot through which the filaments are drawn by means of air flow entering from the sides of the slot and flowing downward through the passage. The filaments are laid onto a foraminous transport belt (for example a wire belt) forming a transport surface T. A vacuum box 12 is positioned below the transport surface T, and delimitates a web forming area on the transport surface T.

[0055] The spunbonding unit (SU) further comprises a compression roller 10 which stabilizes, by means of a low compression, the web W just after it is formed and a pair of thermal point calander rolls 13 (one heated engraved roll and one heated smooth roll), that can be used to bond the layers (L1, W and L2) together.

Delivering means 11, 15

[0056] The first delivering mean 11 is used for laying directly onto the transport surface T, and upstream the web formation area of the spunbonding unit (SU), a bottom pre-consolidated nonwoven layer L1 (for example a spun layer, a meltblown layer or a carder layer). In this configuration, the elastic spunbonded layer W of the invention is formed on top of this bottom layer L1.

[0057] The second delivering mean 15 is used for laying directly onto the spunbonded web W a top pre-consolidated nonwoven layer L2 (for example a spun layer, a meltblown layer or a carder layer). The nonwoven layer W is thus sandwiched between the two outer nonwoven layers L1 and L2.

[0058] In another variant, the elastic spunbonded layer W of the invention can be manufactured off line and wound up in the form of a roll, and the final elastic nonwoven fabric (L1/W/L2) can be manufactured from a roll of said elastic nonwoven W.

[0059] Referring to figure 2, the three layers (L1, W and L2) can be thermo-bonded together by means of calander rolls 13, and the elastic nonwoven fabric (L1/W/L2) is wound up in the form of rolls on a winding machine 14. This winding

machine 14 has to be suitable for elastic material, and preferably enables a strict control of tension variations during winding, said tension variations being caused by the elastic properties of the final composite nonwoven.

[0060] The invention is not limited to an elastic composite nonwoven fabric that is consolidated by thermal bonding, but within the scope of the invention the elastic fabric can be consolidated by using any bonding technology known in the field of nonwoven, and including notably: water needling (also called hydroentanglement) by means of hydro jets (on one side or on both sides of the composite nonwoven), mechanical needling, ultrasonic bonding, air trough bonding and chemical bonding.

[0061] The elastic composite nonwoven fabric of the invention can be also perforated by using any perforation technology that is known in the field of nonwoven, including notably mechanical perforation and perforation by means of hydro jets.

Figure 3- Hydroentangled elastic nonwoven fabric (C/W/S)

[0062] One example of a suitable process line for producing a hydroentangled elastic nonwoven fabric of the invention is illustrated in Figure 3.

[0063] In this example, the process line comprises a carding unit 18, a first spunbonding unit SU, second spunbonding unit 19, a hydraulic needling unit 20, a dewatering unit 21, a drying unit 22, and a winding unit 23.

[0064] The carding unit 18, which is mounted upstream the spunbonding unit SU, is used for producing in line a bottom carded nonwoven layer C.

[0065] Preferably, between this first carding unit 18 and the spunbonding unit SU, the carded nonwoven layer C is compressed by compaction rolls (not shown on figure 3) and/or by means of calander rolls like the calander rolls 13 previously described in reference to figure 2. This compression and/or the calandering is performed in order to pre-consolidate the layer C, before the spunbonded layer W is formed. The same considerations apply for the production lines of figures 4 and 5.

[0066] The spunbonding unit SU is similar to the one of figure 2 and is used for producing in line the elastic spunbonded nonwoven layer W of the fabric.

[0067] The spunbonding unit 19 is similar to spunbonding unit (SU), but in contrast with spunbonding unit SU, spunbonding unit 19 does not comprise any calender rolls. This spunbonding unit 19 is used for laying a top spunbonded layer S onto the elastic spunbonded layer W.

[0068] The composite nonwoven (C/W/S) is transported, downstream the spunbonding unit 19, by means of a conveyor belt 200 through the hydraulic needling unit 20. This hydraulic needling unit 20 is used for bonding together the layers of the nonwoven composite (C/W/S), by means of high pressure water jets (hydroentanglement process) that are directed at least towards the surface of the top layer S, and that penetrate through the structure of the composite and are partially reflected back to the structure.

[0069] In the particular example of figure 3, the water needling process is performed on both sides of the composite nonwoven (C/W/S).

[0070] More particularly, in the example of figure 3, the hydraulic needling unit 20 comprises four successive perforated drums. First perforated drum 201 is associated with two successive hydro-jet beams 201a and 201b. Second perforated drum 202 is associated with two successive hydro-jet beams 202a and 202b. Third perforated drum 203 is associated with two successive hydro-jet beams 203a and 203b. Fourth perforated drum 204 is associated with two successive hydro-jet beams 204a and 204b. The water pressure of the upstream hydro-jet beam 201a is lower than the water pressure of all the other downstream hydro-jet beams 201b, 202a, 202b, 203a, 203b, 204a, 204b, in order to obtain a pre-hydroentanglement of the layers.

[0071] At the exit of hydraulic needling unit 20, a hydroentangled elastic composite C/W/S is obtained.

[0072] The fourth drum 204 can be equipped with a perforation screen, in order to create apertures in the multilayer elastic fabric C/W/S. This perforation step can be also performed by replacing the fourth drum 204 by a suitable drum for perforation, having the surface constituted by one net or several nets superposed one on the other.

[0073] The hydroentangled elastic composite C/W/S is transported downstream the hydraulic needling unit 20 by the conveyor belt 210 of a dewatering unit 21, and over a vacuum box 211, that enables to remove by suction from the fabric most of the water that has been absorbed during the water needling process (conventional dewatering process).

[0074] The hydroentanglement unit 20 and the dewatering unit 21 can be integrated in the same industrial equipment.

[0075] The dewatered hydroentangled elastic fabric (C/W/S) issued from the dewatering unit 21 is continuously fed through the oven of the drying unit 22, wherein heat is applied to the fabric (for example by means of hot air), in order to remove the remaining water still contained within the fabric.

[0076] Then the dried fabric (C/W/S) is wound in the form of a roll, by means of the winding unit 23.

Figure 4- Hydroentangled elastic nonwoven fabric (C/W/C)

[0077] Another example of a suitable process line for producing a hydroentangled elastic nonwoven fabric of the invention is illustrated in Figure 4.

[0078] The process line of figure 4 differs from the process line of figure 3 by the use of a second carding unit 18' (similar to first carding unit 18), that is substituted to the spunbonding unit 19.

Figure 5- Hydroentangled elastic nonwoven fabric (C/W/M/C)

[0079] Another example of a suitable process line for producing a hydroentangled elastic nonwoven fabric of the invention is illustrated in Figure 5.

[0080] The process line of figure 5 differs from the process line of figure 4 by the use of an additional meltblown unit 24, that is positioned between the first spunbonding unit SU and the second carding unit 18'. This meltblown unit 24 is used for producing a meltblown layer M , sandwiched between the elastic spunbonded layer W issued from the first spunbonding unit SU and the carded layer C issued from the second carding unit 18'.

[0081] The term "meltblown layer", as used therein, means any layer essentially made of "meltblown fibers".

[0082] "Meltblown fibers" are well known in the prior art and a meltblown process for making meltblown fibers is disclosed, for example, in U.S. Pat. No. 3,849,241 to Butin. "Meltblown fibers" are generally formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries. The molten threads or filaments issued from the die capillaries are fed into converging high velocity air streams which attenuate the filaments of molten thermoplastic material and reduce their diameter. Said diameter is generally reduced in order to obtain microfibers. Meltblown fibers are thus microfibers that may be continuous or discontinuous, and are generally smaller than 10 microns in diameter. Thereafter, the meltblown fibers are carried by the high velocity air stream and are deposited onto a collecting surface (i.e. the elastic spunbonded nonwoven of the invention) to form a layer of randomly distributed meltblown fibers.

[0083] For example, an additional meltblown layer M is advantageously used when opacity for the elastic nonwoven fabric is required. In particular, in hygienic applications, wherein nonwoven fabrics of higher opacity are required (e.g. for making elastic back ear for diapers or elastic side panel for training pants), a meltblown layer is preferably laid on top of the elastic spunbonded layer W of the invention ; for example, the weight of the meltblown layer M is at least 5 gsm, preferably 8 gsm and more preferably 10 gsm. This meltblown layer gives a more uniform white colour to the elastic nonwoven fabric , and thus improves the aesthetic thereof.

Examples-elastic spunbonded nonwoven (W)

[0084] Different samples of fabric (L1/W/L2) have been produced on a pilot plant, like the one of Fig.2, but without using the calander rolls 13, in order to produce a fabric (L1/W/L2) wherein the layers L1, W and L2 were not thermobonded. Then the layers L1 and L2 were removed in order to keep only the elastic spunbonded layer W.

[0085] In all samples, the spunbonded nonwoven (W) was made from bi-component filaments having a sheath/core arrangement and having the round cross section of figure 1D,.

[0086] The polymeric materials that have been used for producing these spunbonded nonwovens (W) were the following.

First polymeric component (P)

[0087] A dry blend of VM2125 (polymer P_a) and VM6100 (polymer P_b) was used as first polymeric component (P).

VM 2125

[0088] VM 2125 is a specialty polyolefin elastomer commercially available from ExxonMobil Chemical Co, Huston, TX under the trademark of VISTAMAXX®. This specialty polyolefin elastomer is a semi-crystalline elastic propylene-based olefin copolymer comprising at least 85wt% of propylene units and made in the presence of a metallocene catalyst during the polymerization process. This copolymer has a melt flow rate (MFR1 a) of 80 g/10min (measured at 230°C and 2.16Kg - ASTM D-1238), a broad melting temperature range and a highest melting peak of 160°C. This copolymer has a slower crystallization rate than polypropylene homopolymers.

VM6100 (VMX6102)

[0089] VM 6100 is a specialty polyolefin elastomer commercially available from ExxonMobil Chemical Co, Huston, TX under the trademark of VISTAMAXX®. This specialty polyolefin elastomer is a semi-crystalline elastic propylene-based

olefin copolymer comprising at least 80wt% of propylene units and made in the presence of a metallocene catalyst during the polymerization process. This copolymer has a low melt flow rate (MFR1 b) of 3 g/10min (measured at 230°C and 2.16Kg - ASTM D-1238), a broad melting temperature range and a highest melting peak of 160°C. This copolymer has a slower crystallization rate than polypropylene homopolymers. VMX 6100 can be replaced by the equivalent grade VM 6102, having same chemical properties as VM 6100 and giving the same elastic properties to the nonwovens produced.

[0090] The melt low rate (MFR1) of the first polymeric component (P) was calculated by means of the following equation:

$$\ln(MFR1) = Wa \times \ln(MFR1a) + Wb \times \ln(MFR1b) \quad (1)$$

Wherein :

- MFR1 a is the melt flow rate of polymer P_a (MFR1a = 80 g/10min for VM2125)
- MFR1b is the melt flow rate of polymer P_b (MFR1b = 3 g/10min for VM6100 or VM6102)
- Wa and Wb are the weight ratios of polymers P_a and P_b in the blend (Wa+Wb=1).

[0091] In the following examples, the weight ratio (Wa) of VM2125 was 0.8 and the weight ratio (Wb) of VM6100 (or VM6102) was 0.2.The melt flow rate MFR1 of the blend (first polymeric component P) calculated by means of above formula (1) was thus around 41 g/10min.

Second polymeric component(P')

[0092] The second polymeric component was made of aforesaid elastic propylene-based olefin copolymer VM2115

[0093] Other technical characteristics of materials VM6100 (VM6102) and VM 2125 are given in table 1.

TABLE 1 : VM 6100- VM 6102- VM 2125 - VM 2320

MAIN CHARACTERISTICS	VM 6100	VM6102	VM 2125	VM 2320	VM 2120	METHOD
CHEMICAL FAMILY	POLYOLEFIN	POLYOLEFIN	POLYOLEFIN	POLYOLEFIN	POLYOLEFIN	
MFR_g/10min (1)	3	3	80	200	80	ASTM D-1238
DENSITY_g/cm3	0.855	0.863	0.865	0.866	0.868	/
Ethylene Content (wt%)	/	16	13	14	13	ASTM D-3900
HARDNESS (SHORE A)	55	59	63	62	64	ASTM D-2240
FLEXURAL MODULUS_Mpa	/	8.5	29.8	18.6	21.1	ASTM D-790
TENSILE @ BREAK_Mpa	/	>8.3	8.1	6.7	8.6	ASTM D-412
ULTIMATE ELONGATION	/	>2000	860	853	1007	ASTM D-412
TENSILE STRESS @ 100% ELONG._Mpa	/	1.6	3.5	2.8	3.2	ASTM D-412
TENSILE STRESS @ 300% ELONG. Mpa	/	2.0	4.6	3.6	4	ASTM D-412

[0094] The compositions of the filaments of the different samples of spunbonded nonwoven W are summarized in table 2.

TABLE 2 : Filaments composition

Sample	Core_wt% (P)	Sheath_wt% (P')	Core material /P_a	Wa	Core Material /P_b	Wb	Sheath Material (P')	(P') Weight %in the Sheath	Additive in the Sheath	(Additive) Weight % in the Sheath
E-7-6	85	15	VM2125	0.8	VM6100	0.2	VM2125	97%	**(a)**	3%
E-7-8	85	15	VM2125	0.8	VM6100	0.2	VM2125	97%	**(a)**	3%
E-7-10	85	15	VM2125	0.8	VM6100	0.2	VM2125	97%	**(a)**	3%
(a) the additive in the sheath is a slip agent masterbatch containing lubricant and used for facilitating spinning.										

[0095] The main spunbonding process parameters are summarized in the following table 3 for each sample of spunbonded nonwoven W..

TABLE 3: Spunbonding production data – web forming

Sample	(I) Basis weight of W (gsm)	(II) Filament count (dpf)	(III) T° of extruder (3) (°C)	(IV) T° of extruder (4) (°C)	(V) T° of Spinning Beam (°C)	(VI) Through-put (kg/h*m)	(VII) Through-put (ghm)	(VIII) Line speed (m/min)
E-7-6	60	4-6	270	265	240	150	0.50	54
E-7-8	30	4-6	270	265	240	150	0.50	113
E-7-10	80	4-6	270	265	240	150	0.50	40.5

[0096] The elastic properties of the resulting spunbonded nonwoven W of the invention were measured at 23°C ± 2, using an Instron Testing apparatus set at 5 inch gauge length and a stretching rate of 5 inches per minute. At the designated 50% elongation value, the sample is held in the stretched state for 30 seconds and then allowed to fully relax at zero force. The percent recovery can then be measured. At the end the recovery (R) was measured in both CD and MD directions, according to the formula : R = [(Ls-Lr) / (Ls-Lo)]%, wherein Ls represents the stretched length of the specimen; Lr represents the recovered length of the specimen, Lo represents the original length of the specimen.

Recovery 1 st pull - 50%:

[0097] Web samples of a predetermined length Lo in the relaxed state were cut in each web W. The web samples were elongated at 50% elongation, held in the stretched state for 30 seconds and then relaxed to zero tensile force.

Recovery 2nd pull - 50%:

[0098] The web samples were elongated a second time at 50% elongation, held in the stretched state for 30 seconds and then relaxed to zero tensile force. At the end the recovery (R) was measured.

[0099] The resulting nonwoven of the invention has a root mean square (RMS) average recovery of at least 85%, said RMS average recovery being based on machine direction (R_{MD}) and cross direction (R_{CD}) recovery values after 50% elongation and one pull. RMS average recovery are calculated from the formula:

$$\text{RMS average recovery} = [1/2(R_{CD}^2 + R_{MD}^2)]^{1/2}$$

wherein R_{CD} is the recovery measured in the cross direction and R_{MD} is the recovery measured in the machine direction. Preferably, the fabrics have at least about a RMS recovery of 80% after two successive 50% pulls.

[0100] The recovery results issued from these experiments are summarized in Table 4 (elastic spunbonded nonwoven W of the invention).

[0101] Table 5 relates to recovery results obtained with comparative spunbonded webs W not covered by the invention. The main characteristics of the TPU materials used in the comparative examples of table 5 are also summarized in table 6.

TABLE 4 : Elastic spunbonded nonwoven (W) of the invention

					Root Mean Square	
Example N°	Arrangement	Spunbonded Filament bi-component	Spunbonded Filament composition	Total Web (W) - weight gsm	Recovery 1st pull 50%	Recovery 2nd pull 50%
E-7-6	core	85wt%	VM2125(80wt%) +VM6100 (20wt%)	60	**92.3**	**90.2**
	sheath	15wt%	VM 2125 (97wt%) + slip agent(3wt%)			
E-7-8	core	85wt%	VM2125(80wt%) +VM6100 (20wt%)	30	**89.5**	**87.3**
	sheath	15wt%	VM 2125 (97wt%) + slip agent (3wt%)			
E-7-10	core	85wt%	VM2125(80wt%) +VM6100 (20wt%)	80	**94.1**	**92.6**
	sheath	15wt%	VM 2125 (97wt%) + slip agent (3wt%)			

TABLE 5: Elastic spunbonded nonwoven web - Comparative examples

					Root Mean Square	
Example N°		Filament bi-component	Filament composition	Web (W)-weight gsm	Recovery 1 st pull 50%	Recovery 2nd pull 50%
19	core	70wt%	TPU 1185 AM	49	97.1	96.1
	sheath	30wt%	TPU 1185 AM			
20	core	70wt%	TPU 1180 A	50	97.3	96.7
	sheath	30wt%	TPU 1180 A			
21	core	70wt%	TPU 2180 A	49	96.0	94.3
	sheath	30wt%	TPU 2180 A			
22	core	70wt%	VM 2125	50	88.1	86.4
	sheath	30wt%	VM 2125			
23	core	70wt%	VM 2120	51	86.3	83.6
	sheath	30wt%	VM 2120			

TABLE 6 : Elastollan grades

MAIN CHARACTERISTICS	Grade 1180A	Grade 1185 AM	Grade 2180 A	METHOD
CHEMICAL FAMILY	TPU Basis polyol: Polyether	TPU Basis polyol: Polyether	TPU Basis polyol: Polyester-ether	
DENSITY_g/cm3	1.14	1.11	1.13	DIN 53479
HARDNESS (SHORE A) (1)	80	88	77	DIN 53505
TENSILE STRENGTH_Mpa	45	45	45	DIN 53504

(continued)

MAIN CHARACTERISTICS	Grade 1180A	Grade 1185 AM	Grade 2180 A	METHOD
CHEMICAL FAMILY	TPU Basis polyol: Polyether	TPU Basis polyol: Polyether	TPU Basis polyol: Polyester-ether	
ELONGATION @ BREAK_%	650	600	450	DIN 53504
TENSILE STRESS @ 100% ELONG._Mpa	4.5	7	4.5	DIN 53504
TENSILE STRESS @ 300% ELONG. Mpa	8	12	10	DIN 53504
(1) Measurements were performed on compression molded specimens				

[0102] The spunbonded layer (W) of the invention (samples E-7-6; E-7-8; E-7-10) exhibits very high recovery values. These recovery values are higher than recovery values that are obtained for example with spunbonded web made of Sheath/Core bi-component filaments (LLDPE /TPU) as the ones described in examples No 10 of US patent 6,225,243.

[0103] The comparative examples n°19, 20 and 21 were based on pure TPU, same in core and in sheath arrangement. Even though elasticity was good, the elastic TPU layer exhibits a high stickiness. Furthermore, the elastic TPU layer was not thermo-bondable to other polypropylene-based layers. In addition, because of the degradation of the TPU during melting, TPU materials can not be processed in standard polypropylene extruders.

[0104] Compared to examples 19 to 21 (TPU/TPU), the elastic spunbonded layer of the invention (samples E-7-6; E-7-8; E-7-10) is advantageously less sticky, and thus easier to be wound and unwound. Furthermore, the chemical composition of the sheath is similar to polyolefin materials that are mostly used in the field of nonwoven. The polymeric materials used for practicing the invention can thus be advantageously processed in standard polypropylene extruders. Furthermore, thermal bondability of the spunbonded layers (W) of the invention with other polyolefin-based nonwoven layers (L1, L2) is improved.

[0105] The comparative examples N° 22 and N°23 were based on pure VM2125 or VM 2120. Compared to examples N°22 and N°23 (VM/VM), the spunbonded layers (W) of the invention (E-7-6; E-7-8; E-7-10) have advantageously a higher elasticity and elastic recovery.

[0106] Additionally, it has to be outlined that advantageously, and in contrast with other solutions of the prior art as the ones described, for example, in US patent application No 2005/0215964, the spunbonded nonwoven layer W of the invention does not necessarily require any activation step for obtaining its elastic properties.

Examples - Perforated hydroentangled elastic nonwoven fabrics

[0107] Different perforated composite nonwoven fabric (C/W, C/W/S and C/W/C) have been produced according to the manufacturing processes of figures 3 and 4 (examples E-150-FP, E-151-FP, E-152-FP, E-153-FP, E-155-FP). The compositions of these composite nonwoven fabrics are summarized in Table 7.

TABLE 7 : Perforated hydroentangled elastic nonwoven of the invention

Examples	**structure**	**total B.W. (gsm)**	**Bottom Layer, type**	**gsm**	**Elastic spunbonded Layer W (see table 4)**	**gsm**	**Top Layer, type**	**gsm**
E-150-FP	**C/W**	**60**	on line carded PP	30	E-7-8	30	NONE	0
E-151-FP	**C/W/S**	**58**	on line carded PP	20	E-7-8	30	Spunbonbded PP	8
E-152-FP	**C/W/S**	**110**	on line carded PP	20	E-7-10	80	Spunbonbded PP	10

(continued)

Examples	structure	total B.W. (gsm)	Bottom Layer, type	gsm	Elastic spunbonded Layer W (see table 4)	gsm	Top Layer, type	gsm
E-153-FP	**C/W/S**	**90**	on line carded PP	20	E-7-6	60	Spunbonbded PP	10
E-155-FP	**C/W/C**	**94**	on line carded PP	20	E-7-6	60	Carded PP	14
C: carded layer W: Elastic spunbonded layer of tne invention S: Spunbonded layer PP: Polypropylene								

[0108] The outer carded layers (C) with low basis weight give textile appearance and soft touch to the final nonwoven fabric. This property is particularly useful in all applications wherein the composite nonwoven has to come into contact with the skin, for example in diapers, feminine/adult care or the like. The outer polypropylene carded layers (C) also give advantageously a dimensional stabilization to the nonwoven fabric in the machine direction.

[0109] The main process parameters for the final hydroentanglement and perforation steps by means of hydro-jets are summarized in the following table 8.

TABLE 8: Production data - Hydroentanglement and perforation

Examples	Pattern	HET Pressures (bar)								
		beam 201a	beam 201b	beam 202a	beam 202b	beam 203a	beam 203b	beam 204a	beam 204b	speed, m/min
E-150-FP	perfo, screen , 4th drum (i)	50	60	NA	NA	NA	NA	150	150	16
E-151-FP	perfo, screen , 4th drum (i)	50	70	NA	70	NA	NA	180	180	16
E-152-FP	perfo, screen , 4th drum (i)	50	70	NA	70	NA	NA	200	200	16
E-153-FP	perfo, screen , 4th drum (i)	50	70	NA	70	NA	NA	200	200	16

(continued)

Examples	Pattern	HET Pressures (bar)								
		beam 201a	beam 201b	beam 202a	beam 202b	beam 203a	beam 203b	beam 204a	beam 204b	speed, m/min
E-155-FP	perfo, screen , 4th drum (i)	30	40	NA	70	NA	NA	180	180	16

NA: Not active jet beam
(i) In all these examples, the screen used for performing the perforation on the fourth drum 204 was the same, namely a screen manufactured by ALBANY under reference BZ FW 9,5. The specifications of this screen provided by the manufacturer were the following:
Mesh count: 9.5 x 8.5/cm
Warp diameter: 0.63x0.33 mm BZ
Shute diameter: 0.51 mm BZ
Caliper: 0.93mm
Nominal air permeability : 3.77 m/s - 850 CFM.

Example - Non-perforated hydroentangled elastic nonwoven fabrics

[0110] A non perforated composite nonwoven fabric (C/W/M/C) of basis weight 92gsm has been also produced in a pilot plant according to the manufacturing process of figure 5 (example referred "E-105/HET").

[0111] In this example the two external layers were carded layers (C) made of PP (polypropylene fibers). The basis weight of each carded layer (at the output of the carded unit) was 14gsm.

[0112] The elastic spunbonded layer W was made of bicomponent sheath/core filaments having the round cross-section of figure 1D. The core of the filaments was made (first polymeric component P) of a blend VM2125 (70wt%) and VM6100 (30wt%). The melt flow rate MFR1 of this blend (first polymeric component P) calculated by means of formula (1) was thus around 29.87g/10min.

[0113] The outer sheath of the filaments was made of VM 2125 (second polymeric component P'). The weight of the core was 90% of the total basis weight, and the weight of the sheath was 10% of the total basis weight. The basis weight of the elastic spunbonded layer (W) was 54gsm.

[0114] In this example the material used for the elastic meltblown layer (M) was VM 2320. The basis weight of the meltblown layer (M) was 10gsm.

VM 2320

[0115] VM 2320 is a specialty polyolefin elastomer suitable for melt blown process commercially available from ExxonMobil Chemical Co, Huston, TX under the trademark of VISTAMAXX®. This specialty polyolefin elastomer is a semi-crystalline elastic propylene-based olefin copolymer comprising at least 80wt% of propylene units and made in the presence of a metallocene catalyst during the polymerization process. This copolymer has a MFR (Melt Flow Rate) of 200 (measured at 230°C and 2.16Kg - ASTM D-1238), a broad melting temperature range and a highest melting peak of 160°C. This copolymer has a slower crystallization rate than polypropylene homopolymers.

[0116] Other technical characteristics of materials VM 2320 are given in table 1.

[0117] More generally, the thermoplastic materials used for making the meltblown fibers will be knowingly selected by one skilled in the art, in respect of the properties required for the elastic nonwoven fabric. Specialty elastomeric polyolefin VM2320 is given only by way of example. This specialty elastomeric polyolefin can be replaced by any other known thermoplastic material, in particular by any thermoplastic material that are used in the field of hygienic product (diapers, training pants, ..) for making meltblown layers.

[0118] Elastic properties of these elastic nonwoven fabrics of the invention were measured at 23°C ± 2, using an Instron Testing apparatus equipped with Grips type line contact or similar. The grip defines the gauge for the specimen, therefore those skilled in the art know that the grip must hold the specimen to avoid slipping or damage. The above mentioned apparatus has to be set at 1 inch gauge length and a stretching rate of 10 inches per minute. The specimens will have the following dimensions: width 1 inch and length 3 inches. The forces were measured in Newton/inch. Tensile tests, load at peak and elongation at peak and hysteresis cycles have been performed on the above mentioned specimens specifically in cross direction (CD).

[0119] The Instron Testing apparatus is equipped with a software which plots the load-elongation curve and the data are stored in the buffer memory.

CD Load@peak :

[0120] The specimen has been pulled at a stretching rate of 10 inches per minute until the maximum load has been reached. The corresponding value of the CD Load@peak expressed in N/inch is reported in table 9.

CD Elongation@peak :

[0121] From the load-elongation curve of the same specimen used during the previous test measurement we obtain the corresponding value of the CD Elongation@peak expressed in %.

CD Load@150%Elongation :

[0122] From the load-elongation curve of the same specimen used during the first test measurement we obtain the corresponding value of the CD Load@150 %Elongation, expressed in N/inch.

CD Permanent Set after 2 Cycles@150% Elongation :

[0123] A new specimen has been pulled (1st cycle) at a stretching rate of 10 inches per minute till the designated 150% elongation value: the sample is then held in the stretched state for 30 seconds and allowed to fully relax at zero force for 60 seconds. A second pull is applied (2nd cycle) at a stretching rate of 10 inches per minute till the designated 150% elongation value, held in the stretched state for 30 seconds and then allowed to fully relax at zero force. The percent permanent set can then be measured in CD direction and expressed in %, according to the formula :

$$\text{CD Permanent Set after 2 Cycles@150\% Elongation} = [(Lr-Lo) / (Ls-Lo)]\%,$$

wherein Ls represents the stretched length of the specimen, Lr represents the recovered length of the specimen after the 2nd cycle, Lo represents the original length of the specimen.

[0124] The results issued from these tests are summarized in Table 9.

TABLE 9

Examples	CD PERMANENT SET AFTER 2 CYCLES@150%Elongation (%)	CD ELONGATION @ PEAK (%)	CD LOAD@150% Elongation (N/ inch)	CD LOAD @ PEAK (N/ inch)	ELASTIC layer %
E-150-FP	48	207	4.9	11.3	50
E-151-FP	44	238	10.2	13.5	52
E-152-FP	36	239	13.2	16.5	73
E-153-FP	39	210	15.6	19.2	67
E-155-FP	34	265	8	15.2	64
E-105/HET	28	245	8	10.7	70

[0125] The data in the last column of Table 9 ("ELASTIC layer %) represent the weight percentage of the elastic material [i.e. elastic spunbonded layer (W) and elastic meltblown layer for example E-105/HET and elastic spunbonded layer (W) for examples E-150-FP, E-151-FP, E-152-FP, E-153-FP, E-155-FP] on the total weight of the elastic nonwoven fabric.

Example-elastic spunbonded nonwoven (W/M)

[0126] Samples of multilayer nonwoven (C/W/M/C) have been produced on a pilot plant, without bonding the layers together. Then the two outer carded layers were removed in order to keep only the elastic spunbonded (W) and meltblown (M) layers.

[0127] The elastic spunbonded layer W was made of bicomponent sheath/core filaments having the round cross-section of figure 1D. The core of the filaments was made (first polymeric component P) of a blend VM2125 (70wt%) and VM6100 (30wt%). The outer sheath of the filaments was made of VM 2125 (second polymeric component P'). The weight of the core was 90% of the total basis weight, and the weight of the sheath was 10% of the total basis weight. The basis weight of the elastic spunbonded layer (W) was 54gsm.

[0128] In this example the material used for the elastic meltblown layer (M) was VM 2320. The basis weight of the meltblown layer (M) was 10gsm. The elastic properties of the elastic spunbonded nonwoven (W/M) were measured and are given in table 10.

TABLE 10 :

Examples	CD PERMANENT SET AFTER 2 CYCLES@150%Elongation (%)	CD ELONGATION @ PEAK (%)	CD LOAD@150% Elongation (N/ inch)	CD LOAD @ PEAK (N/inch)
E-105	21	398	1.4	3.5

[0129] The elastic nonwoven fabric of the invention is not limited to the particular multilayered structures of the examples previously described. The invention actually encompasses any elastic nonwoven fabric wherein at least one of the layer is an elastic spunbonded nonwoven W as the one defined in the claims.

Claims

1. An elastic spunbonded nonwoven (W) comprising a plurality of core/sheath filaments, wherein the core of each core/sheath filament is made of a first polymeric component (P), and the sheath of each core/sheath filament is made of a second polymeric component (P'), wherein the first polymeric component (P) comprises a blend of at least two elastic propylene-based olefin copolymers (P_a ; P_b) of different melt flow rate (MFR1a and MFR1b), and the second polymeric component (P') comprises an elastic propylene-based olefin copolymer and has a melt flow rate MFR2 that is higher than the melt flow rate MFR1 of the first polymeric component, wherein the melt flow rates MFR1 and MFR2 of the first and second polymeric components (P, P') are greater than 2 g/10min and less than 100 g/10min, as measured by ASTM D-1238 at 230°C and 2.16 kg, wherein the ratio MFR2/MFR1 is higher than 1.5, and wherein the elastic propylene-based olefin copolymers of the first polymeric component and of the second polymeric component comprises propylene and from 10 to 25 weight % of one or more C2 and/or C4 to C10 alpha-olefin co-monomers.

2. An elastic spunbonded nonwoven according to claim 1, wherein the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric component is an ethylene propylene copolymer.

3. An elastic spunbonded nonwoven according to any one of claims 1 to 2, wherein the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric component comprises at least 80wt% of propylene units.

4. An elastic spunbonded nonwoven according to any one of claims 1 to 3, wherein the elastic propylene-based olefin copolymer for the first polymeric component and for the second polymeric component is a metallocene-catalysed polymer.

5. An elastic spunbonded nonwoven according to any one of claims 1 to 4, having a root mean square (RMS) average recovery of at least 85%, said RMS average recovery being calculated from the formula:

$$\text{RMS average recovery} = [1/2(R_{CD}^2 + R_{MD}^2)]^{1/2},$$

wherein R_{MD} and R_{CD} are recovery values (R) measured on a nonwoven specimen respectively in machine direction and cross direction, after 50% elongation and one pull, and calculated from the formula :

$$R = [(Ls-Lr) / (Ls-Lo)]\%,$$

wherein Ls represents the stretched length of the specimen; Lr represents the recovered length of the specimen, Lo represents the original length of the specimen.

6. An elastic spunbonded nonwoven according to claim 5, and having a RMS recovery, after two successive 50% pulls, of at least 80%.

7. An elastic spunbonded nonwoven according to any one of claims 1 to 6, wherein the amount of the first polymeric component is at least 50wt% of the total weight of the filament, and the amount of the second polymeric component is less than 50wt% of the total weight of the filament.

8. An elastic nonwoven fabric comprising at least one first elastic spunbonded nonwoven layer (W) according to any one of claims 1 to 7 and at least one additional nonwoven layer.

9. An elastic nonwoven fabric according to claim 8, wherein at least one additional nonwoven layer is selected from the group : carded nonwoven layer (C), meltblown layer (M), spunbonded layer (S), polyolefin-based nonwoven layer, polypropylene-based nonwoven layer.

10. An elastic nonwoven fabric according to any one of claims 8 to 9, comprising at least two additional carded nonwoven layers (C) and wherein the elastic spunbonded nonwoven layer (W) is sandwiched between the two carded layers.

11. An elastic nonwoven fabric according to claim 10, and comprising an additional meltblown layer (M) interposed between the elastic spunbonded nonwoven layer (W) and one carded nonwoven layer (C).

12. An elastic nonwoven fabric according to any one of claims 8 to 11, wherein the layers are bonded together by one of the following bonding technologies: thermal bonding, water needling, mechanical needling, ultrasonic bonding, air trough bonding and chemical bonding.

13. An elastic nonwoven fabric according to any one of claims 8 to 12, wherein the layers are perforated.

14. An elastic nonwoven fabric according to any one of claims 8 to 13, and having a CD permanent set after two cycles at 150% elongation less 50%, and preferably less than 40%.

15. An elastic nonwoven fabric according to any one of claims 8 to 14, and having a CD elongation@Peak of at least 150 %, and preferably of at least 200 %.

Patentansprüche

1. Elastisches gesponnenes Faservlies (W), umfassend eine Vielzahl von Kern/Hülle-Filamenten, wobei der Kern jedes Kern/Hülle-Filaments aus einer ersten polymeren Komponente (P) hergestellt ist und die Hülle jedes Kern/Hülle-Filaments aus einer zweiten polymeren Komponente (P') hergestellt ist, wobei die erste polymere Komponente (P) ein Gemisch aus mindestens zwei elastischen Olefincopolymeren auf Propylenbasis (Pa; Pb) mit unterschiedlichen Schmelzfließraten (MFR1a und MFR1b) umfasst, und die zweite polymere Komponente (P') ein elastisches Olefincopolymer auf Propylenbasis umfasst und eine höhere Schmelzfließrate MFR2 als die Schmelzfließrate MFR1 der ersten Komponente aufweist, wobei die Schmelzfließraten MFR1 und MFR2 der ersten und zweiten polymeren Komponenten (P, P') größer als 2g/10 min und geringer als 100g/10 min sind, gemessen nach ASTM D-1238 bei 230°C und 2,16 kg, wobei das Verhältnis MFR2/MFR1 größer als 1,5 ist und wobei die elastischen Olefincopolymere auf Propylenbasis der ersten polymeren Komponente und der zweiten polymeren Komponente Propylen und von 10 bis 25 Gew.-% eines oder mehrerer C2- und/oder C4- bis C10-Alphaolefincopolymere umfassen.

2. Elastisches gesponnenes Faservlies nach Anspruch 1, wobei das elastische Olefincopolymer auf Propylenbasis für die erste polymere Komponente und für die zweite polymere Komponente ein Ethylen-Propylen-Copolymer ist.

3. Elastisches gesponnenes Faservlies nach einem der Ansprüche 1 oder 2, wobei das elastische Olefincopolymer auf Propylenbasis für die erste polymere Komponente und für die zweite polymere Komponente mindestens 80 Gew.-% Propyleneinheiten umfasst.

4. Elastisches gesponnenes Faservlies nach einem der Ansprüche 1 bis 3, wobei das elastische Olefincopolymer auf

Propylenbasis für die erste polymere Komponente und für die zweite polymere Komponente ein Metallocenkatalysiertes Polymer ist.

5. Elastisches gesponnenes Faservlies nach einem der Ansprüche 1 bis 4, welches einen quadratischen Mittelwert (RMS) der mittleren Rückformung von mindestens 85% aufweist, wobei die mittlere RMS-Rückformung aus der Formel:

$$\text{mittlere RMS-Rückformung} = [1/2(R_{CD}^2 + R_{MD}^2)]^{1/2}$$

berechnet wird, wobei RMD und RCD Rückformwerte (R) sind, die an einer Vliesstoffprobe jeweils in Maschinenrichtung und in Querrichtung nach 50% Dehnung und einmaligem Ziehen gemessen wurden, und aus der folgenden Formel berechnet werden:

$$R=[(Ls-Lr)/(Ls-lo)]\%,$$

worin Ls die gedehnte Länge der Probe bedeutet; Lr die rückgeformte Länge der Probe bedeutet, und Lo die ursprüngliche Länge der Probe bedeutet.

6. Elastisches gesponnenes Faservlies nach Anspruch 5, welches weiterhin nach zwei aufeinanderfolgenden 50%-Ziehvorgängen eine RMS-Rückformung von mindestens 80% aufweist.

7. Elastisches gesponnenes Faservlies nach einem der Ansprüche 1 bis 6, wobei die Menge der ersten polymeren Komponente mindestens 50 Gew.-% des Gesamtgewichts des Filaments ist und die Menge der zweiten polymeren Komponente weniger als 50 Gew.-% des Gesamtgewichts des Filaments ist.

8. Elastischer Faservliesstoff, umfassend mindestens eine Schicht eines elastischen gesponnenen Faservlieses (W) nach einem der Ansprüche 1 bis 7 und mindestens eine weitere Faservliesschicht.

9. Elastischer Faservliesstoff nach Anspruch 8, wobei mindestens eine weitere Faservliesschicht aus der Gruppe ausgewählt ist: kardierte Faservliesschicht (C), Schmelzblasschicht (M), gesponnene Schicht (S), Faservlies auf Polyolefinbasis und Faservlies auf Polypropylenbasis.

10. Elastischer Faservliesstoff nach einem der Ansprüche 8 bis 9, umfassend mindestens zwei weitere kardierte Faservliesschichten (C), wobei sich die elastische gesponnene Faservliesschicht (W) zwischen den zwei kardierten Schichten befindet.

11. Elastischer Faservliesstoff nach Anspruch 10, umfassend eine weitere Schmelzblasschicht (M) zwischen der elastischen gesponnenen Faservliesschicht (W) und einer kardierten Faservliesschicht (C).

12. Elastischer Faservliesstoff nach einem der Ansprüche 8 bis 11, wobei die Schichten durch eine der folgenden Verbindungstechnologien miteinander verbunden sind: Thermobonding, Wasserstrahl-Vernadelung, mechanische Vernadelung, Ultraschall-Bonding, Air-Through-Bonding und chemisches Verbinden.

13. Elastischer Faservliesstoff nach einem der Ansprüche 8 bis 12, wobei die Schichten perforiert sind.

14. Elastischer Faservliesstoff nach einem der Ansprüche 8 bis 13, welcher eine bleibende Verformumg in Querrichtung (CD) nach zwei Zyklen bei 150% Dehnung von 50% oder weniger hat, bevorzugt 40% oder weniger.

15. Elastischer Faservliesstoff nach einem der Ansprüche 8 bis 14, welcher eine Dehnung bei Spitzenlast in Querrichtung (CD) von mindestens 150 % aufweist, bevorzugt mindestens 200 %.

Revendications

1. Non tissé filé-lié élastique (W) comprenant une multiplicité de filaments du type âme/gaine, dans lequel l'âme de chaque filament du type âme/gaine est constituée d'un premier composant polymérique (P), et la gaine de chaque

filament du type gaine/âme est constituée d'un deuxième composant polymérique (P'), dans lequel le premier composant polymérique (P) comprend un mélange d'au moins deux copolymères élastiques d'oléfine à base de propylène (P_a; P_b) d'indices de fluidité différents (MFR1a et MFR1b), et le deuxième composant polymérique (P') comprend un copolymère élastique d'oléfine à base de propylène et présente un indice de fluidité MFR2 qui est plus élevé que l'indice de fluidité MFR1 du premier composant polymérique, dans lequel les indices de fluidité MFR1 et MFR2 du premier et du deuxième composants polymériques (P, P') sont supérieurs à 2 g/10 min et inférieurs à 100 g/10 min, mesurés selon la norme ASTM D-1238 à 230°C et 2,16 kg, dans lequel le rapport MFR2/MFR1 est supérieur à 1,5, et dans lequel les copolymères élastiques d'oléfine à base de propylène du premier composant polymérique et du deuxième composant polymérique comprennent du propylène et de 10 à 25 % en poids d'un ou de plusieurs co-monomères C2 et/ou C4 à C10 d'alpha-oléfine.

2. Non tissé filé-lié élastique selon la revendication 1, dans lequel le copolymère élastique d'oléfine à base de propylène pour le premier composant polymérique et pour le deuxième composant polymérique est un copolymère d'éthylène et propylène.

3. Non tissé filé-lié élastique selon l'une quelconque des revendications 1 à 2, dans lequel le copolymère élastique d'oléfine à base de propylène pour le premier composant polymérique et pour le deuxième composant polymérique comprend au moins 80 % en poids d'unités de propylène.

4. Non tissé filé-lié élastique selon l'une quelconque des revendications 1 à 3, dans lequel le copolymère élastique d'oléfine à base de propylène pour le premier composant polymérique et pour le deuxième composant polymérique est un polymère catalysé avec un métallocène.

5. Non tissé filé-lié élastique selon l'une quelconque des revendications 1 à 4, ayant une recouvrance moyenne quadratique (RMS) d'au moins 85 %, ladite recouvrance moyenne RMS étant calculée par la formule:

$$\text{recouvrance moyenne RMS} = [1/2(R_{CD}^2 + R_{MD}^2)]^{1/2},$$

dans laquelle R_{MD} et R_{CD} sont des valeurs de la recouvrance (R) mesurées sur un échantillon non tissé respectivement dans une direction machine et dans une direction transversale, après 50 % d'allongement et un étirement, et calculées par la formule:

$$R = [(Ls-Lr)/(Ls-Lo)] \%,$$

dans laquelle Ls représente la longueur étirée de l'échantillon; Lr représente la longueur récupérée de l'échantillon, Lo représente la longueur originale de l'échantillon.

6. Non tissé filé-lié élastique selon la revendication 5, et présentant une recouvrance RMS, après deux étirements successifs à 50 %, d'au moins 80 %.

7. Non tissé filé-lié élastique selon l'une quelconque des revendications 1 à 6, dans lequel la quantité du premier composant polymérique est d'au moins 50 % en poids du poids total du filament, et la quantité du deuxième composant polymérique est inférieure à 50 % en poids du poids total du filament.

8. Etoffe non tissée élastique comprenant au moins une première couche de non tissé filé-lié élastique (W) selon l'une quelconque des revendications 1 à 7 et au moins une couche non tissée additionnelle.

9. Etoffe non tissée élastique selon la revendication 8, dans laquelle au moins une couche non tissée additionnelle est choisie dans le groupe: couche non tissée cardée (C), couche créée par fusion-soufflage (M), couche filée-liée (S), couche non tissée à base de polyoléfine, couche non tissée à base de polypropylène.

10. Etoffe non tissée élastique selon l'une quelconque des revendications 8 à 9, comprenant au moins deux couches non tissées cardées additionnelles (C) et dans laquelle la couche non tissée filée-liée élastique (W) est serrée entre les deux couches cardées.

11. Etoffe non tissée élastique selon la revendication 10, et comprenant une couche additionnelle (M) créée par fusion-

soufflage, interposée entre la couche non tissée filée-liée élastique (W) et une couche non tissée cardée (C).

12. Etoffe non tissée élastique selon l'une quelconque des revendications 8 à 11, dans laquelle les couches sont liées l'une à l'autre par l'une des technologies de liaison suivantes: liaison thermique, aiguilletage par jet d'eau, aiguilletage mécanique, liaison par ultrasons, liaison par traversée d'air et liaison chimique.

13. Etoffe non tissée élastique selon l'une quelconque des revendications 8 à 12, dans laquelle les couches sont perforées.

14. Etoffe non tissée élastique selon l'une quelconque des revendications 8 à 13, et présentant une déformation permanente en CD après deux cycles à 150 % d'allongement inférieure à 50 %, et de préférence inférieure à 40 %.

15. Etoffe non tissée élastique selon l'une quelconque des revendications 8 à 14, et présentant un pic d'allongement en CD d'au moins 150 %, et de préférence d'au moins 200 %.

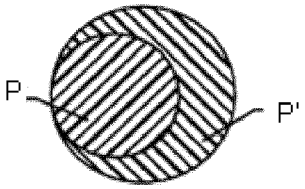


Fig.1A

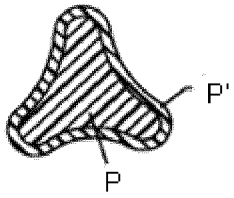


Fig.1B

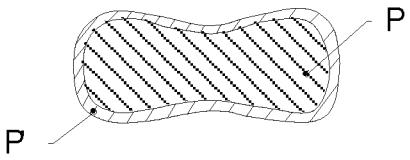


Fig.1C

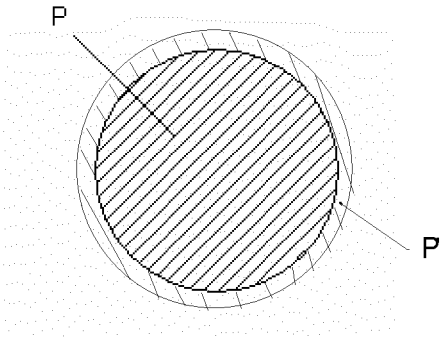


Fig.1D

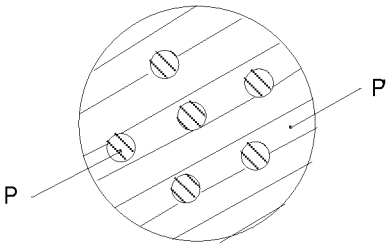


Fig.1E

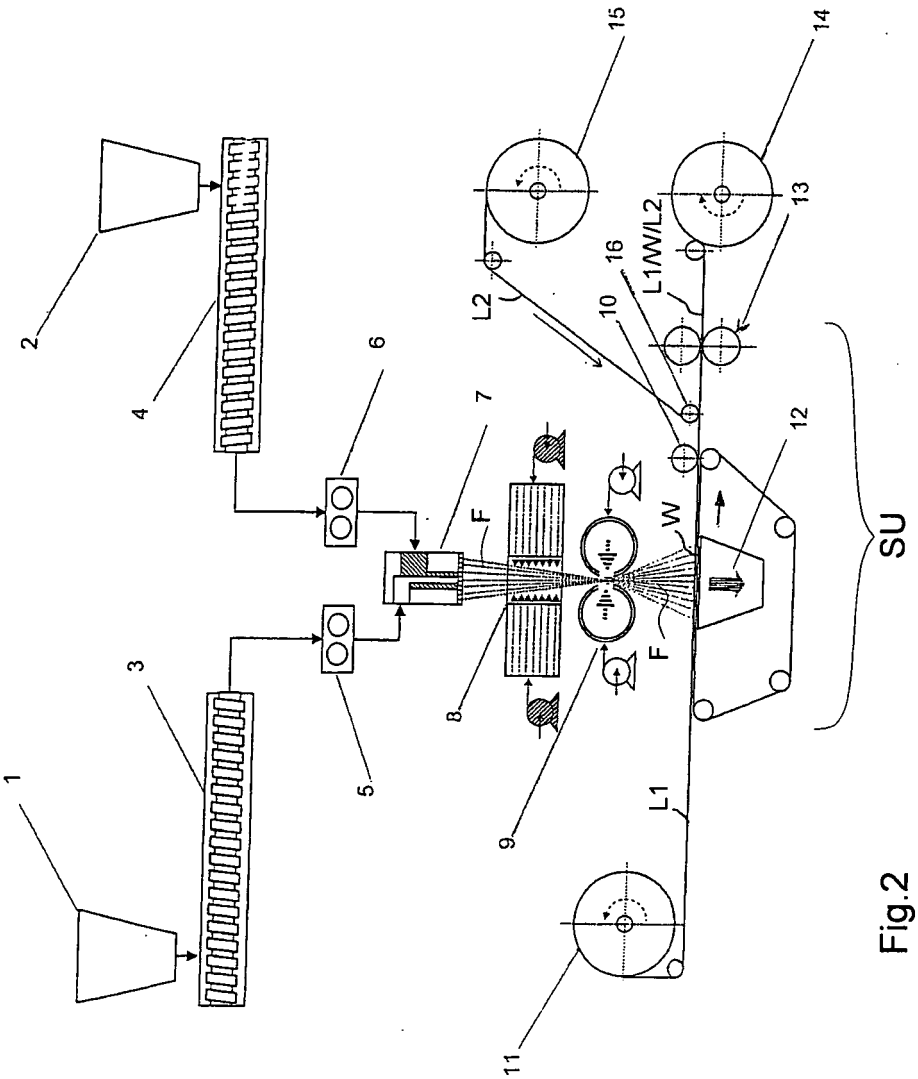


Fig.2

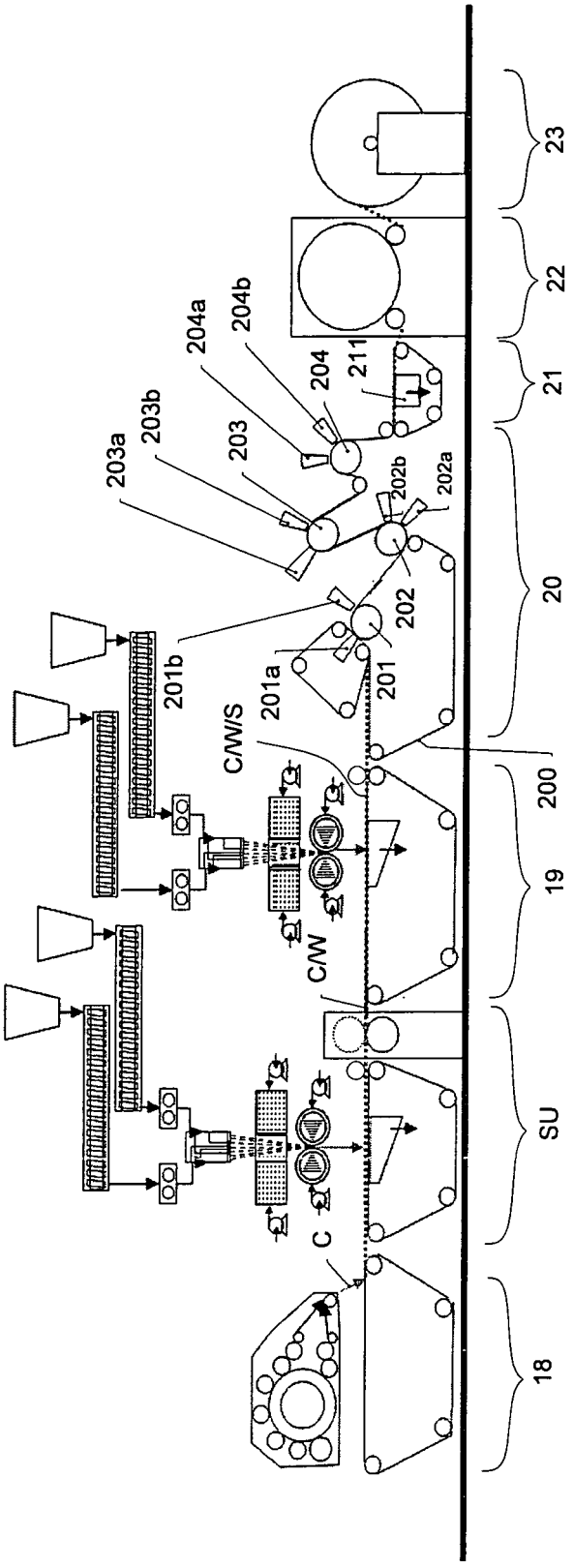

18
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23
C
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204b
211

Fig.3

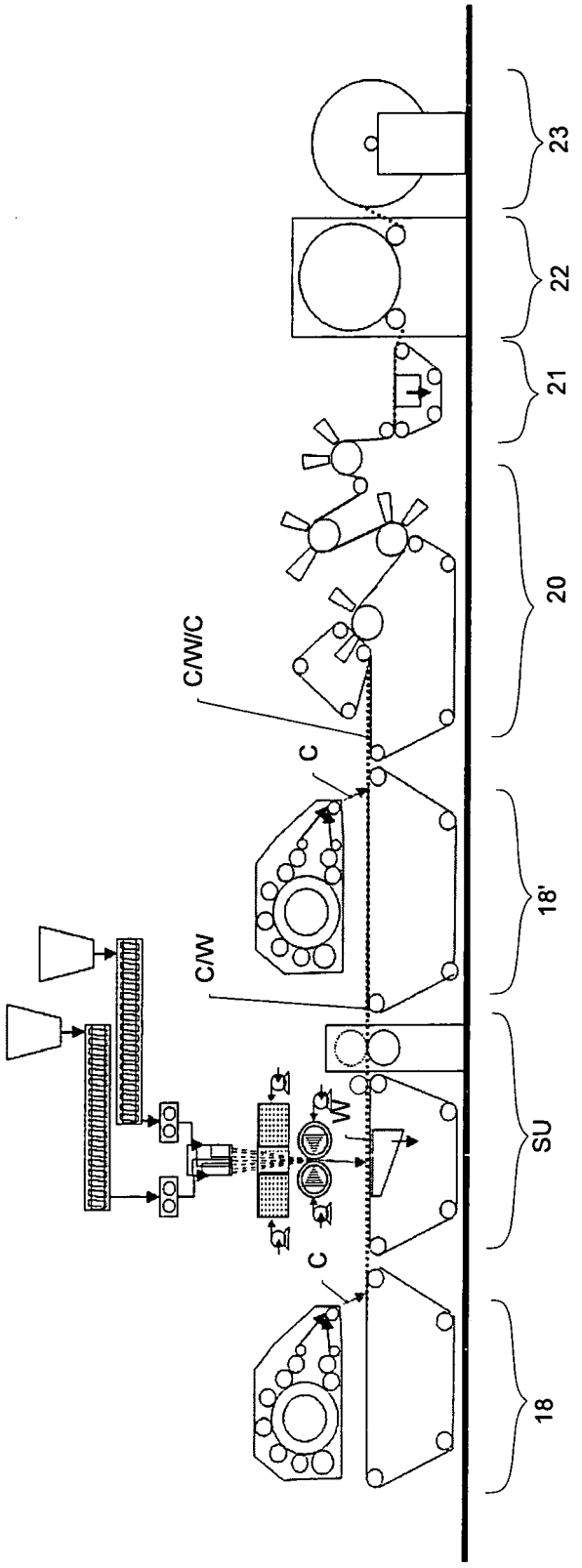


Fig.4

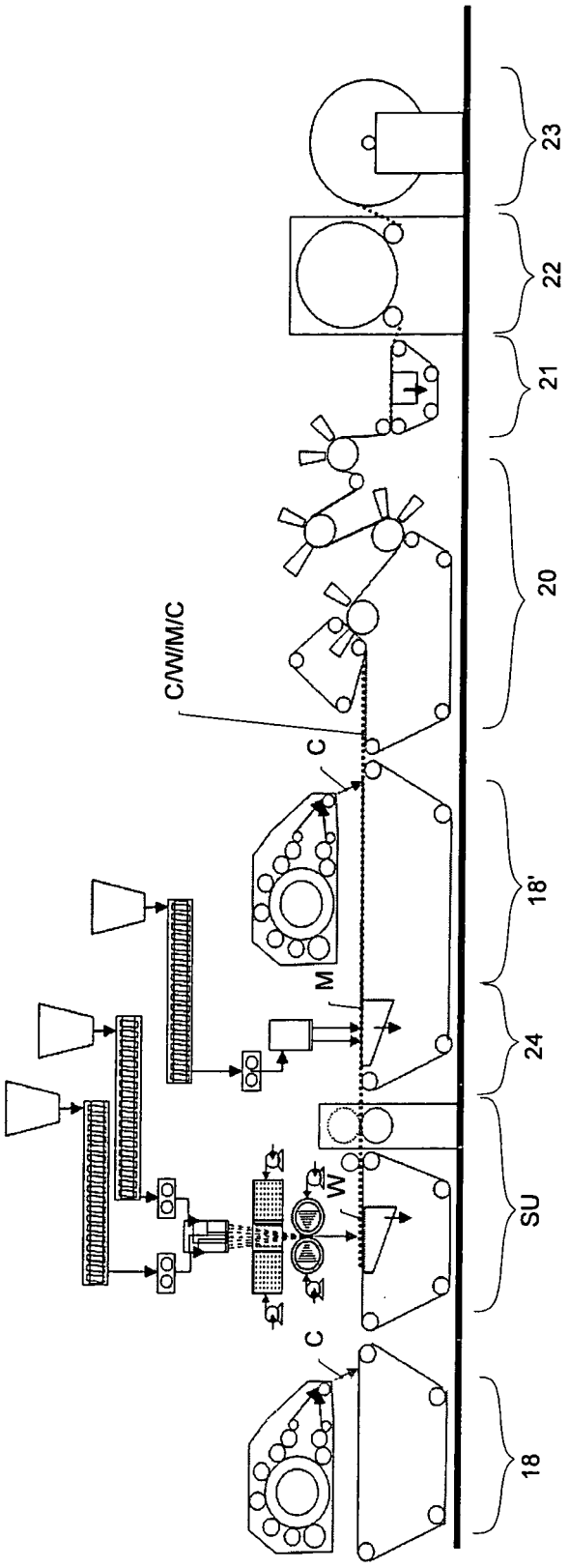


Fig.5

REFERENCES CITED IN THE DESCRIPTION

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