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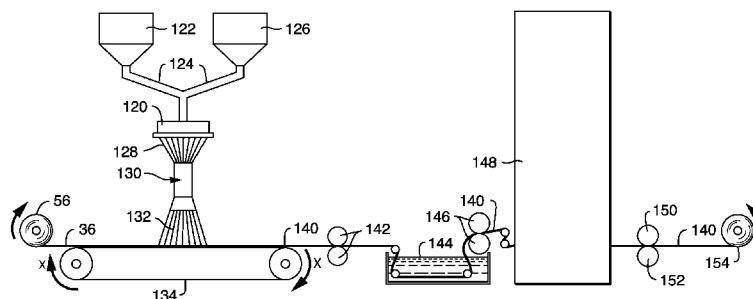


FIG. 2

(57) Abstract: A method for producing a laminate web having a basis weight includes forming a first spunbond layer of about half of the basis weight of the laminate web, bonding the first spunbond layer, winding the first spunbond layer into a roll, and unwinding the roll. The method also includes forming a second layer of the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web and bonding the laminate web.

SOFT AND STRONG LOW COST NONWOVENS

BACKGROUND

This invention relates to nonwoven laminated fabric-like material made of
5 predominantly synthetic fibers.

Low cost soft nonwovens are desirable for multiple product applications, for example in outer covers and bodyside liners for diapers, training pants, youth pants, adult incontinent garments, and feminine hygiene products. Bonded carded webs (BCW) or webs formed from polyethylene or bicomponent fibers of both polyethylene and
10 polypropylene (bicomponent PP/PE) are soft nonwovens but are high cost and not affordable for many disposable absorbent article applications.

Prior art describes various laminates of two or more materials. None of these teach forming a low basis weight spunbond and re-threading it through the meltspun formation and bonding process a second time to achieve a soft nonwoven material.

15 Thus, there remains a need for a low cost nonwoven that can exhibit added strength and softness, where such nonwoven can provide benefits through its use in absorbent articles and other applications.

SUMMARY

20 Polypropylene spunbond is relatively lower cost compared to bonded carded webs, polyethylene, or bicomponent nonwovens. Described herein is a new process to make an improved spunbond material that is softer, yet stronger, using lower cost polypropylene.

In one aspect, the disclosure provides for a method for producing a laminate web having a basis weight, the method including forming a first spunbond layer comprising
25 about half of the basis weight of the laminate web, bonding the first spunbond layer, winding the first spunbond layer into a roll, and unwinding the roll. The method also includes forming a second layer comprising the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web and bonding the laminate web.

30 In another aspect, the disclosure provides for a method for producing a laminate web having a basis weight, the method including forming a first spunbond layer comprising about half of the basis weight of the laminate web, bonding the first spunbond

layer, forming a second spunbond layer comprising the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web, and bonding the laminate web.

In yet another aspect, the disclosure provides a method for producing a laminate web having a basis weight, the method including forming a first spunbond layer comprising about half of the basis weight of the laminate web, bonding the first spunbond layer, winding the first spunbond layer into a roll, and unwinding the roll. The method also includes forming a second layer comprising the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web, wherein the second layer is spunbond, meltblown, coform, or film and is heat bondable to the first spunbond layer; incorporating a benefit agent between the first and second layers; and bonding the laminate web.

The nonwoven laminate has sufficient strength for many desired applications and can be further treated with elements for additional applications. Additional elements can include but are not limited to odor control components, softening agents, hydrophilic, superhydrophilic, hydrophobic, and superhydrophobic treatments. The nonwoven laminate can incorporate dissimilar second layer substrates that include but are not limited to meltblown, coform, and films that are compatibly heat bondable to the first layer. The nonwoven laminate can also include stretchable, extensible, or elastic properties and can be created with desired ripples, rugosities, or textures.

BRIEF DESCRIPTION OF DRAWINGS

The foregoing and other features and aspects of the present disclosure and the manner of attaining them will become more apparent, and the disclosure itself will be better understood by reference to the following description, appended claims and accompanying drawings, where:

Figure 1 is a diagram illustrating apparatus for producing a base layer of spunbond material in accordance with the invention;

Figure 2 is a diagram illustrating apparatus for producing a laminate material using the base layer of Fig. 1 in accordance with the invention;

Figure 3 is a partial cross section to an enlarged scale of the laminate material of Fig. 2 in accordance with the invention; and

Figure 4 is a partial cross section to an enlarged scale of the base layer of Fig. 1 in accordance with the invention.

Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present disclosure. The drawings are representational and are not necessarily drawn to scale. Certain proportions thereof might be exaggerated, while others might be minimized.

DETAILED DESCRIPTION

In an aspect, the present disclosure is generally directed towards a nonwoven material having improved softness and strength for use in a variety of products including absorbent articles. Each example is provided by way of explanation and is not meant as a limitation. For example, features illustrated or described as part of one aspect or figure can be used on another aspect or figure to yield yet another aspect. It is intended that the present disclosure include such modifications and variations.

When introducing elements of the present disclosure or the preferred aspect(s) thereof, the articles “a,” “an,” “the,” and “said” are intended to mean that there are one or more of the elements. The terms “comprising,” “including,” and “having” are intended to be inclusive and mean that there can be additional elements other than the listed elements. Many modifications and variations of the present disclosure can be made without departing from the spirit and scope thereof. Therefore, the exemplary aspects described above should not be used to limit the scope of the disclosure.

The term “absorbent article” refers herein to an article that can be placed against or in proximity to the body (i.e., contiguous with the body) of the wearer to absorb and contain various liquid, solid, and semi-solid exudates discharged from the body. Such absorbent articles, as described herein, are intended to be discarded after a limited period of use instead of being laundered or otherwise restored for reuse. It is to be understood that the present disclosure is applicable to various disposable absorbent articles, including, but not limited to, diapers, training pants, youth pants, swim pants, feminine hygiene products, including, but not limited to, menstrual pads, incontinence products, medical garments, surgical pads and bandages, other personal care or health care garments, and the like without departing from the scope of the present disclosure.

The term “bonded” refers herein to the joining, adhering, connecting, attaching, or the like, of two elements. Two elements will be considered bonded together when they are joined, adhered, connected, attached, or the like, directly to one another or indirectly to one another, such as when each is directly bonded to intermediate elements. The
5 bonding of one element to another can occur via continuous or intermittent bonds.

The term “carded web” refers herein to a web containing natural or synthetic staple length fibers typically having fiber lengths less than about 100 mm. Bales of staple fibers can undergo an opening process to separate the fibers that are then sent to a carding process that separates and combs the fibers to align them in the machine direction after
10 which the fibers are deposited onto a moving wire for further processing. Such webs are usually subjected to some type of bonding process such as thermal bonding using heat and/or pressure. In addition to or in lieu thereof, the fibers can be subject to adhesive processes to bind the fibers together such as by the use of powder adhesives. The carded web can be subjected to fluid entangling, such as hydroentangling, to further
15 intertwine the fibers and thereby improve the integrity of the carded web. Carded webs, due to the fiber alignment in the machine direction, once bonded, will typically have more machine direction strength than cross machine direction strength. A carded web so bonded becomes a bonded carded web or BCW.

The term “film” refers herein to a thermoplastic film made using an extrusion and/or
20 forming process, such as a cast film or blown film extrusion process. The term includes apertured films, slit films, and other porous films that constitute liquid transfer films, as well as films that do not transfer fluids, such as, but not limited to, barrier films, filled films, breathable films, and oriented films.

The term “gsm” refers herein to grams per square meter.

25 The term “hydrophilic” refers herein to fibers or the surfaces of fibers that are wetted by aqueous liquids in contact with the fibers. The degree of wetting of the materials can, in turn, be described in terms of the contact angles and the surface tensions of the liquids and materials involved. Equipment and techniques suitable for measuring the wettability of particular fiber materials or blends of fiber materials can be
30 provided by Cahn SFA-222 Surface Force Analyzer System, or a substantially equivalent system. When measured with this system, fibers having contact angles less than 90 are designated “wetable” or hydrophilic, and fibers having contact angles greater than 90 are designated “nonwetable” or hydrophobic.

The term "meltblown" refers herein to fibers formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into converging high velocity heated gas (e.g., air) streams that attenuate the filaments of molten thermoplastic material to reduce their diameter, which
5 can be a microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly dispersed meltblown fibers. Such a process is disclosed, for example, in U.S. Patent No. 3,849,241 to Butin et al., which is incorporated herein by reference. Meltblown fibers are microfibers that can be continuous or discontinuous, are generally smaller than about 0.6
10 denier, and can be tacky and self-bonding when deposited onto a collecting surface.

A "meltspun" fiber refers generically to a fiber that is formed from a molten polymer by a fiber-forming extrusion process, for example, such as fibers that are made by the meltblown and spunbond processes.

The term "nonwoven" refers herein to materials and webs of material that are
15 formed without the aid of a textile weaving or knitting process. The materials and webs of materials can have a structure of individual fibers, filaments, or threads (collectively referred to as "fibers") that can be interlaid, but not in an identifiable manner as in a knitted fabric. Nonwoven materials or webs can be formed from many processes such as, but not limited to, meltblowing processes, spunbonding processes, carded web processes, etc.

20 The term "pliable" refers herein to materials that are compliant and that will readily conform to the general shape and contours of the wearer's body.

The term "spunbond" refers herein to small diameter fibers that are formed by extruding molten thermoplastic material as filaments from a plurality of fine capillaries of a spinnerette having a circular or other configuration, with the diameter of the extruded
25 filaments then being rapidly reduced by a conventional process such as, for example, educative drawing, and processes that are described in U.S. Patent No. 4,340,563 to Appel et al., U.S. Patent No. 3,692,618 to Dorschner et al., U.S. Patent No. 3,802,817 to Matsuki et al., U.S. Patent Nos. 3,338,992 and 3,341,394 to Kinney, U.S. Patent No. 3,502,763 to Hartmann, U.S. Patent No. 3,502,538 to Peterson, and U.S. Patent No. 3,542,615 to Dobo
30 et al., each of which is incorporated herein in its entirety by reference. Spunbond fibers are generally continuous and often have average deniers larger than about 0.3, and in an aspect, between about 0.6, 5, and 10 and about 15, 20, and 40. Spunbond fibers are generally not tacky when they are deposited on a collecting surface.

The term "thermoplastic" refers herein to a material that softens and that can be shaped when exposed to heat and that substantially returns to a non-softened condition when cooled.

Absorbent and other articles can be made from a material that includes a layer of substantially continuous polymeric filaments formed by a spunbonded process into a web, the thermoplastic polymer being extruded through a spinnerette or the like to form discrete filaments which are, thereafter, drawn and deposited in a substantially random manner on a carrier belt or the like to form a web. Such web material is a "spunbonded" web material. The web possesses integrity due to the entanglement of the individual fibers in the web as well as some degree of thermal or self-bonding between the fibers.

The polymers used to prepare the spunbonded webs can be a wide variety of thermoplastic polymers of either the same or different type. Polypropylene is a particularly useful polymer for this purpose.

The filaments in the spunbonded web layer can for example have a diameter of between 15 to 25 microns. The material can have a basis weight of less than about 7 gsm to greater than about 40 gsm.

While the spunbonded fabric may be the conventional spunbond material made in accordance with the teachings of U.S. Pat. No. 3,692,618, it is preferred that the spunbonded layers be made by a process as taught in U.S. Pat. No. 4,340,563.

Disclosed is a process and materials therefrom wherein polypropylene spunbond with cotton-like softness approaching that of bicomponent webs and BCW are now possible. Spunbond webs are typically formed in one step wherein continuous meltspun fibers from one or more banks are deposited onto a moving porous forming surface then consolidated in a nip between a pair of bonding rolls. For example, the current practice for producing a 20 gsm spunbond web involves laying down 20 gsm of meltspun fibers from one or more banks onto the forming surface, feeding the web through bond rolls nip, and winding up the material in one pass.

To produce the same 20 gsm polypropylene spunbond using the process disclosed herein, a smaller portion of the basis weight, such as approximately half of the web (e.g., 10 gsm), is first formed, bonded, and wound in a roll. The 10 gsm roll is then unwound and a second 10 gsm layer is formed on top of it. Surprisingly, the two-layer web has a soft, drapable, and cotton-like handfeel that approaches the softness of high cost BCW or bicomponent webs. The present multi-layer material is thus softer in hand and has

improved formation than an equivalent weight spunbond material produced in one pass, which is the current industry practice. Furthermore, not only is a softer material realized, but a stronger material is created due to the fact that at least one layer of the resultant multi-layer material is bonded twice. After the first pass laying down the meltspun fibers, the spunbond web is bonded between a pair of bonding rolls. In a two-layer structure, when that spunbond web is subsequently fed back into the second layer forming process, it is bonded a second time.

A laminate nonwoven material including two webs of spunbonded fibers will hereafter be referred to as nonwoven laminate material of the type described.

The material is preferably a laminate of two spunbonded layers but may be a laminate of a single spunbonded layer and another layer such as a melt-blown layer. The laminate can be impregnated with a thermal stabilizing agent before hot calendering on at least one side.

Fig. 3 illustrates an example of a laminate material in accordance with the invention from which it will be seen that the material is composed of two layers of spunbonded material. The material can be treated by impregnating it with a fluorocarbon. The outer surface of each of the spunbonded layers can be hot calendered.

The laminate material has been subjected to embossing as illustrated at 19 of Fig. 3. These embossments are in the form of small bond areas normally arranged in a pattern (e.g., a rectangular or diagonal pattern).

The calendering can be carried out by a single pass between a steel roller and a backing roller. The roller may be a 'NIPCO' type variable crown roller to ensure uniform pressure across the width especially when the material is wide (i.e., having a width of 1 to 2 meters). A calender system can also be used to simultaneously calender both sides of a fabric.

Referring to Fig. 1, which is a schematic drawing of one example of apparatus for producing a laminate material in accordance with the invention, it will be seen that a spinneret 20 is fed with an appropriate polymer from a hopper 22 through inlet pipes 24 and with optional suitable pigments/additives from the second hopper 26. The fine polymer filaments 28 produced by the spinneret 20 pass through a high velocity air drawing system generally illustrated at 30 and the resultant filaments 32 are fed on to a moving forming screen 34, a vacuum being supplied beneath the screen so that the hot filaments form a tangled bonded web on the forming screen.

The spunbonded layer 36 of spunbonded polymer is moved along by the movement of the forming screen 34 that rotates in the direction of the arrows x.

The spunbonded layer 36 is fed between two bonding rollers 42, one of which is provided with projections in a pattern so as to produce a pattern of depressed bond areas (e.g., that shown at 19 in Fig. 4), over the whole surface of the spunbonded layer 36.

In an optional part of the process, the spunbonded layer 36 is then optionally fed into a bath 44 of a fluorocarbon and lithium nitrate mixture that saturates the laminate. On leaving the bath, the spunbonded layer 36 is optionally passed between two squeeze rollers 46 to remove excess liquid.

The impregnated spunbonded layer 36 is then dried by passing it over a series of heated rollers, drums, or the like within a standard drying unit generally indicated at 48 and the dried web is then passed between two calendered rollers 50/52, the top roller 50 being a heated steel roller and the bottom roller 52 being a backing roller.

The spunbonded layer(s) can be calendered on either one side which is suitable, for example, for garments (with the calendered side on the outside) or the two outer sides to make it suitable for use in other applications such as wipes.

Such calendering is preferably carried out by passing the material through a nip of a smooth heated roller and a non-heated roller. Preferably the heated roller is of steel and the backing roller is made for example of plastic, cotton, or paper.

Preferably the roller is heated to a temperature substantially the same as the melting point of the polymer of the fibers in the layer to be calendered (e.g., 167° C (333° F) for polypropylene).

The nip is set so as to give a light pressure (e.g., 40 kg per cm) and the material is passed through the nip sufficiently quickly so that in effect the surface is given a "shock heat" treatment which acts to produce additional fiber to fiber bonds in the spunbond layer in contact with the heated roller between the primary pattern bonds already produced by the bonding rollers.

Either one or both spunbond sides of the material may be smooth calendered. When both sides are calendered the material could be used for other applications for example wipes. The wiping surfaces would have low lint for critical wiping applications. Such a fabric calendered on both sides could also usefully be used in a variety of other applications demanding good surface durability, examples of which could include

protective bedding fabrics, for mattresses and pillows, robot cover fabrics, and agricultural fabrics, for example, a substrate fabric for a thermal screen in a greenhouse.

The spunbonded layer 36 is then wound on a rewind roller 54.

5 In an alternative arrangement the spunbonded layer 36 can be produced by one apparatus and the spunbonded layer 36 can then be treated by passing it through a bath, drying it, and then calendering on a second separate apparatus.

To apply a second layer thereby forming a laminate material 140, the spunbonded layer 36 is then unwound on an unwind roller 56. A second layer of spunbonded polymer is produced by a spinneret and air drawing system similar to that described above to
10 produce the first spunbonded layer 36, so that the laminate material 140 leaving the forming screen comprises two layers of spunbonded material such as is illustrated in Fig. 3. Referring to Fig. 2, which is a schematic drawing of one example of apparatus for producing a laminate material 140 in accordance with the description, it will be seen that a spinneret 120 is fed with an appropriate polymer from a hopper 122 through inlet pipes
15 124 and with optional suitable pigments/additives from the second hopper 126. The fine polymer filaments 128 produced by the spinneret 120 pass through a high velocity air drawing system generally illustrated at 130 and the resultant filaments 132 are fed on to a moving forming screen 134, a vacuum being supplied beneath the screen so that the hot filaments form a tangled bonded web on the forming screen.

20 The layer 36 of spunbonded polymer and the laminate material 140 are moved along by the movement of the forming screen 134 that rotates in the direction of the arrows x.

The laminate material 140 is fed between two bonding rollers 142, one of which is provided with projections in a pattern so as to produce a pattern of depressed bond areas
25 (e.g., that shown at 19 in Fig. 3), over the whole surface of the laminate material.

In an optional part of the process, the laminate material 140 is then optionally fed into a bath 144 of a fluorocarbon and lithium nitrate mixture that saturates the laminate. On leaving the bath, the laminate material 140 is optionally passed between two squeeze rollers 146 to remove excess liquid.

30 The impregnated laminate material 140 is then dried by passing it over a series of heated rollers, drums or the like within a standard drying unit generally indicated at 148 and the dried web is then passed between two calendered rollers 150, 152, the top roller 150 being a heated steel roller and the bottom roller 152 being a backing roller.

In this arrangement the upper surface of the laminate material 140 is thus calendered to produce the desired effect described hereinbefore and to create a laminate material 140 in accordance with the invention.

The laminate material 140 is then wound on a rewind roller 154.

5 The extra time that would typically be needed to run the material twice through the process can be mitigated by running the machine at twice the speed to produce half the basis weight (e.g., 10 gsm for a 20 gsm final product), compared to the typical speed used to produce a 20 gsm product using the standard industry one-pass spunbond process.

10 In various aspects of the present disclosure, the first and second layers 16, 18 of the laminate material 140 need not be equal in basis weight. Each layer 16, 18 and the laminate material 140 itself can be of any suitable basis weight. In addition, benefit agents such as odor control actives, softening agents, hydrophilic, superhydrophilic, hydrophobic, and superhydrophobic treatments, and the like can be incorporated within, on, or between the layers 16, 18 by spraying, soaking, or any other suitable method.

15 In alternate aspects of the present disclosure, the number of layers in the laminate material 140 can be two as described above or can be greater than two to increase bulk and achieve other benefits. For example, three 8 gsm layers rather than two 12 gsm layers can be processed to produce an integrated, soft 24 gsm laminate material 140.

20 In other aspects of the present disclosure, one or more of the layers 16, 18 need not be spunbond, but can be meltblown, coform, film, or any other suitable materials that are heat bondable to each other.

25 One or more of the layers 16, 18 can be stretchable, extensible, or elastic as is known in the art. Similarly, the degree of bonding can be adjusted; for example, low bonding can accommodate extensibility. Different bond pattern designs with different arrangements and/or varying bond percent areas can be used for aesthetic and other reasons.

The rate at which one or more of the layers 16, 18 is fed into the bond roll nip can be adjusted to be different. For example, one layer can be fed faster or slower than the other layer(s) to create ripples, rugosity, or texture for aesthetics and other benefits.

30 Finally, one or more layers can have different colors for aesthetics, indication, or any other suitable reason.

The dimensions and values disclosed herein are not to be understood as being

strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

5 All documents cited in the Detailed Description are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present disclosure. To the extent that any meaning or definition of a term in this written document conflicts with any meaning or definition of the term in a document incorporated by reference, the meaning or definition assigned to the
10 term in this written document shall govern.

 While particular aspects of the present disclosure have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the disclosure. It is therefore intended to cover in the appended claims all such changes and modifications
15 that are within the scope of this disclosure.

What Is Claimed Is:

1. A method for producing a laminate web having a basis weight, the method comprising:
 - 5 forming a first spunbond layer comprising a portion of the basis weight of the laminate web;
 - bonding the first spunbond layer;
 - winding the first spunbond layer into a roll;
 - unwinding the roll;
 - 10 forming a second layer comprising the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web; and
 - bonding the laminate web.
2. The method of claim 1, wherein the first spunbond layer has a basis weight
15 different from a basis weight of the second layer.
3. The method of claim 1, further comprising incorporating a benefit agent between the first and second layers or within one or both of the first and second layers.
- 20 4. The method of claim 3, wherein the benefit agent is an odor control active or a softening agent.
5. The method of claim 1, further comprising forming a third layer on top of the laminate web and bonding the laminate web and the third layer.
25
6. The method of claim 1, wherein the second layer is spunbond, meltblown, coform, or film and is heat bondable to the first spunbond layer.

7. The method of claim 1, wherein one of the first spunbond layer and the second layer is stretchable, extensible, or elastic.

8. The method of claim 1, further comprising controlling the rate at which one of the first spunbond layer and the second layer is fed into a bond roll nip to be different from the rate at which the other of the first spunbond layer and second layer is fed into the bond roll nip to create ripples, rugosity, or texture.

9. The method of claim 1, further comprising treating the first spunbond layer and/or the second layer with a hydrophobic, superhydrophobic, hydrophilic, or superhydrophilic treatment.

10. The method of claim 1, wherein the first spunbond layer comprises a polymer different from a polymer of the second layer.

15

11. The method of claim 10, wherein the first spunbond layer includes polypropylene and the second spunbond layer includes polyethylene.

12. A method for producing a laminate web having a basis weight, the method comprising:

20

forming a first spunbond layer comprising a portion of the basis weight of the laminate web;

bonding the first spunbond layer;

forming a second spunbond layer comprising the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web; and

25

bonding the laminate web.

13. The method of claim 12, wherein the first spunbond layer has a basis weight different from a basis weight of the second spunbond layer.

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14. The method of claim 12, wherein one of the first spunbond layer and the second spunbond layer is stretchable, extensible, or elastic.

15. The method of claim 12, further comprising controlling the rate at which one of the first spunbond layer and the second spunbond layer is fed into a bond roll nip to be different from the rate at which the other of the first spunbond layer and second spunbond layer is fed into the bond roll nip to create ripples, rugosity, or texture.

16. A method for producing a laminate web having a basis weight, the method comprising:

forming a first spunbond layer comprising about half of the basis weight of the laminate web;

bonding the first spunbond layer;

winding the first spunbond layer into a roll;

unwinding the roll;

forming a second layer comprising the remainder of the basis weight of the laminate web on top of the first spunbond layer to form a laminate web, wherein the second layer is spunbond, meltblown, coform, or film and is heat bondable to the first spunbond layer;

incorporating a benefit agent between the first and second layers or within one or both of the first and second layers; and

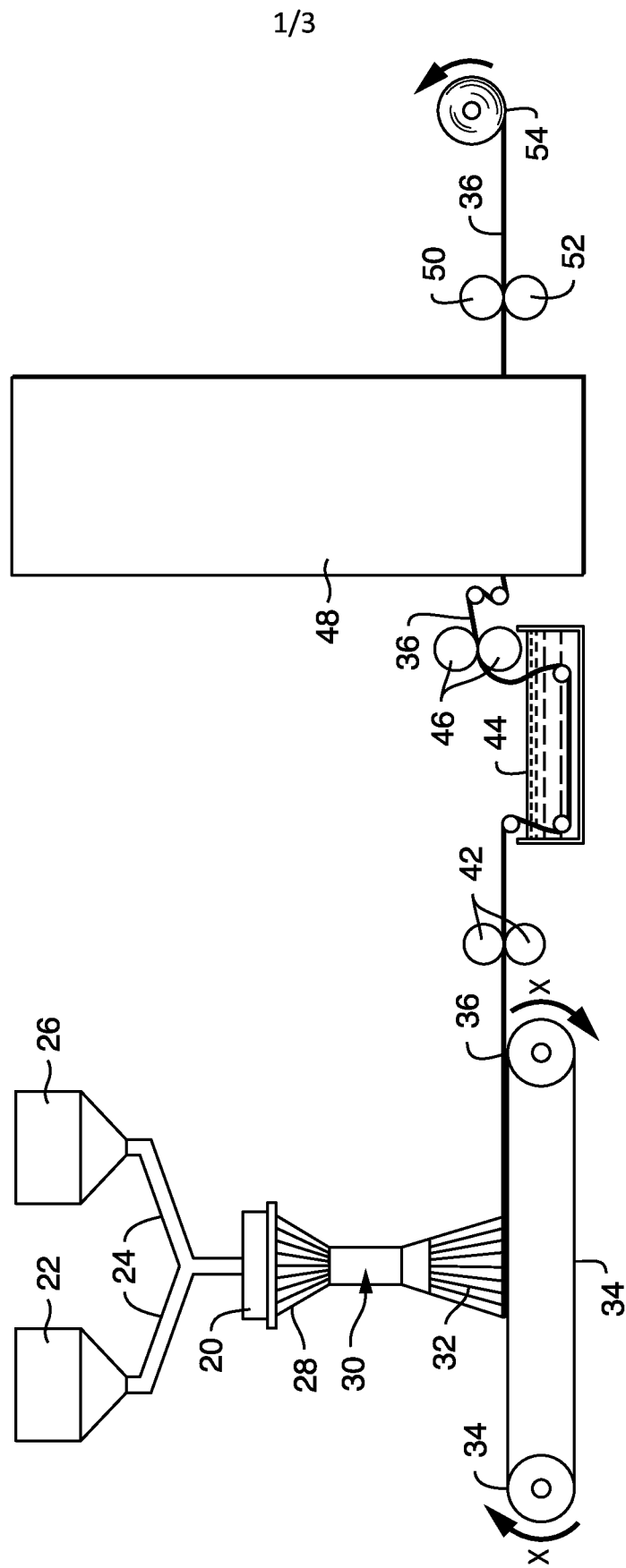
bonding the laminate web.

17. The method of claim 16, wherein the first spunbond layer has a basis weight different from a basis weight of the second layer.

18. The method of claim 16, wherein the benefit agent is an odor control active or a softening agent.

19. The method of claim 16, wherein one of the first spunbond layer and the second layer is stretchable, extensible, or elastic.

20. The method of claim 16, wherein the first spunbond layer comprises a
5 polymer different from a polymer of the second layer.



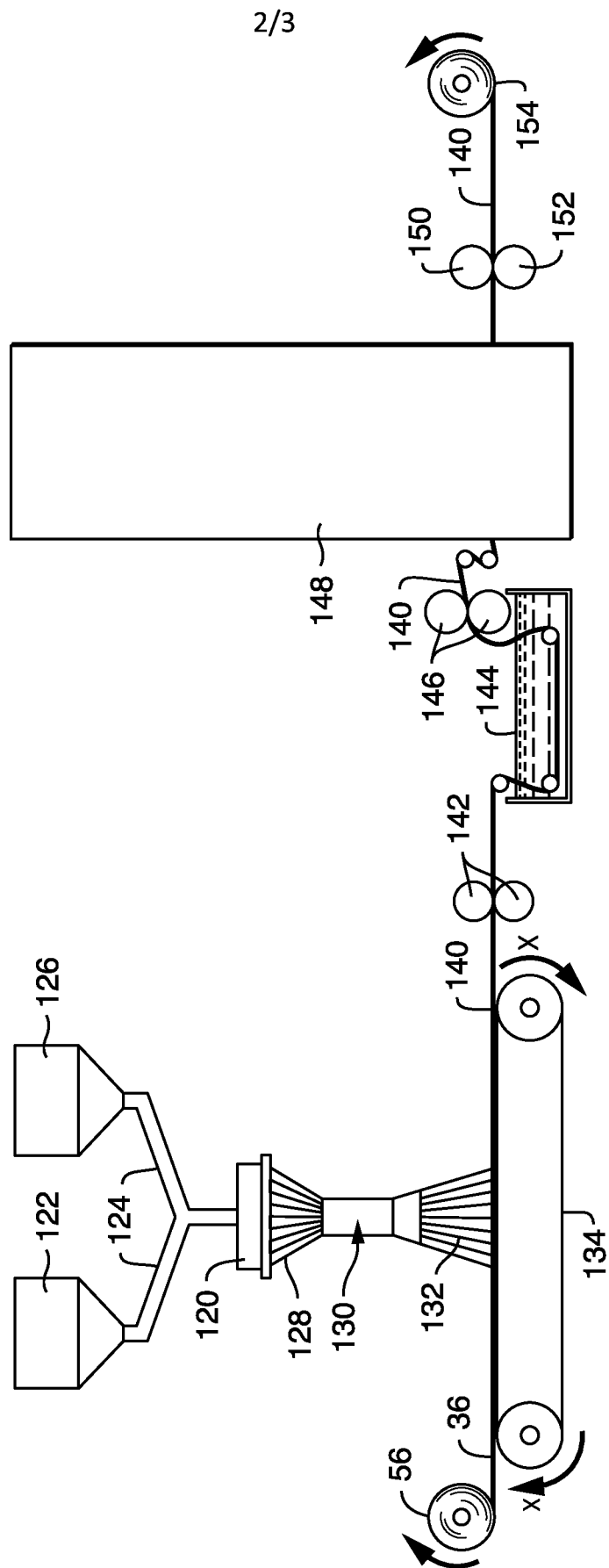


FIG. 2

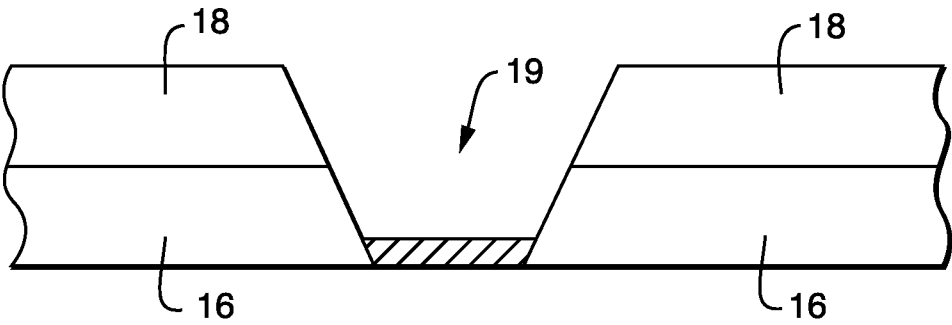


FIG. 3

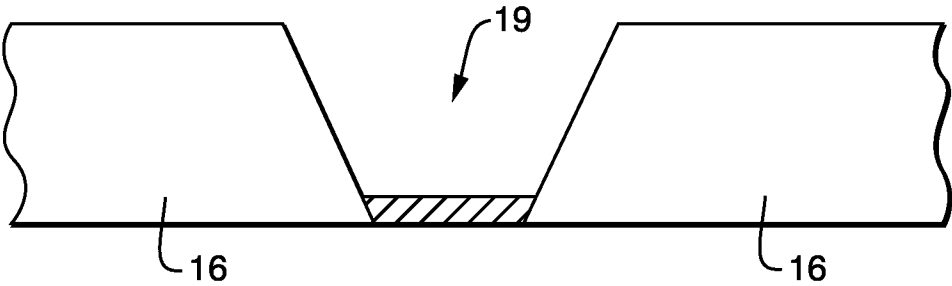


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/049051**A. CLASSIFICATION OF SUBJECT MATTER****D04H 1/559(2012.01)i, D04H 1/54(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D04H 1/559; D04H 13/00; D04H 3/16; D04H 5/00; B23B 5/26; D01F 8/06; B01D 39/00; A61B 19/08; D04H 3/04; D04H 3/00; D04H 1/00; D04H 1/54

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: laminate web, basis weight, spunbond, bonding, winding, unwinding, soft, strong

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004-0102123 A1 (BOWEN JR, U. W. et al.) 27 May 2004 See abstract; paragraphs [0025]-[0037] and [0046].	1-20
Y	WO 03-027374 A1 (E.I. DU PONT DE NEMOURS AND COMPANY) 03 April 2003 See abstract; pages 9-11; figure 1.	1-20
A	US 2004-0127128 A1 (THOMAS, OOMMAN P.) 01 July 2004 See abstract; paragraphs [0030]-[0040] and [0117]-[0120]; figures 1-6 and 10.	1-20
A	US 2007-0026753 A1 (NEELY, J. R. et al.) 01 February 2007 See abstract; paragraphs [0032]-[0052] and [0064]-[0067]; figures 1-5.	1-20
A	KR 10-2008-0060829 A (CLEAN & SCIENCE CO., LTD.) 02 July 2008 See abstract; paragraphs [19]-[32]; figures 1-5.	1-20
A	US 2012-0234333 A1 (JENKINS, S. E. et al.) 20 September 2012 See abstract; paragraphs [0028]-[0032] and [0060]-[0063]; figures 1-4.	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

29 April 2015 (29.04.2015)

Date of mailing of the international search report

30 April 2015 (30.04.2015)

Name and mailing address of the ISA/KR

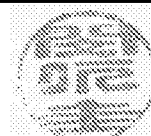
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/049051

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004-0102123 A1	27/05/2004	EP 1563133 A2 JP 2006-507427 A WO 2004-048665 A2	17/08/2005 02/03/2006 10/06/2004
WO 03-027374 A1	03/04/2003	EP 1436454 A1 JP 2005-504185 A US 2003-0056883 A1	14/07/2004 10/02/2005 27/03/2003
US 2004-0127128 A1	01/07/2004	EP 1579047 A1 EP 1579047 B1 JP 2006-512491 A KR 10-1057948 B1 KR 10-2005-0096112 A US 7476447 B2 WO 2004-061181 A1	28/09/2005 12/11/2014 13/04/2006 18/08/2011 05/10/2005 13/01/2009 22/07/2004
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KR 10-2008-0060829 A	02/07/2008	KR 10-0952421 B1 WO 2008-078858 A1	14/04/2010 03/07/2008
US 2012-0234333 A1	20/09/2012	None	