(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 November 2007 (22.11.2007)

PCT

(10) International Publication Number
WO 2007/133925 A1

(51) **International Patent Classification:**
B32B 3/00 (2006.01) *B32B 27/36* (2006.01)

(21) **International Application Number:**
PCT/US2007/067787

(22) International Filing Date: 30 April 2007 (30.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/746,707 8 May 2006 (08.05.2006) US

(71) **Applicant** *(for all designated States except US):* **MEADWESTVACO CORPORATION** [US/US]; MeadWestvaco Corporate Center, 11013 West Broad Street, Glen Allen, VA 23060 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only):* **FOLEY, Stephen** [US/US]; 8 Meadow Ridge Drive, Pittsfield, MA 01201 (US). **WALSH, Reed** [US/US]; 91 W. Village Square Road, Centerville, Utah 84014 (US).

(74) Agent: CAPELLI, Christopher; MeadWestvaco Corporation, One High Ridge Park, Stamford, CT 06905 (US).

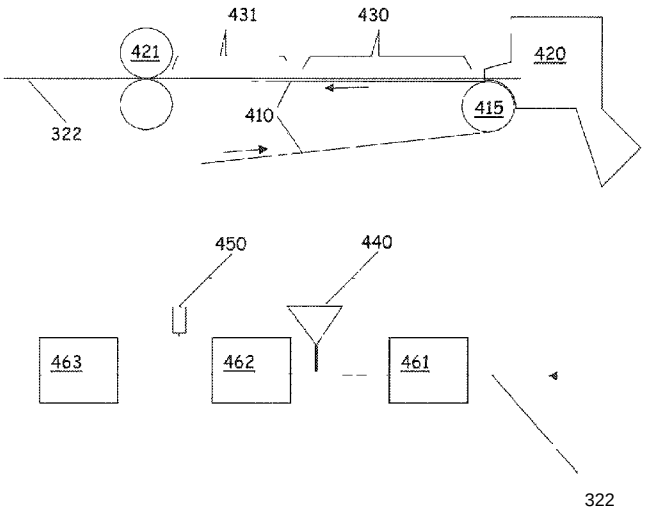
(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, **AT,** AU, **AZ, BA, BB, BG, BH, BR, BW, BY, BZ,** CA, **CH, CN, CO,** CR, CU, **CZ, DE, DK, DM, DZ,** EC, EE, **EG,** ES, **FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO,** RS, RU, SC, **SD,** SE, **SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ,** UA, **UG,** US, **UZ, VC, VN, ZA, ZM, ZW**

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SURFACE APPLICATION OF DECORATIVE MATERIALS TO PAPER FOR USE IN LAMINATES



(57) **Abstract:** A laminate structure and method of production is described whereby a decorative layer includes visual characteristics that are formed by surface application of materials to the decorative layer.

WO 2007/133925 A1

SURFACE APPLICATION OF DECORATIVE MATERIALS TO PAPER FOR USE IN LAMINATES

Inventors: Stephen T. Foley, Reed H. Walsh

REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority under 35 U.S.C. §119(e) of U.S. provisional application serial number 60/746,707, filed on May 8, 2006, which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Decorative laminate materials are used in such applications as countertops, floors, paneling, furniture surfaces, and the like. A common method of manufacturing such laminate materials uses one or more substrate layers of material such as saturating Kraft paper (for example, as manufactured by MeadWeslvaco Corporation). Several "base" layers may provide thickness, stability, and strength to the laminate.

[0003] A second tvpe of layer is typically added on top of the substrate layers, as a decorative or "decor" layer, for example containing a printed pattern such as a wood grain, or a color.

[0004] A third "overlay" layer ma}' be added to provide durability such as abrasion resistance or waterproofing, or give other desired characteristics. The third layer may be transparent so that the decor layer is visible yet protected

from wear.

[0005] All three types of layers may typically be produced by methods known In the art. While the different layers may have special properties, they typically share a characteristic ability to become saturated with resin materials, then heated and pressed to result in a product including a sandwich of layers collectively known as decorative laminate. The transparent layer may be based upon a special "overlay" paper or paperboard made up of materials such as wood fiber selected to become essentially invisible after the saturating and pressing operation. A transparent overlay paper is useful for permitting the decor layer to be readily visible.

SUMMARY

[0006] A laminate structure, and a method of producing the same, is described whereby at least a part of the materials contributing to the appearance of a decorative paper are applied to the surface of the paper, a process that provides flexibility in adjusting the visual appearance of the decorative paper and the laminate product.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 illustrates a typical laminate structure;

[0008] FFG. 2 illustrates a variation of the laminate appearance by materials

added to the overlay layer;

[0009] FIG, 3 illustrates preferred embodiments of the invention directed to surface application of materials to the decorative layer; and

[0010] FiG. 4 illustrates a method for forming a decorative layer containing surface-applied materials.

DETAILED DESCRIPTION

[001 I J FIG. 1 illustrates a typical laminate structure 100, shown as an exploded view of the several layers. One or more base layers 110 are typically provided, which may be made of a substrate such as saturating Kraft paper. Base layers may provide thickness, stability, and strength to the laminate structure.

[0012] A decorative or "decor" layer 120 is typically added on top of the substrate layers 110, for example containing on either or both sides a printed pattern such as a stone appearance (e.g., granite or marble), a wood grain, or a color. More than one decorative layer 120 may be used, although typically one is sufficient, particularly if the decorative layer 120 is opaque.

[0013] An overlay layer 130 is typically added on top of the decorative layer 120, to provide durability such as abrasion resistance or waterproofing, or give other desired characteristics. As is known in the art, the third layer is typically designed to become transparent so that the decor layer is visible yet protected

from wear.

[0014] Although the laminate structure 100 is shown having a decorative pattern on only one side (e.g., the "top" side), it should be understood that either or both sides could be produced with a decorative pattern if desired. Although the layers 110, 120, and 130 (and other layers as described in the additional FIGs.) are shown having no thickness, it is understood that the layers have a finite thickness (for example, a starting thickness determined by the thickness of the material used for the layer, such as saturating Kraft paper) to provide strength and other desired properties. The final thickness may differ from the starting thickness due to compression during the lamination process. The thicknesses of each layer may be different.

[0015] FIG. 2 shows a decorative laminate 200 where decorative or inclusion materials 231 have been added to overlay layer 230 during production on a paper machine. (Similarly inclusion materials (not shown) could have been added to decorative layer 220 during its production on a paper machine.) With such a method, the high speed of a paper machine, and the large amounts of furnish (paper pulp, additives, etc., possibly including inclusion materials) and the time needed to reach a steady state production of a uniform product may result in significant waste when it is desired to produce only limited amounts of a particular decorative paper. Often thousands of pounds of product must be

produced, when much less is actually required, and some of this product may be off-specification .

[001b] In accordance with preferred embodiments of the invention, an exemplary laminate structure 302 is shown in FIG. 3. In the example shown, one or more base layers 110 are provided. A decorative layer 322 is provided having a particular appearance. At least a portion of the appearance, for example features 323, is provided by a surface operation such as spraying, curtain coating, roll coating, blade coating, conventional saturating processes, dry sprinkling of materials, or like operations either on the paper machine or in an off-machine process that may be rapidly changed, resulting in much less product waste than of such features were applied into the paper furnish itself. Even within the same production run on a paper machine, or in an oft-machine process, a second decorative paper 324 may be produced, with at least a portion of the appearance, for example features 325, provided by a surface operation such as spraying, curtain coating, roll coating, blade coating, conventional saturating processes, dry sprinkling of materials, etc., either on the paper machine or in an off-machine process. This decorative paper 324 may be used for producing a second laminate structure 304. In FIG. 3, the flexibility of such a method is illustrated by the example of decorative paper 324 differing in visual appearance from decorative paper 322, in several aspects including color, shape, size, and size distribution of

the visual features. Saturation components, such as melamine formaldehyde resin, may be included in the coating, such that part or all of the saturation process is combined with the coating process. Materials to provide wear resistance may also be included in the coating. Thus the coating may provide one or more of visual characteristics, abrasion resistance, and saturating properties.

[0017] The decorative paper thus produced may also be used in non-laminate products *and* applications.

[0018] An overlay layer 330 may also be provided. Although only one overlay layer 330 is shown for the examples in FIG. 3, more than one overlay layer can be incorporated in the laminate 302 or 304, for example to provide greater perceived depth, better durability, etc. Possible applications for the laminate (or for the layers or papers in a non-laminate usage) include floors, wall paneling, ceilings, countertops, and fixtures. In some applications an overlay layer may not be needed. For example if the end product is wall paneling, ceilings, wallpaper, or lampshade material, a wear resistant overlay layer may not be needed. On the other hand, floors and some countertops may use a wear resistant overlay layer.

[0019] Other possible applications include the use of decorative papers for translucent panels and shapes, decorative sheet molding, lamp shades, home storage containers, other decorative products, and for scrapbooking applications. Some of these applications are laminated products, and some use the decorative

paper or sheets without lamination.

[0020] As an exemplary embodiment a melamine laminate may be created comprising several phenolic saturated Kraft bottom layers 110, followed by a melamine saturated decorative layer 322 or 324 with a particular pattern, then by an overlay layer 330 being the top most layer.

[0021] The thickness of the final laminate product may range from 0.030 inches to 3/4". The thickness of an exemplary overlay layer may be approximately 0.005 inches.

[0022] In one embodiment, decorative features added by a surface application may include fiber, filler, pigment, pearlescent particles, glitter, and other decorative materials that may be fed to a surface application device such as a curtain or spray coater, dry sprinkling, etc., along with chemicals such as polymers to make the application be evenly distributed or splotchy. Other decorative features may include natural fibers such as banana fiber, moss, sisal, and others, metal chop and other unique materials such as holographies. Splotchiness (that is, size and distribution of the decorative effects) may also be adjusted by means of parameters such as Mow rate of the coating, and solids level in the coating. The visual effects can range in size from "larger scale" (more than 0.25 inch in at least one dimension), down to smaller scale (such as 20-6000 microns). Useful solid particles that may be applied include mica, glitter particles

such as metallized PET (polyethylene terephthalate) or metal foil cut into different sizes and shapes. The material vendor may provide the material in "shredded" form. Some of this product may be "off the shelf" and some may be custom-made as needed. Thus the customized visual features resulting from the use of surface-applied materials into decorative layers 322 or 324 may include one or more of color, size, shape, reflectiveness, and other visually perceived characteristics, or the materials may provide wear resistance. It should be noted that the inventive method allows visual effects to be used which include particles or features that are larger than what can be applied by conventional printing means, for example, solids flecks or particles greater than *Vi"* in at least one dimension. The inventive method may allow the user to dispense with a printing step that would otherwise be needed to provide a desired character or appearance, or a printing step could be applied to the paper before or after treating the paper with the inventive method.

[0023] Other useful inclusion materials include materials with iridescent or opalescent appearance. In some cases the inclusion materials may be chosen to provide a realistic appearance such as a stone appearance, but in other cases they may be used to provide an eye-catching appearance that may not represent a particular natural material.

[0024] Other useful decorative materials may include coloration materials that

may be applied uniformly or non-uniformly, on the paper machine or off-machine. A coating may be used such as a mixture of melamine or other resin, adhesives such as PVOH, starch, binder, polymers such as acrylic or polyester, or other coatings or combinations thereof that can be laid down on the paper. The binder may not all be the normal resins used in laminates. Particles or inclusions may then be sprinkled onto the coated paper, or particles and inclusions can be pre-irtixed into the coating then applied through various methods. Some useful functional materials include wear resistant or abrasion resistant materials such as grit added or premixed into the coating, or dry-sprinkled onto the coating after the coating is applied. The wear or abrasion resistance thus provided in a decorative layer may eliminate the need for an overlay layer. In some cases a top coating may be applied over the first coating.

[0025] FlG. 4 illustrates an exemplary method for making the decorative layer 322 or 324 using a paper machine, A forming wire 410 in the form of an endless belt passes over a breast roll 415 that rotates proximate to a headbox 420. The headbox provides a fiber slurry in water with a fairly low consistency (for example, about 0.5% solids) that passes onto the moving forming wire 410. During ά first distance 430 water drains from the slurry and through the forming wire 410, forming a web of wet fibers. The slurry during distance 430 may yet have a wet appearance as there is free water on its surface. At some point as

drainage continues the free water may disappear from the surface, and over distance 431, water may continue to drain although the surface appears free from water. Eventually the web is carried by a transfer felt or press felt through one or more pressing devices such as press rolls 421 that help to further dewatering the web, usually with the application of pressure, vacuum, and sometimes heat. After pressing, the web is dried, These steps as described so far are well known in the art of papermaking.

[0026] The paper web created by this process may comprise fibers that are chosen and prepared such that they eventually become invisible when incorporated with resin into the laminate structures previously described, Other components may be added which remain visible in the laminate structures.

[0027] As an example, decorative or inclusion material, liquid or solid, maybe added to the slurry shortly after leaving the headhox. Addition at these locations provides good mixing throughout the slurry. Standard papermaking practice is to try to achieve uniform distribution of solids in the slurry, leading to good "formation" of the paper product. However, if the inclusions have different physical or chemical properties from the usual paper fibers, it is possible that additives may be used that would cause the inclusions to form small localized groupings, for example to form a variegated distribution in the inclusion layer being produced by the process. The point at which inclusion materials are added

may influence their orientation in the web.

[0028] Decorative or inclusion materials may be added when the web being formed has just left the headbox, and is fairly fluid, for example in the first distance 430. Material added at this point, whether liquid or solid, may be less likely to distribute evenly because the slurry of fibers is becoming set. Therefore migration of the decorative materials or inclusions across the web or into the web may be somewhat limited. This could for example cooperate with a means such a sprayer which may apply decorative material or inclusions less uniformly than possible when such additions are made at the headbox. Less uniform distribution may provide more realism for some types of simulated natural materials.

[0029] Decorative or inclusion materials may be added when the web being formed is further away from the headbox, and less fluid, for example in the second distance 431. Materials added at this point may be expected to remain closer to the surface of the web. Adding materials here might reduce the appearance of depth in a final laminated product. However, it could facilitate forming "clumped" or variegated decorative materials or inclusions for example by spraying onto the web a suspension of such materials in a coarse spray-pattern.

[0030] Decorative or inclusion materials, besides being added to the web at

the "wet end" of the paper machine, for example in locations 430, 431, may also be added at other locations toward the dry end of the paper machine. For example a decorative paper 320 or 324 being formed on the paper machine may be treated by application of materials using a curtain coater 44O$_7$ or a spray coaler 450, or dry sprinkler or other means (not shown). As noted above, these devices may be located at other positions, including wet end locations 430, 431. Typically one or more drying sections such as 461, 462, and 463 may be used to dry the papei .

[0031] Besides applying decorative or otherwise functional materials on the paper machine as shown in FIG. 4, such materials may be applied in off-paper-machine processes as well, using similar coating or application methods. Materials may be applied by dry-sprinkling.

[0032] Besides the materials added to the web for enhancing visual appearance, other materials may also be added for providing durability and wear resistance. In some cases materials that enhance visual appearance may also provide durability and wear resistance.

[0033] Methods of making and using the laminate structure in accordance with the invention should be readily apparent from the mere description of the laminate structure and its varied appearances as provided herein. No further discussion or illustration of such methods, therefore, is deemed necessary.

[0034] While preferred embodiments of the invention have been described and illustrated, it should be apparent that many modifications to the embodiments and implementations of the invention can be made without departing from the spirit or scope of the invention. Although the preferred embodiments illustrated herein have been described in connection with a laminate structure and with a stone or wood appearance, these embodiments may easily be implemented in accordance with the invention in other structures or to simulate other appearances. The decorative sheets described herein may be used for both laminate and non-laminate applications.

[0035] It is to be understood therefore that the invention is not limited to the particular embodiments disclosed (or apparent from the disclosure) herein, but only limited by the claims appended hereto.

CLAIMS

[0036] What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A laminate structure comprising

At least one base layer, and

a decorative layer comprising a pattern; said pattern comprising at least in part a visually perceived or wear-resistant characteristic achieved by a surface application to said decorative layer.

2. The laminate structure of claim I, further comprising at least one overlay layer.

3. The laminate structure of claim 1 or 2, wherein at least one of said layers comprises saturating paper.

4. The laminate structure of claim 1, wherein said surface application is by a curtain coater, spray coater, roll coater, blade coater, saturating process, or dry sprinkling.

5. The laminate structure of claim 1, wherein said surface application is carried out in an on-paper machine operation.

6. The laminate structure of claim 1, wherein said surface application is carried out in an off-paper machine operation.

7. The laminate structure of claim ï, wherein said visually perceived or wear-resistant characteristic is chosen from the group consisting of shape, color, reflectivity, refractive index, opacity, size, size distribution, and wear resistance.

8. A decorative sheet comprising

A fibrous layer; and

a visually perceived or wear-resistant characteristic added to said fibrous layer by a surface application to said fibrous layer.

9. The decorative sheet of claim 8, further comprising at least one overlay layer.

10. The decorative sheet of claim 8, wherein said fibrous layer comprises saturating paper.

11. The decorative sheet of claim 8, wherein said surface application is by a curtain coater, spray coater, roll coater, blade coater, saturating process, or dry sprinkling.

12. The decorative sheet of claim 8, wherein said siirface application is carried out in an on-paper machine operation.

13. The decorative sheet of claim 8, wherein said surface application is carried out in an off-paper machine operation.

14. The decorative sheet of claim 8, wherein said visually perceived or wear-resistant characteristic is chosen from the group consisting of shape, color, reflectivity, refractive index, opacity, size, size distribution, and wear resistance.

15. A method of creating a laminate structure, the method comprising;

providing one or more base layers;

providing a decorative layer comprising a pattern; said pattern comprising at least in part a visually perceived or wear-resistant characteristic achieved by a surface application to said decorative layer.

16. The method of claim 15, wherein said stirface application is by a curtain coater, spray coater, roll coater, blade coater, saturating process, or dry sprinkling.

17. The method of claim 15, wherein said surface application is carried out in an on-paper machine operation.

18. The method of claim 15, wherein said stirface application is carried out in an off-paper machine operation.

19. The method of claim 15, wherein said visually perceived or wear-resistant characteristic is chosen from the group consisting of shape, color, reflectivity, refractive index, opacity, size, size distribution, and wear resistance.

20. The method of claim 15, further comprising the step of providing an overlay layer.

21. The method of any one of claims 15 ~ 20, further comprising saturating said layers with a saturating resin.

22. The method of claim 21, further comprising applying heat.

23. The method of claim 21, further comprising applying pressure.

24. A method of creating a decorative sheet, the method comprising:

providing a fibrous layer;

applying to said fibrous layer a visually perceived or wear-resistant characteristic achieved by a surface application to said fibrous layer.

25. The method of claim 24, wherein said surface application is by a curtain coaler, spray coater, roll coater, blade coater, saturating process, or dry sprinkling.

26. The method of claim 24, wherein said surface application is carried out in an on-paper machine operation.

27. The method of claim 24, wherein said surface application is carried out in an off-paper machine operation.

28. The method of claim 24, wherein said visually perceived or wear-resistant characteristic is chosen from the group consisting of shape, color, reflectivity, refractive index, opacity, size, size distribution, and wear resistance.

FIG. 1

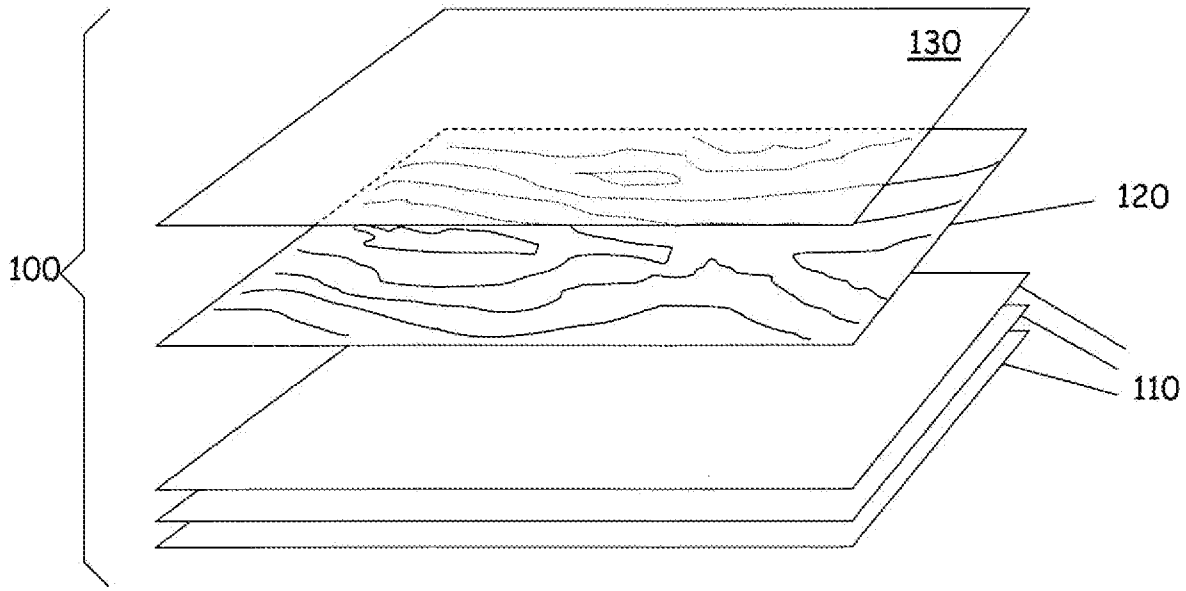


FIG. 2

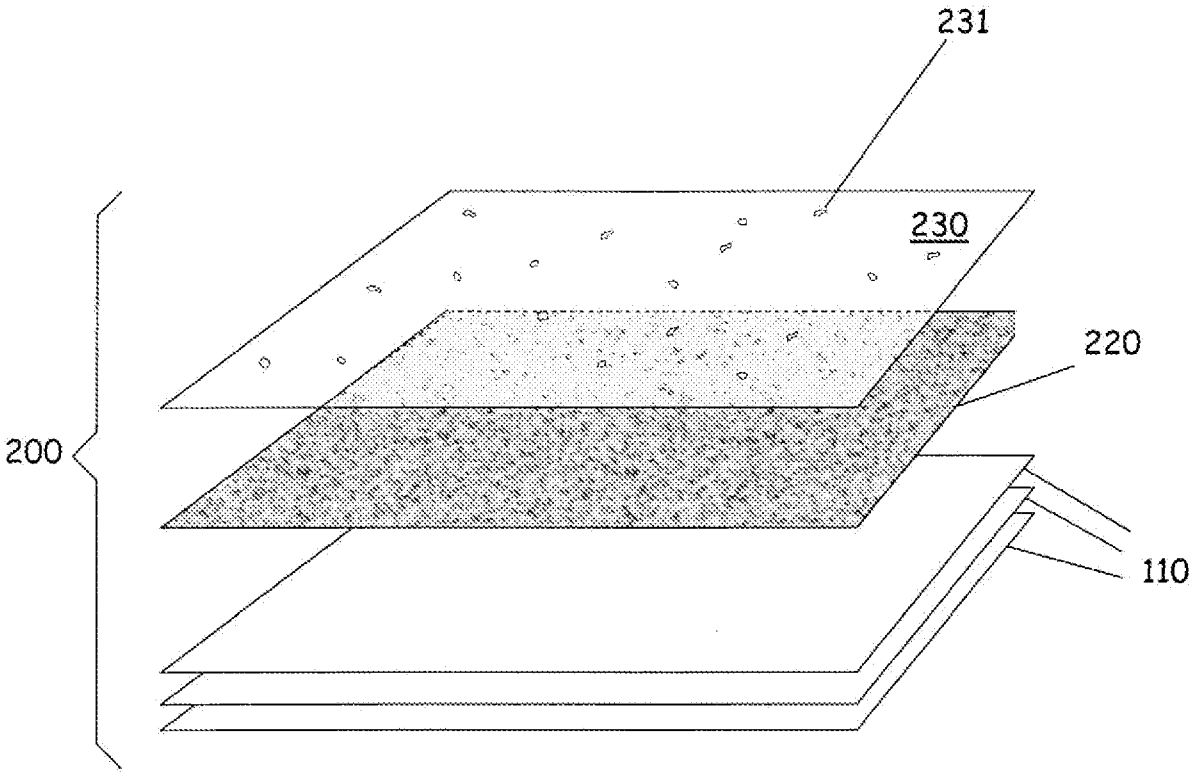


FIG. 3

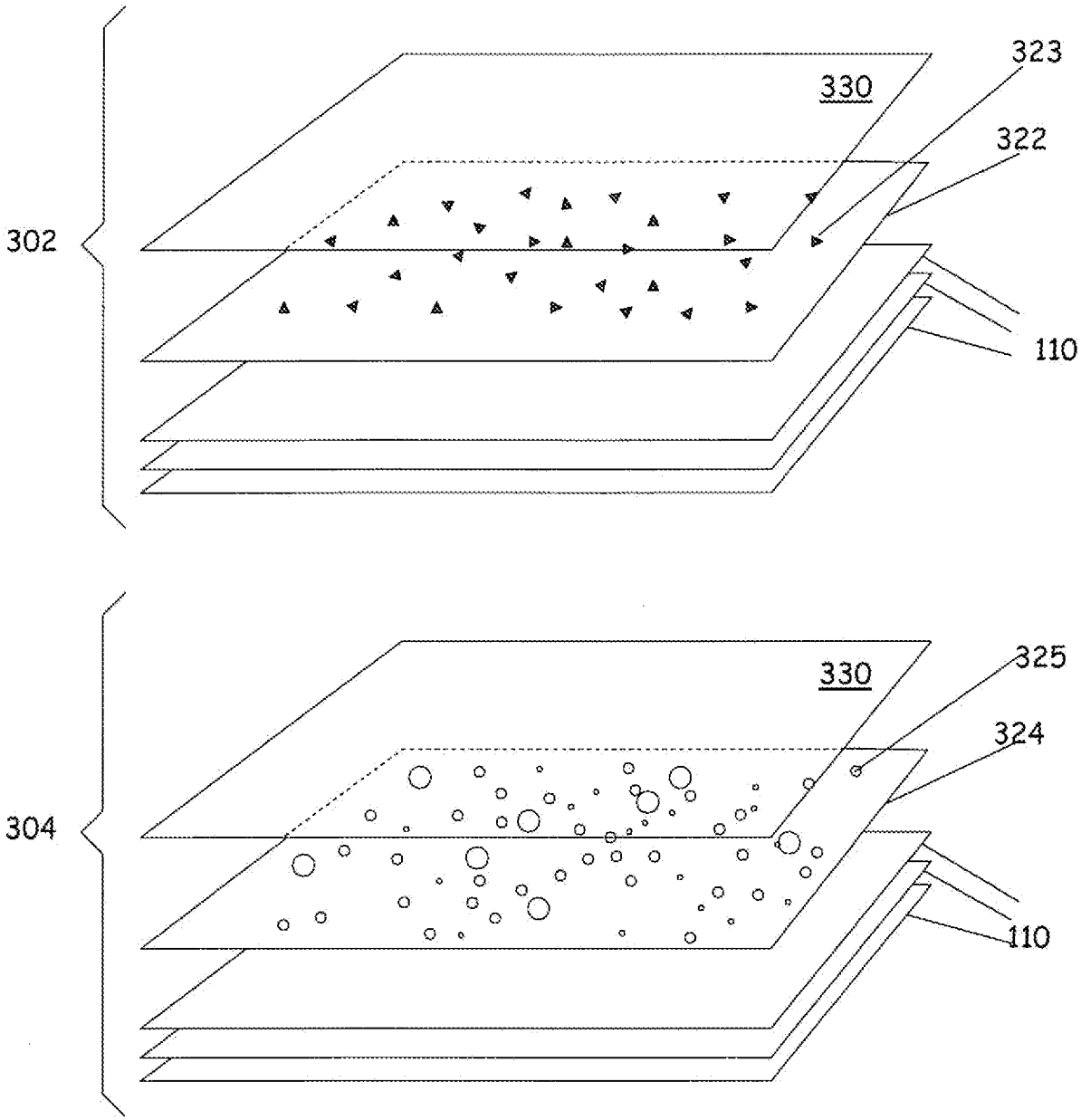
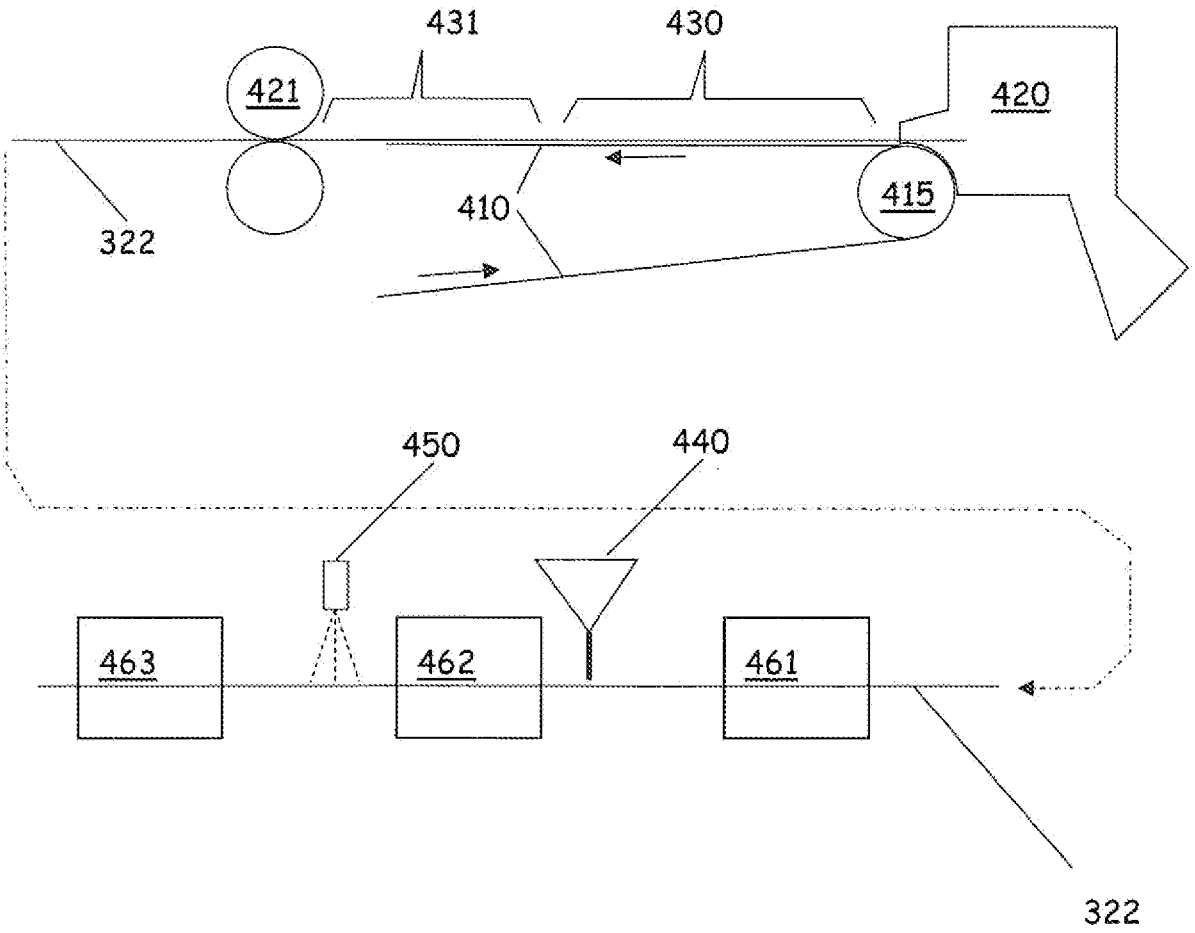


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 07/67787

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B32B 3/00, 27/36 (2007.01)
USPC - 428/156, 480
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)
USPC - 428/156, 480

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC- 428/151 ,156,167,195.1 ,201 ,480, 156/289; 162/181 .1; 106/2 (text search - see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST (PGPB.USPT.USOC.EPAB.JPAB^DialogPro (General Research); Google Scholar
Laminate, layer, paper, decorative, pattern, texture, overlay, saturating, curtain, spray, roll, blade, coat, sprinkle, on-paper, off-paper, machine, visual, wear, color, shape, pigment, opacity, reflect, refract, fiber, fibrous, heat, pressure

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,853,901 A (CESSNA) 29 December 1998 (29.12.1998), abstract, Fig. 2 and 4, col 1, ln 58-66, col 2, ln 59-63, col 4, ln 50 - col 5, ln 10, col 7, ln 16-29, col 7, ln 60 - col 8, ln 26, col 8, ln 56 -65, and col 9, ln 16-40.	1-28
A	US 6,723,200 B1 (ZHANG) 20 April 2004 (20.04.2004), entire document.	1-28
A	US 6,716,314 B2 (JOHNSON et al) 06 April 2004 (06 04 2004), entire document.	1-28
A	US 4,376.812 A (WEST) 15 March 1983 (15.03.1983), entire document.	1-28

D Further documents are listed in the continuation of Box C. ☐

* 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	Date of mailing of the international search report
13 September 2007 (13.09.2007)	15 OCT 2007
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk 571-272-4300 PCT OSP 571-272-7774

Form PCT/ISA/2 10 (second sheet) (April 2007)