

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
7 October 2004 (07.10.2004)

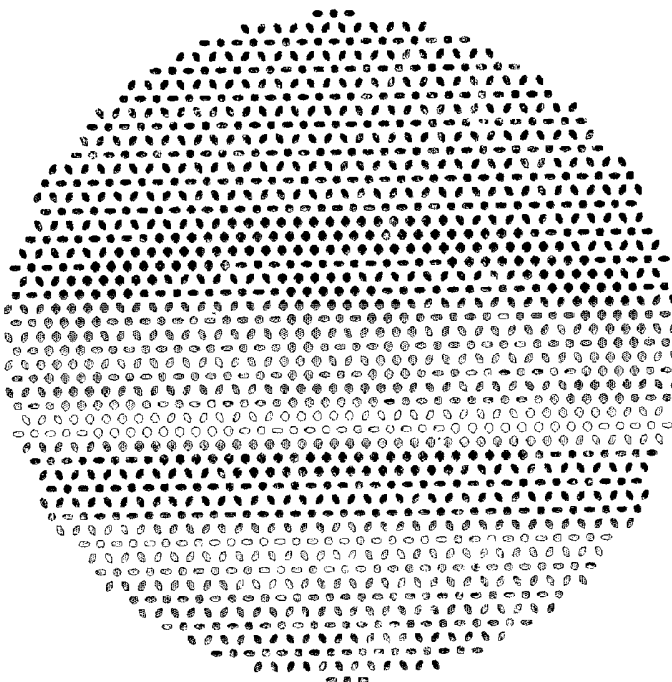
PCT

(10) International Publication Number  
**WO 2004/085730 A1**

- (51) International Patent Classification<sup>7</sup>: **D04H 13/00**, 1/54, 3/14
- (21) International Application Number:  
PCT/US2004/008482
- (22) International Filing Date: 18 March 2004 (18.03.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
10/393,969 21 March 2003 (21.03.2003) US
- (71) Applicant (for all designated States except US): **E.I. DUPONT DE NEMOURS AND COMPANY** [US/US];  
1007 Market Street, Wilmington, DE 19898 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **MARMON, Samuel, E.** [US/US]; 1329 Brinkley Branch Road, Galatin, TN 37066 (US). **RUDISILL, Edgar, N.** [US/US];  
1123 Lipscomb Drive, Nashville, TN 37204 (US).
- (74) Agent: **STEINBERG, Thomas, W.**; E. I. DU PONT DE NEMOURS AND COMPANY, LEGAL PATENT RECORDS CENTER, 4417 Lancaster Pike, Wilmington, DE 19805 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, 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, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, 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, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,

[Continued on next page]

(54) Title: PATTERN BONDED NONWOVEN FABRICS



(57) Abstract: A pattern bonded nonwoven fabric comprising a nonwoven fiber web having a geometrically repeating and visually discernable base pattern of bond points having at least one shape with at least one area defined by the shape and a second visually distinguishable bond pattern incorporated within said base pattern.

WO 2004/085730 A1



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*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.*

**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*

## **PATTERN BONDED NONWOVEN FABRICS**

### **Field of the Invention**

This invention is related to pattern bonded nonwoven fabrics having  
5 a secondary pattern bonded within a first bond pattern.

### **Background of the Invention**

Many processes for producing bonded nonwoven fabrics are known  
in the art. In particular, it is known to apply heat and pressure for bonding  
10 at limited areas of a nonwoven web by passing it through the nip between  
heated calender rolls either or both of which may have patterns of lands  
and depressions on their surfaces. During such a bonding process,  
depending on the types of fibers making up the nonwoven web, the  
bonded regions may be formed autogenously, i.e., the fibers of the web  
15 are melt fused at least in the pattern areas, or with the addition of an  
adhesive.

It is known in the art that physical properties of bonded nonwoven  
fabrics are related to the degree and the pattern of bonding. In general, a  
large bonded area may be applied to provide dimensional stability to  
20 nonwoven fabrics, at the expense of flexibility and porosity, and  
geometrically repeating bond patterns are employed to provide isotropic  
dimensional stability. However, different property requirements for  
different uses may dictate the use of random or irregular patterns.

It would be useful if there were a way to use a visually  
25 distinguishable bond pattern to identify a fabric without significantly  
changing the characteristics of the fabric such as surface abrasion  
resistance, web strength and dimensional stability. U.S. Pat. No.  
6,093,665 to Sayovitz et al. discloses a geometrically repeating base  
pattern of bonded regions wherein a regular pattern of some of the bond  
30 regions are removed to create a visually distinguishable bond pattern.  
However, the absence of some bond regions could lead to less bonding of

the fabric resulting in a weaker fabric and more fabric fuzzing. If several adjacent bond points were removed even less bonding of the fabric would occur which could lead to an even weaker fabric and even more fabric fuzzing. It would be desirable to have a pattern bonded nonwoven fabric that maintains the number of bond points to maintain fabric strength and fabric fuzzing level, while changing the bond pattern sufficiently to create a visually distinguishable second bond pattern.

### **SUMMARY OF THE INVENTION**

One embodiment of the present invention is a pattern bonded nonwoven fabric comprising a nonwoven fiber web having a geometrically repeating and visually discernable base pattern of bond points having at least one shape with at least one area defined by the shape and a second visually distinguishable bond pattern incorporated within said base pattern.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is an illustrative bond pattern of the present invention.

FIG. 2 is a magnified portion of the bond pattern in FIG. 1.

FIG. 3 is another illustrative bond pattern of the present invention.

### **DETAILED DESCRIPTION OF THE INVENTION**

The present invention provides nonwoven fabrics having one or more of visually recognizable and discernible secondary bond patterns. A visually recognizable secondary bond pattern is highly suited as an identification mechanism for nonwoven fabrics without significantly sacrificing useful properties of the fabrics, such as surface abrasion resistance, web strength and dimensional stability. Accordingly, the present invention can be used to create identification marks to denote various sources of origin, characteristics and properties of nonwoven fabrics, e.g., weight, composition, hydrophobicity, hydrophilicity and the like, and to denote designated uses for each fabric, e.g., medical applications, such as medical or surgical gowns or drapes, environmental

uses, such as for articles of protective apparel, including jump suits, overalls, gloves, lab coats, and the like. In addition, the bond patterns can act as alignment or demarcation points to assist manufacturing processes in which articles, such as garments, diapers, protective clothings and the like, from such nonwoven fabrics are assembled or produced.

The present invention is useful for nonwoven fabrics having geometrically repeating base bond patterns. The size, shape, arrangement and pattern of bond points for the base bond patterns may vary widely as long as the patterns created by the base bond points are regular and repeating. Depending on required aesthetic effects and physical properties for different uses of the nonwoven fabrics, the size and/or shape of each bond point as well as the distance between adjacent bond points in a repeating bond pattern may vary. As mentioned above, the total bonded area of the fabric and size of bond points impart different properties to the nonwoven fabrics. For example, highly bonded areas tend to impart dimensional stability, while lesser bonded areas provide flexibility, drapability and porosity. Of the various base bond patterns, particularly useful patterns are evenly spaced repeating bond patterns having bond points of uniform shape and size.

The present invention is directed toward pattern bonded nonwoven fabrics having a visually distinguishable secondary bond pattern, incorporated within the base bond pattern, that can be used to identify a fabric without significantly changing the characteristics of the fabric such as surface abrasion resistance, web strength and dimensional stability. This is achieved by using a pattern bonded nonwoven fabric with a geometrically repeating and visually discernable base bond pattern of bond points having at least one shape with at least one area defined by the shape and wherein some of the base bond points are replaced with bond points distinct from the base bond points, such as by having the same shape bond point with a different area, a different shape bond point and the same area, or a different shape bond point with a different area, to provide a distinct and visually distinguishable secondary bond pattern incorporated within the geometrical base bond pattern.

The base bond pattern is made up of bond points that exhibit one or more combinations of shape and size in a particular arrangement. This pattern may vary as long as the patterns created by the bond points are regular, repeating and visually discernable.

- 5           The bond points of the pattern bonded nonwoven fabric (the total bonded area) cover from about 6% to about 50%, preferably from about 10% to about 40% of the surface of the nonwoven fabric. The identifiable and base bond points separately cover from about 3% to about 47%, preferably from about 5% to about 35% of the surface of the nonwoven
- 10 fabric. Bonding too large an area could result in a stiff, harsh fabric, while bonding too small an area could result in a weak fabric. The bond point density of the pattern bonded nonwoven fabric is from about 8 to about 128 bond points per  $\text{cm}^2$ , preferably from about 12 to about 64 bond points per  $\text{cm}^2$ . The area of any individual bond point is less than about  $0.3 \text{ cm}^2$ ,
- 15 preferably less than about  $0.2 \text{ cm}^2$ . The area of an individual identifiable secondary bond point is from about 25% to about 300%, preferably from about 40% to about 250% of the area of an individual base bond point.

Many shapes of bond points can be used, including but not limited to circles, ovals, squares, diamonds, lines and crosses.

- 20           Nonwoven webs suitable for producing the present nonwoven fabrics are any known nonwoven webs that are amenable to pattern bonding, which include, but are not limited to, fiber webs fabricated from staple fibers, continuous fibers or mixtures thereof, and the fibers may be natural, synthetic or mixtures thereof. In addition, suitable fibers may be
- 25 crimped or uncrimped, and synthetic fibers may be monocomponent fibers or multicomponent conjugate fibers, e.g., bicomponent side-by-side or sheath-core fibers.

- Illustrative of suitable natural fibers include cellulosic fibers, cotton, jute, pulp, wool and the like. When natural fiber webs are utilized, a binder
- 30 or an adhesive, in the form of fibers or powders, may be sprayed on or mixed with the fibers of the web to consolidate the constituent fibers or otherwise applied to form bonded regions. Illustrative of suitable binders

include ethylene vinylacetate, acrylate adhesives, acrylic adhesives, latex and the like.

Synthetic fibers suitable for the present invention are produced from synthetic thermoplastic polymers that are known to form fibers, which  
5 include, but are not limited to, polyolefins, e.g., polyethylene, polypropylene, polybutylene and the like; polyamides, e.g., nylon 6, nylon 6/6, nylon 10, nylon 12 and the like; polyesters, e.g., polyethylene terephthalate, polybutylene terephthalate and the like; polycarbonate; polystyrene; thermoplastic elastomers; vinyl polymers; polyurethane; and  
10 blends and copolymers thereof. Additionally suitable fibers include glass fibers, carbon fibers, semi-synthetic fibers, e.g., viscose rayon fibers and cellulose acetate fibers, and the like. In accordance with known properties of each polymer, synthetic and semi-synthetic polymer fibers can be bonded autogenously, i.e., the fibers of the web are melt-fused under heat  
15 and pressure, or with the use of a binder. For example, fiber webs of polyolefins, polyamides, polyesters, vinyl polymers or the like can be autogenously bonded, and webs of glass fibers and/or carbon fibers require the use of a binder.

Suitable staple fiber webs may be prepared by carding a mass of  
20 staple fibers with a woolen or cotton carding machine or a garnetting machine, and suitable continuous fiber webs may be prepared by conventional air laying methods that produce webs from meltblown fibers and/or spunbond fibers. As used herein, the term "meltblown fibers" indicates fibers formed by extruding a molten thermoplastic polymer  
25 through a plurality of fine, usually circular, die capillaries as molten threads or filaments into a high velocity gas stream which attenuates the filaments of molten thermoplastic polymer to reduce their diameter. In general, meltblown fibers have an average fiber diameter of up to about 10 microns. After the fibers are formed, they are carried by the high velocity  
30 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. Pat. No. 3,849,241 to Butin. As used herein, the term "spunbond fibers" refers to small diameter fibers that are formed by

extruding a molten thermoplastic polymer as filaments from a plurality of fine, usually circular, capillaries of a spinneret. The extruded filaments are then rapidly drawn by an eductive or other well-known drawing mechanism. The resulting fibers, in general, have an average diameter  
5 larger than that of meltblown fibers. Typically, spunbond fibers have an average diameter in excess of 12 microns and up to about 55 microns. The production of spunbond webs is disclosed, for example, in U.S. Pat. Nos. 4,340,563 to Appel et al. and 3,692,618 to Dorschner et al.

The fabrics of the present invention further include laminates of two  
10 or more of the above-mentioned nonwoven webs and laminates of nonwoven webs and films. A useful example of a laminate containing multiple webs is a sandwich structure with spunbond webs on the outside of the laminate to provide strength with one or more meltblown webs inside of the laminate between the spunbond webs to provide various  
15 filtering capabilities. Various films known in the art, particularly thermoplastic films, can be bonded to the nonwoven webs, autogenously or with the use of a binder, to provide added barrier properties, such as moisture, chemical and aroma barrier properties. Useful thermoplastic films can be produced from, for example, polyolefins, e.g., polyethylene,  
20 polypropylene, polybutylene and the like; polyamides, e.g., nylon 6, nylon 6/6, nylon 10, nylon 12 and the like; polyesters, e.g., polyethylene terephthalate, polybutylene terephthalate and the like; polycarbonate; polystyrene; thermoplastic elastomers; vinyl polymers; polyurethane; and blends and copolymers thereof.

25 The present invention can be practiced employing any pattern bond forming process known in the art. Preferably, the bond pattern is applied using a conventional calender bonding process. In general, the calender bonding process employs pattern roll pairs for bonding at limited areas of the web by passing it through the nip between the rolls, at least one of  
30 which rolls is heated and has a pattern of lands and depressions on its surface. Alternatively, the bond pattern can be applied by passing the web through a gap formed by an ultrasonic work horn and anvil. The anvil may



be in the form of a roll having raised portions to provide a pattern bonded fabric.

The temperature of the pattern rolls and the nip pressure should be selected so as to effect bonding without having undesirable accompanying side effects such as excessive shrinkage or web degradation. Although appropriate roll temperatures and nip pressures are generally influenced to an extent by parameters such as web speed, web basis weight, fiber characteristics, presence or absence of adhesives and the like, it is preferred that the roll temperature be in the range between softening and crystalline melting temperatures of the component fiber polymer in combination with nip pressures on raised points (pin pressure) of about 7 MPa to about 350 MPa. It may not be desirable to expose the web to a temperature where extensive fiber melting occurs. For example, the preferred pattern bonding settings for polypropylene webs are a roll temperature in the range of about 127 °C and 160 °C, and a pin pressure in the range of about 7 MPa to about 700 MPa. However, when adhesives other than melt-adhesives are utilized to consolidate and to form the present bond pattern, no significant heat and pressure need to be applied since only a minimal pin pressure is needed to hold the fibers in place until the adhesives cure to form permanent bonds.

Suitable pattern rolls for the present invention may be produced from well known materials, such as steels for patterned rolls and high temperature rubbers for smooth rolls, and according to processes well known in the art. The pattern rolls may be produced from a mold containing desired patterns. Suitable pattern roll forming procedures are well known in the engraving art. The bond patterns of the present invention, as an alternative to the above-described in-line roll patterning process, can also be formed by stamping processes known in the art, using male and female molds.

FIG. 1 provides an illustrative example of the bond pattern of the present invention. A second visually distinct bond pattern of a capital D within an oval can be seen within the geometrically repeating base bond pattern. FIG. 2 provides a magnified portion of FIG. 1. The geometrically

repeating base bond pattern is made up of circular **10** and oval **12** bond points. The circles **10** are surrounded by six ovals **12** radiating outwardly from the circles **10** creating a nested daisy flower pattern. Each oval **12** is adjacent to two circles **10**. The base bond points can all be of the same shape or different shapes. The visually identifiable second bond pattern is made up of diamond-shaped bond points **14**. Each diamond **14** has replaced either a circle **10** or an oval **12**. All of the diamonds in FIG. 1 produce a capital D within an oval. It is further noted that many diamond bond points **14** are adjacent to one another.

FIG. 3 provides another illustrative example of the bond pattern of the present invention. The outline of a visually identifiable cross bond pattern can be seen on the geometrically repeating base bond pattern. Similar to FIG. 2, the geometrically repeating base bond pattern is made up of circular **10** and oval **12** bond points to create a nested daisy flower pattern. The visually identifiable second bond pattern is made up of diamond-shaped bond points **14**. Each diamond **14** has replaced either a circle **10** or an oval **12**. All of the diamonds in FIG. 3 produce an outline of a cross.

### **TEST METHODS**

The following examples employed the following test methods. ASTM refers to the American Society for Testing and Materials. INDA refers to the Association of the Nonwoven Fabric Industry.

Basis Weight is a measure of the mass per unit area of a fabric and was determined by ASTM D 3776, which is hereby incorporated by reference, and is reported in g/m<sup>2</sup>.

Grab Tensile Strength is a measure of the breaking strength of a fabric and was conducted according to ASTM D 5034, which is hereby incorporated by reference, and is reported in Newtons (N).

Elongation is a measure of the amount a fabric stretches prior to failure (breaking) in the grab tensile strength test and was conducted according to ASTM D 5034, which is hereby incorporated by reference, and is reported as a percent.

Handle-O-Meter is a measure of the drapability of a fabric and was measured according to INDIA 90.3-92, which is hereby incorporated by reference, and is reported in grams (g).

5

### EXAMPLE 1

A three-layer fabric was created using a bond pattern of this invention that contains a visually distinguishable secondary pattern of bond points in a geometrically repeating pattern of base bond points as illustrated in FIG. 1. The three-layer fabric comprised two outer layers of spunbond fibers and a central layer of meltblown fibers made according to the process disclosed in WO 0109425 to Rudisill et al. hereby incorporated by reference. The spunbond fibers were sheath-core bicomponent fibers in which the core comprised polyethylene terephthalate and the sheath comprised polyethylene. The ratio of sheath to core was 50% by weight. The central layer was made of side-by-side bicomponent meltblown fibers in which one component was polyethylene terephthalate and the other was polyethylene. The polyethylene terephthalate resin comprised about 65% by weight of the fiber. The weight of each spunbond layer was  $21 \text{ g/m}^2$  and the weight of the meltblown layer was  $17 \text{ g/m}^2$ . The three layers were fed to a nip of a calender apparatus comprised of upper and lower steel heated rolls. The upper roll was engraved with secondary pattern of diamond-shaped bond elements creating a capital D within an oval, incorporated within the base bond pattern of nested daisies, as illustrated in FIG. 1 and the lower roll was a smooth anvil roll. Referring to FIG 2, the circles 10 and ovals 12 cover 15% of the surface of the fabric. The diamonds 14 cover 20% of the surface of the fabric. The bonded point density of the fabric is 34 points per  $\text{cm}^2$ . Both rolls were about 46 cm in diameter and heated to about  $120^\circ\text{C}$  with a nip pressure setting of 35 kN per linear m. Handle-O-Meter and Grab Tensile and Elongation data are in the Table.

### COMPARATIVE EXAMPLE A

The same three-layer fabric of Example 1 was used except that fabric was bonded using only the base pattern of bond points. Handle-O-Meter and Grab Tensile and Elongation data are in the Table.

- 5 Comparing the data from the Table, it is clear that the bond pattern of the present invention does not significantly degrade the physical properties of the nonwoven fabric while providing visually identifiable secondary bond patterns.

10

**TABLE**  
**NONWOVEN WEB PROPERTIES**

Example	H-O-M (MD) (g)	H-O-M (XD) (g)	Grab Tensile (XD) (N)	Elongation (XD) (%)
1	27.4	11.1	91.6	82.6
A	25.6	10.1	87.6	81.1

H-O-M = Handle-O-Meter & XD = Cross Direction

### EXAMPLE 2

- 15 FIG. 3 shows another example of the present invention. A visually distinguishable bonding pattern of an outline of a cross can be seen on the geometrically repeating base bond pattern. Similar to FIG. 2, the geometrically repeating base bond pattern is made up of circular 10 and oval 12 bond points to create a nested daisy flower pattern. The visually
- 20 identifiable secondary bond pattern is made up of diamond-shaped bond points 14. Each diamond 14 has replaced either a circle 10 or an oval 12. All of the diamonds in FIG. 3 produce an outline of a cross. The circles 10 and ovals 12 cover 15% of the surface of the fabric. The diamonds 14 cover 20% of the surface of the fabric. The bonded point density of the
- 25 fabric is 30 points per cm<sup>2</sup>.

## CLAIMS

What is claimed is:

1. A pattern bonded nonwoven fabric comprising a nonwoven  
5 fiber web having a geometrically repeating and visually discernable base  
pattern of bond points having at least one shape with at least one area  
defined by the shape and a second visually distinguishable bond pattern  
incorporated within said base pattern.
2. The pattern bonded nonwoven fabric of claim 1, wherein  
10 some of the bond points of the base bond pattern are replaced with  
second pattern bond points having different shapes and/or areas from the  
bond points of the base bond pattern.
3. The pattern bonded nonwoven fabric of claim 2, wherein the  
second pattern bond points are of the same shape of the base pattern  
15 bond points with a different area.
4. The pattern bonded nonwoven fabric of claim 2, wherein the  
second pattern bond points are of a different shape from the base pattern  
bond points with the same area.
5. The pattern bonded nonwoven fabric of claim 2, wherein the  
20 second pattern bond points are of a different shape from the base pattern  
bond points and a different area.
6. The pattern bonded nonwoven fabric of claim 1, wherein the  
fabric comprises a laminate of at least one nonwoven fiber web and at  
least one film.
- 25 7. The pattern bonded nonwoven fabric of claim 1, wherein the  
nonwoven fiber web is selected from staple fiber nonwoven webs,  
spunbond nonwoven webs and meltblown nonwoven webs.

8. The pattern bonded nonwoven fabric of claim 1, wherein the fabric comprises multiple nonwoven webs.

9. The pattern bonded nonwoven fabric of claim 8, wherein the fabric comprises a first spunbond nonwoven web, at least one meltblown  
5 nonwoven web and a second spunbond nonwoven web.

10. The pattern bonded nonwoven fabric of claim 2, wherein the area of an individual secondary pattern bond point is from about 25% to about 300% of the area of an individual base pattern bond point.

11. An article of protective clothing comprising the pattern  
10 bonded nonwoven fabric according to claim 1.

12. A medical drape comprising the pattern bonded nonwoven fabric according to claim 1.

1/3

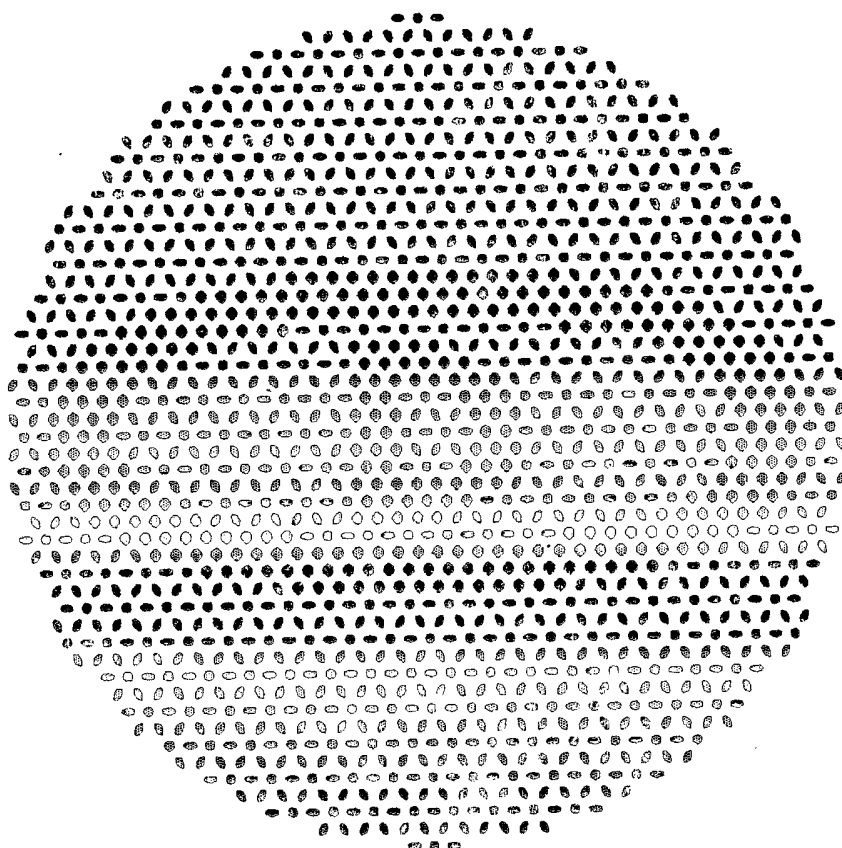


FIG. 1

2/3

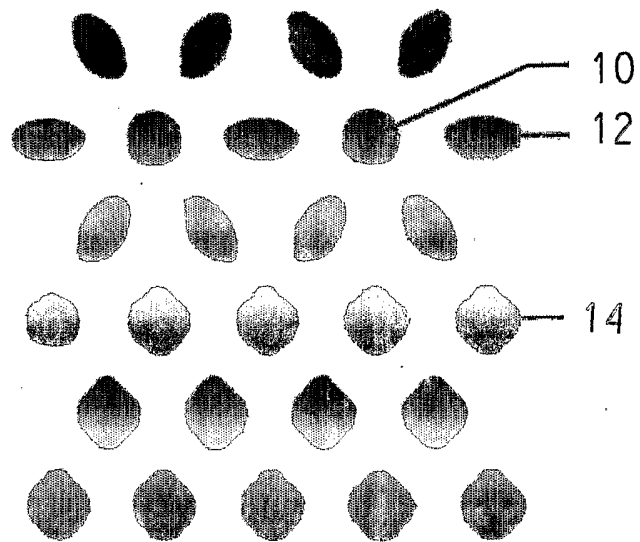


FIG. 2



3/3

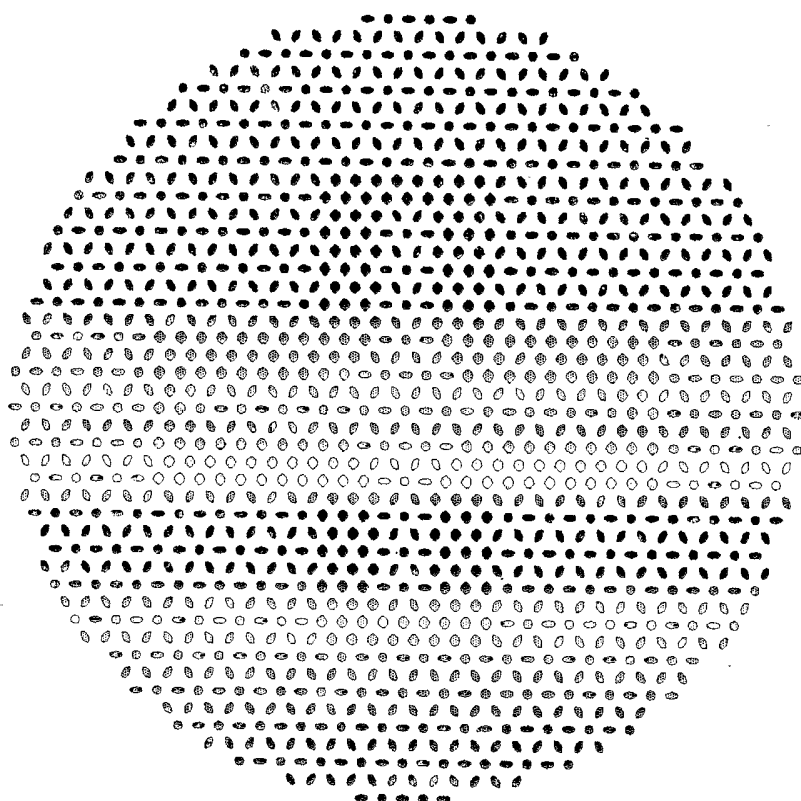


FIG. 3

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2004/008482

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 D04H13/00 D04H1/54 D04H3/14

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)  
IPC 7 D04H

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

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)  
EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 569 860 A (KIMBERLY CLARK CO) 18 November 1993 (1993-11-18) page 5, lines 27-43 -----	1
X	US 4 333 979 A (SCIARAFFA MICHAEL A ET AL) 8 June 1982 (1982-06-08) column 5, lines 7-25 -----	1,2
X	US 4 493 868 A (MEITNER GARY H) 15 January 1985 (1985-01-15) column 2, lines 19-36; claim 13 -----	1,6,7
A	US 6 093 665 A (MAYFIELD ANGELA RAYE ET AL) 25 July 2000 (2000-07-25) column 1, lines 36-49; figures 2-5 -----	1-13
A	US 5 057 357 A (WINEBARGER CRAIG M) 15 October 1991 (1991-10-15) column 3, line 19 - column 4, line 60 -----	1-13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 document 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.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

27 July 2004

Date of mailing of the international search report

03/08/2004

Name and mailing address of the ISA  
European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Lanniel, G

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/008482

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0569860	A	18-11-1993	US 5366786 A	22-11-1994
			AU 3850793 A	18-11-1993
			CA 2080084 A1	16-11-1993
			DE 69312387 D1	04-09-1997
			DE 69312387 T2	06-11-1997
			EP 0569860 A1	18-11-1993
			ES 2106224 T3	01-11-1997
			JP 6049761 A	22-02-1994
			KR 236746 B1	02-03-2000
			MX 9302491 A1	01-12-1993
			US 5798167 A	25-08-1998
US 4333979	A	08-06-1982	IT 1171466 B	10-06-1987
			MX 162832 B	28-06-1991
US 4493868	A	15-01-1985	NONE	
US 6093665	A	25-07-2000	AU 688319 B2	12-03-1998
			AU 6622094 A	18-04-1995
			CA 2113931 A1	31-03-1995
			DE 69421713 D1	23-12-1999
			DE 69421713 T2	06-07-2000
			EP 0721520 A1	17-07-1996
			ES 2138079 T3	01-01-2000
			KR 270797 B1	01-11-2000
			WO 9509261 A1	06-04-1995
US 5057357	A	15-10-1991	NONE	