

(19)



(11)

EP 3 300 773 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.04.2018 Bulletin 2018/14

(51) Int Cl.:
A62D 5/00 (2006.01)

(21) Application number: **16191251.4**

(22) Date of filing: **29.09.2016**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **ZHANG, Peter**
Morris Plains, NJ 07950 (US)
• **ZHAO, Linan**
Morris Plains, NJ 07950 (US)
• **ZHANG, Bruce**
Morris Plains, NJ 07950 (US)

(71) Applicant: **Honeywell International Inc.**
Morris Plains, NJ 07950 (US)

(74) Representative: **Houghton, Mark Phillip**
Patent Outsourcing Limited
1 King Street
Bakewell, Derbyshire DE45 1DZ (GB)

(54) **A METHOD TO PRODUCE ULTRA-SOFT SOLVENT BASED POLYURETHANE GLOVE**

(57) Embodiments relate generally to methods and systems for forming a chemical protection glove comprising a plurality of hollow beads. A chemical protection glove may comprise an outer layer comprising a chemically impermeable material, and a plurality of hollow beads dispersed throughout the outer layer. The hollow beads at least partially extend from the surface of the outer layer, and the hollow beads create a textured sur-

face on the outer layer. A fabric layer is located beneath the outer layer of the glove, and the material of the outer layer at least partially penetrates through the fabric layer. An inner layer configured to contact the user's skin comprises a plurality of hollow beads dispersed throughout the inner layer, where the hollow beads can at least partially extend from the surface of the inner layer to create a textured surface on the inner layer.

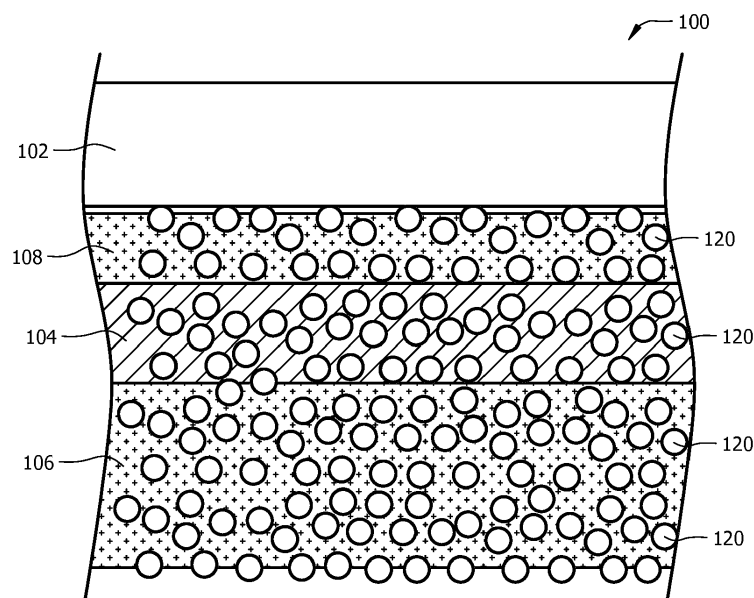


FIG. 2B

EP 3 300 773 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

5 [0001] Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED

RESEARCH OR DEVELOPMENT

10 [0002] Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

15 [0003] Not applicable.

BACKGROUND

20 [0004] Seamless, three-dimensional gloves may be formed using a glove mold and dipping the mold into a liquidized material that may dry to form the glove material. Such gloves may be used to protect a user's hands from chemicals, dust, grease, or other harmful substances. These gloves may be formed in various sizes to accommodate the user.

SUMMARY

25 [0005] In an embodiment, a chemical protection glove may comprise an outer layer comprising at least one layer of a chemically impermeable material; a fabric layer located beneath the outer layer of the glove; and an inner layer configured to contact the user's skin comprising a plurality of hollow beads dispersed throughout the inner layer, wherein the hollow beads at least partially extend from the surface of the inner layer, and wherein the hollow beads create a textured surface on the inner layer.

30 [0006] In an embodiment, a method for forming a chemical protection glove may comprise placing a fabric layer onto a glove mold; dipping the glove mold with the fabric layer into a polyurethane solution comprising a plurality of hollow beads; forming an outer layer of the polyurethane solution onto the fabric layer, wherein the hollow beads are dispersed through the outer layer; and forming an inner layer of the polyurethane solution by allowing the polyurethane solution to penetrate the fabric layer, wherein the hollow beads are dispersed throughout the inner layer.

35 [0007] In an embodiment, a chemical protection glove may comprise an outer layer comprising at least one layer of a chemically impermeable material, and comprising a plurality of hollow beads dispersed throughout the outer layer, wherein the hollow beads at least partially extend from the surface of the outer layer, and wherein the hollow beads create a textured surface on the outer layer; a fabric layer located beneath the outer layer of the glove, wherein the material of the outer layer at least partially penetrates through the fabric layer; and an inner layer configured to contact
40 the user's skin comprising a plurality of hollow beads dispersed throughout the inner layer, wherein the hollow beads at least partially extend from the surface of the inner layer, and wherein the hollow beads create a textured surface on the inner layer.

BRIEF DESCRIPTION OF THE DRAWINGS

45 [0008] For a more complete understanding of the present disclosure, reference is now made to the following brief description, taken in connection with the accompanying drawings and detailed description, wherein like reference numerals represent like parts.

50 FIGS. 1A-1B illustrate a method for forming a glove according to an embodiment of the disclosure; and
FIGS. 2A-2B illustrate cross-sectional views of a glove according to an embodiment of the disclosure.

DETAILED DESCRIPTION

55 [0009] It should be understood at the outset that although illustrative implementations of one or more embodiments are illustrated below, the disclosed systems and methods may be implemented using any number of techniques, whether currently known or not yet in existence. The disclosure should in no way be limited to the illustrative implementations, drawings, and techniques illustrated below, but may be modified within the scope of the appended claims along with

their full scope of equivalents.

[0010] The following brief definition of terms shall apply throughout the application:

The term "comprising" means including but not limited to, and should be interpreted in the manner it is typically used in the patent context;

The phrases "in one embodiment," "according to one embodiment," and the like generally mean that the particular feature, structure, or characteristic following the phrase may be included in at least one embodiment of the present invention, and may be included in more than one embodiment of the present invention (importantly, such phrases do not necessarily refer to the same embodiment);

If the specification describes something as "exemplary" or an "example," it should be understood that refers to a non-exclusive example;

The terms "about" or "approximately" or the like, when used with a number, may mean that specific number, or alternatively, a range in proximity to the specific number, as understood by persons of skill in the art field; and

If the specification states a component or feature "may," "can," "could," "should," "would," "preferably," "possibly," "typically," "optionally," "for example," "often," or "might" (or other such language) be included or have a characteristic, that particular component or feature is not required to be included or to have the characteristic. Such component or feature may be optionally included in some embodiments, or it may be excluded.

[0011] Embodiments of the disclosure include methods and systems for creating a glove comprising a plurality of hollow beads located within the material of the glove. The hollow beads may be dispersed within a coating that is used to form at least one of the inner and/or outer surfaces of the glove.

[0012] Typically, solvent based polyurethane (PU) has been used in the glove coating industry and may be preferred for its low cost and soft hand feeling. Unfortunately, problems may arise with using PU coatings, such as PU penetration and unacceptable coating edge appearance, which may lead to unpleasant hand feeling and unacceptable quality of glove appearance. Some users may be unsatisfied with the comfort levels of PU glove products, because of these issues.

[0013] Embodiments of the disclosure comprises elements for improving the solvent based PU glove with ultra-soft hand feeling, improved wearing comfort, lightweight materials, and good coating edge quality.

[0014] In typical solvent based PU coated gloves, the PU solution may penetrate through fabrics to form a coating on the inner surface of the glove. The inner coating may provide an unwelcome rubber-like feeling as it contacts the user's skin. Embodiments of the disclosure may comprise a plurality of hollow beads within the PU solution, where the hollow beads may also penetrate through the fabric and be present in the inner coating. The hollow beads may at least partially extend from the surface of the coating, creating raised bubbles or "nubbins" which may improve tactile feel for the user's hand. Additionally, the hollow beads may reduce the total weight of the glove by providing hollow areas throughout the material and reducing the amount of PU material that is required. For example, with the same thickness of coating created on the glove, the weight of the glove that incorporates the hollow beads may be reduced by approximately 40% when compared to a typical PU coated glove. In some embodiments, the hollow beads may provide a barrier to spreading of the PU solution, thereby creating a uniform coating edge.

[0015] Referring now to FIGS. 1A-1B, an exemplary process of forming a glove 100 is shown. In FIG. 1A, a fabric layer 104 is placed on a glove mold (or form) 102. Then, the glove mold 102, with the fabric layer 104 attached, may be dipped into a material to form a chemical protection layer 106 (or outer layer), wherein the chemical protection layer 106 may comprise a plurality of hollow beads. In some embodiments, the material of the chemical protection layer 106 may at least partially penetrate through the fabric layer 104, and may form a coating on the inner surface of the fabric layer 104, as well as the outer surface.

[0016] Referring now to FIGS. 2A-2B, a cross-sectional view of the glove 100 is shown, where FIG. 2A corresponds to FIG. 1A and FIG. 2B corresponds to FIG. 1B. In FIG. 2A, the fabric layer 104 is located adjacent to the glove mold 102. Then in FIG. 2B, the glove mold 102 and fabric layer 104 have been dipped to apply the chemical protection layer 106. As described above, the chemical protection layer 106 may comprise a plurality of hollow beads 120, where the hollow beads 120 may be dispersed throughout the glove 100. In some embodiments, the material of the chemical protection layer 106 may penetrate the fabric layer 104 to create an inner coating (or inner layer) 108 on the inner surface of the glove 100. In some embodiments, the hollow beads 120 may penetrate through the fabric layer 104 as well, wherein the hollow beads 120 may be small enough to pass through any openings in the fabric layer 104. In some embodiments, the hollow beads 120 may at least partially extend from the surface of the chemical protection layer 106, providing a textured surface on the outer layer of the glove 100. In some embodiments, the hollow beads 120 may at least partially extend from the surface of the inner coating 108 (or inner layer), providing a textured surface on the inner layer of the glove 100. The hollow beads 120 may be dispersed evenly throughout the chemical protection layer 106, fabric layer 104, and inner coating 108.

[0017] The presence of the hollow beads 120 in the chemical protection layer 106 may not compromise the chemical protection qualities of the glove 100. The hollow beads 120 may influence the mechanical properties of the glove 100,

especially abrasion, and this may be accounted for by including a crosslink agent in the formulation of the PU coating material.

[0018] In some embodiments, the hollow beads 120 may comprise a hollow glass material. In some embodiments, the hollow beads 120 may comprise one or more materials including hollow glass beads, hollow polyvinyl chloride (PVC) beads, hollow polyvinyl alcohol (PVA) beads, polymethyl methacrylate (PMMA) and/or other hollow organic and inorganic beads. In some embodiments, the hollow beads 120 may comprise a diameter less than approximately 50 micrometers (μm). In some embodiments, the hollow beads 120 may also be known as bubbles, spheres, microspheres, or particles. While described as being hollow, various other low-density materials including beads of microfoamed materials and the like (e.g., having a plurality of internal voids rather than a single internal void) can also be used. The beads formed from such materials can be made of the same materials and have the same dimensions as those described above.

[0019] In some embodiments, the glove 100 described above may provide improved comfort in wearing for a user. This may be demonstrated by the results of a comparison test with a typical PU glove that does not contain the hollow beads. Additionally, for reference, the glove 100 was compared with 100% lamb's wool, which may be considered a standard for softness and comfort. The results of the comparison test are shown below in Table 1. The testing was completed using a PhabrOmeter instrument, where a larger value indicates a higher dexterity and comfort. As can be seen in the table, the testing results for the glove containing the hollow beads are an improvement over the original (or typical) glove, and are closer in number to those results from the 100% lamb's wool.

Table 1: Comparison Test Results

Sample Name	Overall fabric hand	Flexibility	Smoothness	Softness
100% Lamb's wool	1	0.8223	0.1008	0.9048
Glove (with Hollow Beads)	0.7916	0.5265	0.2131	0.7842
Glove (Original)	0.6146	0.247	0.096	0.7077

[0020] A process for making the glove described above may comprise preparing the PU coating dispersion, wherein the PU coating dispersion (or solution) may comprise PU, hollow beads, pigment, and solvent. In some embodiments, the PU dispersion may be mixed by adding PU latex into the solvent (which may comprise dimethylformamide (DMF)). Then, the hollow beads and pigment may be added to the mixture, which may be stirred to control the viscosity of the solution.

[0021] Then, a fabric layer may be placed on the glove mold, and the mold and fabric may be dipped into the PU solution. In some embodiments, the mold and fabric layer may be heated before dipping. The dipping process may comprise one dip into the solution or multiple dips into the solution. The dipping process may allow the mold and fabric to sit in the solution for a set amount of time. In some embodiments, the dipping process may comprise leaching for approximately 30-40 minutes in hot water.

[0022] After the dipping process forms the inner and outer coating of the glove, the glove may be dried. For example, the glove may be dried in an oven at approximately 70 to 120 degrees Celsius. In some embodiments, during the drying process, the beads may float to and extend from the surface of the coating layers, creating the textured surfaces. In other words, when the volume of the wet coating layer is decreased by drying (i.e. some of the coating layer evaporates away), the hollow beads may "appear" on the surfaces of the glove.

[0023] In a first embodiment, a chemical protection glove may comprise an outer layer comprising at least one layer of a chemically impermeable material; a fabric layer located beneath the outer layer of the glove; and an inner layer configured to contact the user's skin comprising a plurality of hollow beads dispersed throughout the inner layer, wherein the hollow beads at least partially extend from the surface of the inner layer, and wherein the hollow beads create a textured surface on the inner layer.

[0024] A second embodiment can include the glove of the first embodiment, wherein the outer layer and inner layer of the glove comprise a polyurethane solution.

[0025] A third embodiment can include the glove of the first or second embodiments, wherein the polyurethane solution of the outer layer penetrates through the fabric layer to form the inner layer.

[0026] A fourth embodiment can include the glove of any of the first to third embodiments, wherein the outer layer also comprises a plurality of hollow beads dispersed throughout the outer layer, wherein the hollow beads at least partially extend from the surface of the outer layer, and wherein the hollow beads create a textured surface on the outer layer.

[0027] A fifth embodiment can include the glove of any of the first to fourth embodiments, wherein the glove is formed by dipping the fabric layer into a polyurethane solution comprising the hollow beads, and wherein the polyurethane solution penetrates through the fabric layer to form the outer layer and the inner layer.

[0028] A sixth embodiment can include the glove of the fifth embodiment, wherein the polyurethane solution further

comprises a dimethylformamide solvent.

[0029] A seventh embodiment can include the glove of any of the first to sixth embodiments, wherein the hollow beads comprise a diameter less than approximately 50 micrometers.

[0030] An eighth embodiment can include the glove of any of the first to seventh embodiments, wherein the hollow beads comprise a hollow glass material.

[0031] A ninth embodiment can include the glove of any of the first to eighth embodiments, wherein the hollow beads comprise at least one of the following materials: hollow glass beads, hollow polyvinyl chloride beads, hollow polyvinyl alcohol beads, polymethyl methacrylate, other hollow organic and inorganic beads, or a combination thereof.

[0032] A tenth embodiment can include the glove of any of the first to ninth embodiments, wherein the polyurethane solution comprises a crosslink agent.

[0033] In an eleventh embodiment, a method for forming a chemical protection glove may comprise placing a fabric layer onto a glove mold; dipping the glove mold with the fabric layer into a polyurethane solution comprising a plurality of hollow beads; forming an outer layer of the polyurethane solution onto the fabric layer, wherein the hollow beads are dispersed through the outer layer; and forming an inner layer of the polyurethane solution by allowing the polyurethane solution to penetrate the fabric layer, wherein the hollow beads are dispersed throughout the inner layer.

[0034] A twelfth embodiment can include the method of the eleventh embodiment, further comprising drying the glove.

[0035] A thirteenth embodiment can include the method of the eleventh or twelfth embodiments, further comprising creating a textured surface on the inner layer by at least partially exposing the hollow beads of the inner layer.

[0036] A fourteenth embodiment can include the method of the thirteenth embodiment, wherein partially exposing the hollow beads of the inner layer is accomplished by drying the glove.

[0037] A fifteenth embodiment can include the method of the any of the eleventh to fourteenth embodiments, further comprising creating a textured surface on the inner layer by at least partially exposing the hollow beads of the outer layer.

[0038] A sixteenth embodiment can include the method of the fifteenth embodiment, wherein partially exposing the hollow beads of the outer layer is accomplished by drying the glove.

[0039] A seventeenth embodiment can include the method of any of the eleventh to sixteenth embodiments, further comprising mixing the polyurethane solution comprising polyurethane latex, a solvent, the hollow beads, and a pigment.

[0040] In an eighteenth embodiment, a chemical protection glove may comprise an outer layer comprising at least one layer of a chemically impermeable material, and comprising a plurality of hollow beads dispersed throughout the outer layer, wherein the hollow beads at least partially extend from the surface of the outer layer, and wherein the hollow beads create a textured surface on the outer layer; a fabric layer located beneath the outer layer of the glove, wherein the material of the outer layer at least partially penetrates through the fabric layer; and an inner layer configured to contact the user's skin comprising a plurality of hollow beads dispersed throughout the inner layer, wherein the hollow beads at least partially extend from the surface of the inner layer, and wherein the hollow beads create a textured surface on the inner layer.

[0041] A nineteenth embodiment can include the glove of the eighteenth embodiment, wherein the glove is formed by dipping the fabric layer into a polyurethane solution comprising the hollow beads, and wherein the polyurethane solution penetrates through the fabric layer to form the outer layer and the inner layer.

[0042] A twentieth embodiment can include the glove of the eighteenth or nineteenth embodiments, wherein the hollow beads comprise a hollow glass material and comprise a diameter less than approximately 50 micrometers.

[0043] While various embodiments in accordance with the principles disclosed herein have been shown and described above, modifications thereof may be made by one skilled in the art without departing from the spirit and the teachings of the disclosure. The embodiments described herein are representative only and are not intended to be limiting. Many variations, combinations, and modifications are possible and are within the scope of the disclosure. Alternative embodiments that result from combining, integrating, and/or omitting features of the embodiment(s) are also within the scope of the disclosure. Accordingly, the scope of protection is not limited by the description set out above, but is defined by the claims which follow, that scope including all equivalents of the subject matter of the claims. Each and every claim is incorporated as further disclosure into the specification and the claims are embodiment(s) of the present invention(s). Furthermore, any advantages and features described above may relate to specific embodiments, but shall not limit the application of such issued claims to processes and structures accomplishing any or all of the above advantages or having any or all of the above features.

[0044] Additionally, the section headings used herein are provided for consistency with the suggestions under 37 C.F.R. 1.77 or to otherwise provide organizational cues. These headings shall not limit or characterize the invention(s) set out in any claims that may issue from this disclosure. Specifically and by way of example, although the headings might refer to a "Field," the claims should not be limited by the language chosen under this heading to describe the so-called field. Further, a description of a technology in the "Background" is not to be construed as an admission that certain technology is prior art to any invention(s) in this disclosure. Neither is the "Summary" to be considered as a limiting characterization of the invention(s) set forth in issued claims. Furthermore, any reference in this disclosure to "invention" in the singular should not be used to argue that there is only a single point of novelty in this disclosure. Multiple inventions

may be set forth according to the limitations of the multiple claims issuing from this disclosure, and such claims accordingly define the invention(s), and their equivalents, that are protected thereby. In all instances, the scope of the claims shall be considered on their own merits in light of this disclosure, but should not be constrained by the headings set forth herein.

[0045] Use of broader terms such as "comprises," "includes," and "having" should be understood to provide support for narrower terms such as "consisting of," "consisting essentially of," and "comprised substantially of." Use of the terms "optionally," "may," "might," "possibly," and the like with respect to any element of an embodiment means that the element is not required, or alternatively, the element is required, both alternatives being within the scope of the embodiment(s). Also, references to examples are merely provided for illustrative purposes, and are not intended to be exclusive.

[0046] While several embodiments have been provided in the present disclosure, it should be understood that the disclosed systems and methods may be embodied in many other specific forms without departing from the spirit or scope of the present disclosure. The present examples are to be considered as illustrative and not restrictive, and the intention is not to be limited to the details given herein. For example, the various elements or components may be combined or integrated in another system or certain features may be omitted or not implemented.

[0047] Also, techniques, systems, subsystems, and methods described and illustrated in the various embodiments as discrete or separate may be combined or integrated with other systems, modules, techniques, or methods without departing from the scope of the present disclosure. Other items shown or discussed as directly coupled or communicating with each other may be indirectly coupled or communicating through some interface, device, or intermediate component, whether electrically, mechanically, or otherwise. Other examples of changes, substitutions, and alterations are ascertainable by one skilled in the art and could be made without departing from the spirit and scope disclosed herein.

Claims

1. A chemical protection glove (100) comprising:

an outer layer (106) comprising at least one layer of a chemically impermeable material;
a fabric layer (104) located beneath the outer layer (106); and
an inner layer (108) configured to contact a user's skin comprising a plurality of hollow beads (120) dispersed throughout the inner layer (108), wherein the hollow beads (120) at least partially extend from a surface of the inner layer (108), and wherein the hollow beads (120) create a textured surface on the inner layer (108).

2. The chemical protection glove (100) of claim 1, wherein the outer layer (106) and inner layer (108) comprise a polyurethane solution.

3. The chemical protection glove (100) of claim 2, wherein the polyurethane solution of the outer layer (106) extends through the fabric layer (104) to form the inner layer (108).

4. The chemical protection glove (100) of claim 1, wherein the outer layer (106) comprises a plurality of hollow beads (120) dispersed throughout the outer layer (106), wherein the plurality of hollow beads (120) at least partially extend from the surface of the outer layer (106), and wherein the hollow beads (120) create a textured surface on the outer layer (106).

5. The chemical protection glove (100) of claim 1, wherein the fabric layer (104) is saturated with a polyurethane solution comprising the hollow beads (120), and wherein the polyurethane solution extends through the fabric layer (104) to form the outer layer (106) and the inner layer (108).

6. The chemical protection glove (100) of claim 5, wherein the polyurethane solution further comprises a dimethylformamide solvent.

7. The chemical protection glove (100) of claim 1, wherein the hollow beads (120) have a diameter of less than or equal to about 50 micrometers.

8. The chemical protection glove (100) of claim 1, wherein the hollow beads (120) comprise a hollow glass material.

9. The chemical protection glove (100) of claim 1, wherein the hollow beads (120) comprise at least one of the following materials: hollow glass beads, hollow polyvinyl chloride beads, hollow polyvinyl alcohol beads, hollow polymethylmethacrylate beads, other hollow organic and inorganic beads, or any combination thereof.

10. The chemical protection glove (100) of claim 1, wherein the chemically impermeable material comprises a polyurethane solution, and wherein the polyurethane solution comprises a crosslink agent.

11. A method for forming a chemical protection glove comprising:

5 placing a fabric layer onto a glove mold;
dipping the glove mold with the fabric layer into a polyurethane solution comprising a plurality of hollow beads;
forming an outer layer of the polyurethane solution onto the fabric layer, wherein the hollow beads are dispersed
10 through the outer layer; and
forming an inner layer of the polyurethane solution by allowing the polyurethane solution to penetrate the fabric layer, wherein the hollow beads are dispersed throughout the inner layer.

12. The method of claim 11, further comprising: drying the glove.

15 13. The method of claim 11, further comprising: creating a textured surface on the inner layer by at least partially exposing the hollow beads of the inner layer.

14. The method of claim 11, further comprising: creating a textured surface on the inner layer by at least partially exposing the hollow beads of the outer layer.

20 15. The method of claim 11, further comprising: mixing the polyurethane solution, wherein the polyurethane solution comprises polyurethane latex, a solvent, the hollow beads, and a pigment.

25

30

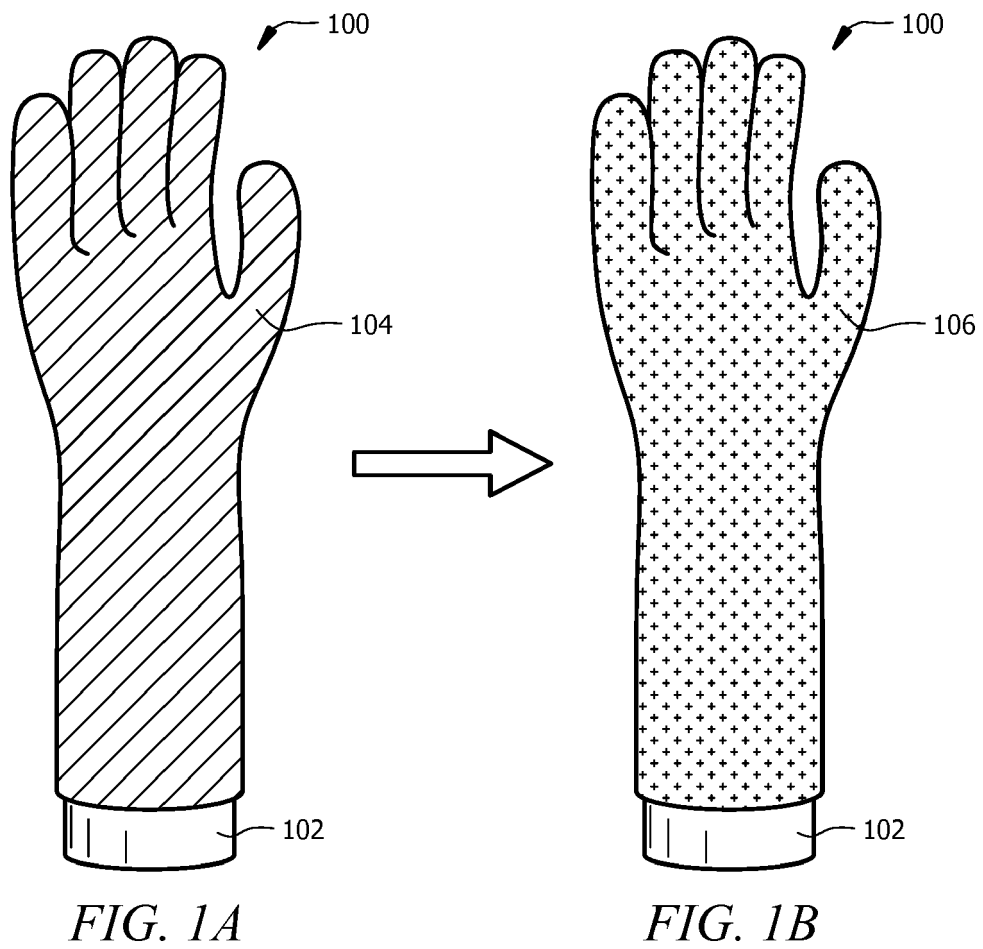
35

40

45

50

55



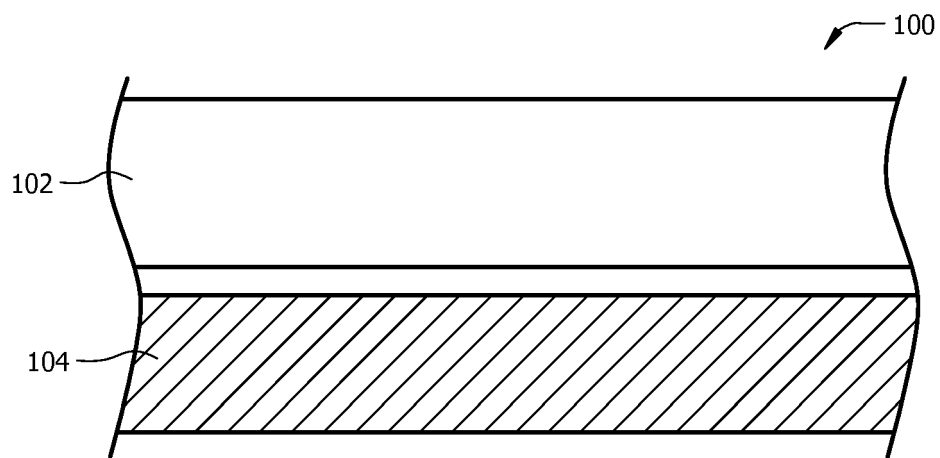


FIG. 2A

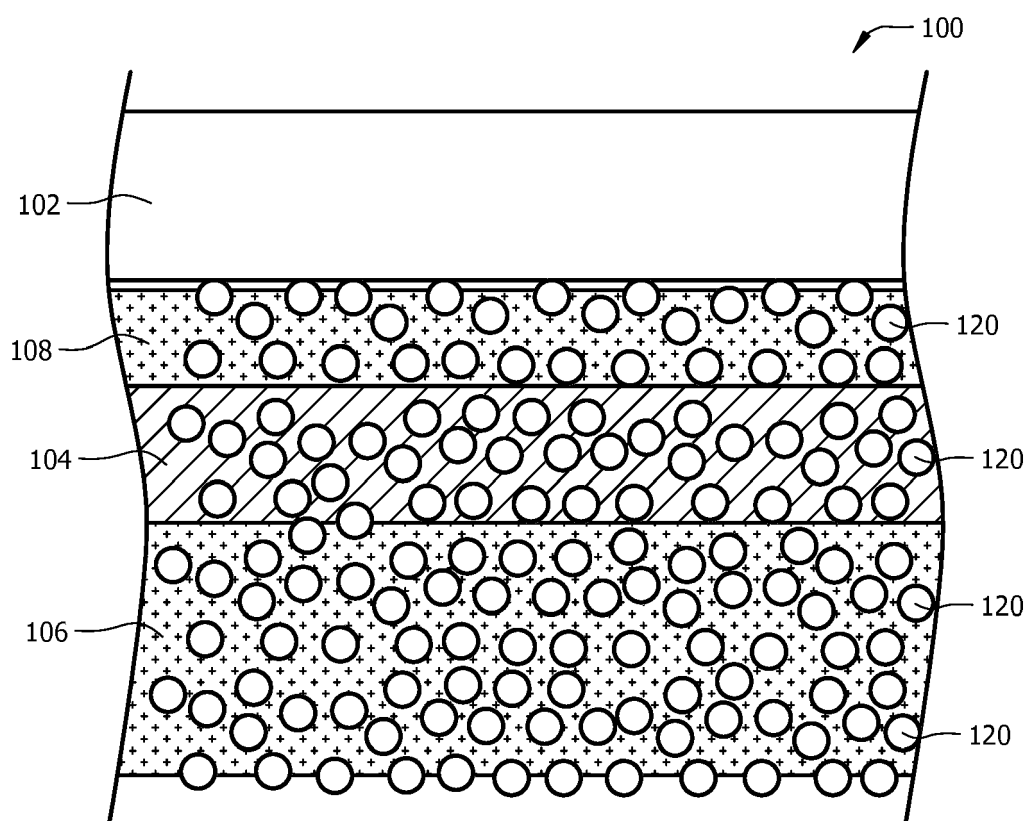


FIG. 2B



EUROPEAN SEARCH REPORT

Application Number
EP 16 19 1251

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2016/029721 A1 (SHEEHY BRIAN HART [US] ET AL) 4 February 2016 (2016-02-04) * page 1, paragraphs 6,8,10,11 * * page 2, paragraphs 21,26,29 *	1-15	INV. A62D5/00
A	WO 2015/074106 A1 (ANSELL LTD [AU]) 28 May 2015 (2015-05-28) * claims *	1-15	
A	DE 203 18 173 U1 (BLUECHER GMBH [DE]) 25 November 2004 (2004-11-25) * the whole document *	1-15	
A	DE 203 18 069 U1 (BLUECHER GMBH [DE]) 5 January 2005 (2005-01-05) * the whole document *	1-15	
A	US 2011/206920 A1 (EHSANI MOHAMMAD REZA [US]) 25 August 2011 (2011-08-25) * the whole document *	1-15	
A	WO 2008/108755 A1 (DU PONT [US]; MCKINNEY RONALD JAMES [US]; TEW STEPHANIE MICHELLE [US]) 12 September 2008 (2008-09-12) * claims *	1-15	TECHNICAL FIELDS SEARCHED (IPC) A62D
A	US 2003/134063 A1 (VANCE JEFFREY DUANE [US] ET AL) 17 July 2003 (2003-07-17) * claims *	1-15	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 March 2017	Examiner Dalkafouki, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 19 1251

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-03-2017

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016029721 A1	04-02-2016	NONE	
WO 2015074106 A1	28-05-2015	AU 2014353876 A1 EP 3073849 A1 US 2015143609 A1 WO 2015074106 A1	19-05-2016 05-10-2016 28-05-2015 28-05-2015
DE 20318173 U1	25-11-2004	AT 463966 T DE 10354902 A1 DE 20316856 U1 DE 20318173 U1 ES 2343412 T3	15-04-2010 19-05-2005 25-11-2004 25-11-2004 30-07-2010
DE 20318069 U1	05-01-2005	DE 10354623 A1 DE 20317080 U1 DE 20318069 U1	25-05-2005 02-12-2004 05-01-2005
US 2011206920 A1	25-08-2011	NONE	
WO 2008108755 A1	12-09-2008	NONE	
US 2003134063 A1	17-07-2003	AU 2003205093 A1 US 2003134063 A1 WO 03059617 A2	30-07-2003 17-07-2003 24-07-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82