



(51) International Patent Classification:

A41D 19/00 (2006.01) A41H 43/00 (2006.01)

(21) International Application Number:

PCT/US2018/064697

(22) International Filing Date:

10 December 2018 (10.12.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/608,903 21 December 2017 (21.12.2017) US

(71) Applicant: **MEDLINE INDUSTRIES, INC.** [US/US];
Three Lakes Drive, Northfield, Illinois 60093 (US).

(72) Inventors: **ORAVEC, Evan**; c/o Medline Industries, Inc., Three Lakes Drive, Northfield, Illinois 60093 (US). **MACLEOD, Katie**; c/o Medline Industries, Inc., Three Lakes Drive, Northfield, Illinois 60093 (US). **STEPHENS, Margaret**; c/o Medline Industries, Inc., Three Lakes Drive, Northfield, Illinois 60093 (US).

(74) Agent: **KRATZ, Rudy et al.**; Fitch, Even, Tabin & Flannery LLP, 120 S. LaSalle Street, Suite 2100, Chicago, IL 60603 (US).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: DISPOSABLE GLOVES AND METHODS OF USING AND MAKING

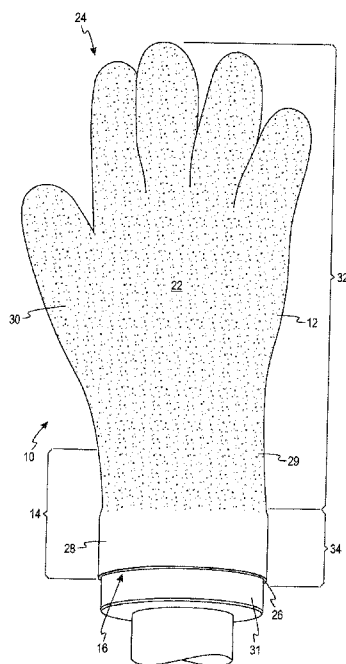


Fig. 2

(57) Abstract: A disposable glove and a method for making the disposable glove that reduces or eliminates glove cuff roll-down. The disposable glove includes a treated area on the interior surface of the glove that extends from the hand area to a portion of the wrist-forearm area of the glove but such that at least a portion of the interior near the glove opening is untreated. The untreated portion of the interior surface of the disposable glove resists glove cuff roll-down when the glove is positioned on a user's hand and forearm.



DISPOSABLE GLOVES AND METHODS OF USING AND MAKING

Technical Field

[0001] This disclosure relates generally to disposable gloves and methods of using and making these gloves.

Background

[0002] Disposable medical gloves are widely used as a protective measure and have become mandatory in many industries and nearly all medical settings. In particular, disposable gloves are required as a means for protecting medical staff from coming into contact with bodily fluids during surgical procedures and cleanup thereof, medical examinations, laboratory testing, and other medical procedures. Disposable gloves have traditionally been made of rubber materials such as latex, thermoplastic materials such as vinyl, and other natural and synthetic materials. Often the gloves have a coating on the interior surface of the disposable gloves to make donning of the gloves easier. Coatings have largely replaced powder in disposable gloves to reduce the occurrence of allergic reactions to the powder by users of the gloves.

[0003] In addition to gloves, medical staff must also wear other protective garments, such as medical or surgical gowns to protect them from coming into contact with bodily fluids. For example, such a gown is typically worn over the torso and arms of medical staff members during cleanup of medical equipment that has been used in a surgical procedure. Disposable gloves may then be placed on the hands and forearms of the individual, while a portion of the glove is placed over the sleeve of the gown to ensure that no portion of the individual's arm or hand is exposed.

[0004] Gowns worn by cleaning personnel typically are manufactured of materials such as blends of polyester, polypropylene and polyethylene. Gowns manufactured from these materials are generally more slippery than surgical gowns of the past that were made out of cloth fabrics.

[0005] The use of these materials in gowns worn by cleaning personnel, in combination with the use of disposable gloves having coatings on the interior surfaces of the gloves, has produced problems for medical staff. Specifically, as coated disposable gloves are

placed over the sleeves of existing gowns, the inner surface of the coated disposable gloves contacts the slippery outer surface of the gown and causes the gloves to roll down the arm or the wrist-forearm of the gown. This problem, often referred to as glove cuff roll-down, permits the possibility of contamination due to partial exposure of the individual's arm.

[0006] The present invention addresses this problem by providing gloves and methods of making gloves that reduce the occurrence of glove cuff roll-down, and cleaning methods involving such gloves.

Brief Description of the Drawings

[0007] FIG. 1 is a perspective view of an exemplary disposable glove with a cut-away portion of the wrist-forearm area;

[0008] FIG. 2 is a perspective view of the disposable glove of FIG. 1 prior to being stripped from its former;

[0009] FIG. 3 comprises a diagrammatic representation of the apparatus used to carry out the method for making the disposable glove of FIG. 1; and

[0010] FIG. 4 comprises a flow diagram illustrating steps in a method for preparing gloves of the type shown in Fig. 1.

[0011] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions and/or relative positioning of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are often not depicted to facilitate a less obstructed view of these various embodiments.

Detailed Description

[0012] Generally speaking, a disposable medical glove includes a flexible body with a first area and a second area. The first area includes a palm and back area that can be disposed adjacent either the palm or back of the hand and a plurality of finger-receiving receptacles. The second area includes a wrist-forearm area. The wrist-forearm area includes a cuff portion and may include a beaded cuff. In an exemplary configuration, the disposable glove is

composed of a nitrile material and has a chlorinated coating that is only partially disposed on the interior surface of the disposable glove. The partial coating on the interior surface of the disposable glove covers the first area and a portion of the second area such that, for example, the beaded cuff and the cuff portion are uncoated and resistant to glove cuff roll-down.

[0013] The gloves may be universally handed such that a user may wear the same glove on either hand. In other words, the palm or back area or the middle body of the glove is configured such that it can be comfortably and effectively worn adjacent a palm of a user or the back of a user's hand without a defined configuration for one hand or the other.

[0014] The flexible body of the disposable medical examination glove is formed of one or more synthetic latex materials, such as, for example, nitrile. The gloves are made by dipping formers, such as ceramic formers, into one or more baths of uncured nitrile material, and then subsequently, dipping the same formers into tanks containing a chlorine solution. When the nitrile-dipped formers are dipped into the chlorine tank, unsaturated bonds in the nitrile material react with the chlorinated coating to form a more slippery, less tacky surface than the uncoated nitrile surface. This surface facilitates donning of the gloves. By not applying the chlorine solution at and near the opening of the glove such that a cuff portion of the glove remains untreated, the nitrile remains unbonded, such that the cuff portion of the resulting glove has a relatively increased tackiness. This provides a higher coefficient of friction between the glove and the surface with which that portion of the glove interacts, such as, the gown sleeve.

[0015] The method for making such disposable gloves generally comprises forming the disposable glove on a ceramic former. The disposable glove includes a first area and a second area. The first area includes a palm-hand area and a plurality of finger-receiving receptacles. The second area includes a wrist-forearm area. The method comprises dipping the disposable glove into a chlorinating solution coating such that the palm-back area and a portion of the wrist-forearm area react with the chlorine to form a lower-friction surface and a portion of the wrist-forearm area remains uncoated. The method further comprises removing the disposable glove from the former by inverting the disposable glove so that the lower-friction surface is disposed on an interior surface of the disposable glove. The uncoated portion of the wrist-forearm area reduces glove cuff roll-down when the disposable glove is worn by a user.

[0016] A method for using the glove includes donning a medical gown, placing a first hand into a first universally-handed disposable glove as described herein above, placing a second hand into a second universally-handed disposed glove, disposing an uncoated, upper portion of the first and second universally-handed disposable gloves over sleeves of the medical gown, and cleaning soiled medical tools or supplies. The gloves alternatively may be used for medical examination purposes, or for other purposes where contamination or soiling of the hands is to be avoided.

[0017] The gloves may be sold in bulk with more than two gloves per package, for instance 10, 25, or 50 gloves per package. This is in contrast to typical surgeon's gloves, which have a pre-defined handedness and which are typically sold in pairs. Any suitable package may be provided. For example, the package may comprise a cardboard box having a tear-away cardboard cutout disposed therein, through which individual ones of the multiple universally-handed gloves is withdrawn for use. In this manner, a user may pull any two of the multiple gloves through an opening through the cardboard box and don them for use.

[0018] The process 400 illustrated in FIG. 4 may be employed to make a disposable glove 10 having a flexible body formed of nitrile that is partially treated with chlorine with an untreated area disposed adjacent the glove opening. The process 400 includes cleaning 402 a ceramic former, brushing 404 the ceramic former, and rinsing 406 the ceramic former. Subsequently, the process 400 comprises dipping 408 the former in a coagulant and then drying 410 the coagulant. At step 412, the former is dipped into a tank of solution, and then, at step 414, the former is placed in an oven. An optional second nitrile dipping step 416 and oven step 418 may follow the first. The former undergoes a leaching process 420, a beading process 422, and a vulcanization process 424. In step 416, the ceramic former and the flexible body of the glove disposed thereon undergo water cooling. These steps are typical of known glove-forming processes.

[0019] After the cooling step 426, the ceramic former undergoes a chlorination step 428. The chlorination dipping step 428 is a short dip, as compared to the nitrile dip, which means that the chlorine does not cover the entire surface of the nitrile glove. The short chlorination dip 428 may be accomplished by lowering the ceramic former a shorter distance than it was lowered into the nitrile tank or the chlorine tank may be lowered the length of the desired short dip. By one approach, the short-dip process described herein coats the interior surface of the glove leaving about 3-in. to about 4-in. of cuff uncoated at the opening of the

disposable glove. Non-limiting examples of a suitable solution for use in the tank for the chlorination dip 428 include a chlorine gas diluted in water, such that the chlorine concentration is in a range of between about 500ppm to about 800ppm. After the short chlorination dip, the process 400 includes post leaching 430 and a chlorination oven step 432. The process 400 also includes stripping 434 a formed disposable glove 10 from the ceramic former.

[0020] The disposable glove 10 shown in Fig. 1 comprises a hollow flexible body article having a first area 11 and a second area 13. The first area 11 includes a hand area 12. The second area 13 includes and a wrist-forearm area 14. The disposable glove 10 has an open end 16 into which a hand is inserted. The hand area 12 includes a palm and back area 22 and a plurality of finger-receiving receptacles 24. Unlike surgeon's gloves, the disposable gloves 10 described herein are universally handed such that the palm-back area 22 may be worn adjacent either the palm or the back of the hand. The wrist-forearm area 14 includes a beaded cuff 26 and a cuff portion 28.

[0021] The ASTM D6319 requires that nitrile examination gloves be at least 1.97 mil (measured as a single wall thickness) or 0.05mm at the finger and at the palm. The thickness of the disposable glove 10 may range from about 1.97 mil thickness to about 13 mil thickness (measured as a single wall thickness). In one illustrative configuration, the thickness of the disposable glove 10 (measured as a single wall thickness) is about 5.5 mil to about 13 mil.

[0022] The wrist-forearm area 14 of FIG. 1 has been cutaway to show the interior surface 29 of the disposable glove 10. A portion of the interior surface 29 of the disposable glove 10 includes a treated surface 30 formed by chlorination as described above.

[0023] This surface 30 is particularly appropriate for disposable gloves intended for cleaning medical devices or tools. The glove may have a length of about 16-inches with 3-4 inches of the glove remaining untreated.

[0024] The partially-treated gloves 10 were compared to nitrile gloves with a completed treated interior in a study where the objective was to assess if the nitrile glove partially-treated with chlorine could reduce the amount the glove "rolls-down" from its initial position on the arm during use. During the study, participants donned either a set of partially-treated nitrile gloves or a set of completely treated nitrile gloves and washed surgical equipment for ten minutes. The top position of the gloves was measured for each arm before

and after washing the equipment. Participants then repeated this procedure with the other glove type; the order of the gloves was randomly assigned. The partially-treated glove demonstrated about 38% less roll-down as compared to the glove with an interior surface entirely treated with chlorine (a roll down of 35.1 mm was measured for a partially-treated set of gloves as opposed to a roll down of 57.2 mm for a fully-treated set of gloves).

[0025] It is contemplated that the treated surface 30 may be disposed on different portions of the interior surface 29 of the disposable glove 10 other than the portions shown in FIG. 1. The location of the treated surface on the interior surface 29 of the disposable glove 10 are features that may be modified based on cost considerations, the desired level of donnability of the disposable glove 10, ease of application of the coating, production capabilities, etc.

[0026] In addition to the treated surface 30 described above, the disposable glove 10 may also be coated with other substances that add to the performance of the disposable glove 10, such as aloe, moisturizers, anti-bacterial agents, anti-fungal agents or combinations thereof.

[0027] With reference to FIG. 2, while on the former 31, the interior surface 29 of the disposable glove 10 is exposed. As shown in FIG. 2, according to one embodiment, a selected portion 32 of the interior surface 29 is treated with a chlorinated solution beginning from the finger-receiving receptacles 24 extending to and including a portion of the wrist-forearm area 14. However, a portion 34 of the interior surface 29 that includes the beaded cuff 26 and the cuff portion 28 is not coated or is at least substantially not coated. In other words, while the embodiments of the present invention described herein include a disposable glove 10 having a portion 34 of the interior surface 29 that is not treated (namely the beaded cuff 26 and the cuff portion 28), it is possible that a small area(s) of the beaded cuff 26 and the cuff portion 28 may contain a nominal amount of chlorination due to, for example, slight variances in the dipping process.

[0028] The uncoated or substantially untreated portions 34 of the interior surface 29, namely the beaded cuff 26 and the cuff portion 28, help to reduce or eliminate the occurrence of glove cuff roll-down. Glove cuff roll-down occurs when the interior surface 29 of the disposable glove 10, which is at least partially coated, comes in contact with the sleeve material of the medical gown, surgical gown or other protective garment and, due to the slippery nature of the coating and the material used in the gown or other protective garment,

causes the gown or other protective garment to slide down the arm or wrist-forearm of a user. Although not intending to be bound by the particular theory or theories disclosed herein, it is believed that the reduction or elimination of glove cuff roll-down is achieved because the interior surface of the disposable gloves made from natural rubber latex and/or synthetic rubber materials is tacky when exposed in an uncoated state. The tacky portion, namely the untreated or substantially untreated portion 34, of the disposable glove 10 is believed to grip the gown sleeves and the gown/protective garment material more effectively.

[0029] Turning to FIG. 3, the former 31 hand is dipped into a first tank of nitrile or other suitable glove-forming material(s) (not shown). In some embodiments, the former 31 may be dipped a second or more times into the first tank of nitrile or other suitable glove-forming material(s) to reinforce the disposable glove 10 as it is formed on the former 31. It is also contemplated that the former 31 could be dipped one or more times into additional glove-forming tank(s). The number of dips or the types of material(s) in the tank(s) may depend on cost considerations, the desired level of donnability of the disposable glove 10, ease of application of the coating, production capabilities, etc. The former 31 containing the nitrile or the other suitable glove-forming material(s) formed by this dipping process may then be cured to form the disposable glove 10 having a hand area 12 and a wrist-forearm area 14. At this point, the disposable glove 10 is in an inverted position on the former 31, with the interior surface 29 of the disposable glove 10 exposed.

[0030] The disposable glove 10 formed by the dipping process as described above is, in one embodiment, then dipped into a tank containing a chlorinated solution 36 as shown in FIG. 3 such that less than all of the disposable glove 10 is immersed in the tank containing the solution 36. Non-limiting examples of suitable materials for use in the treatment tank include, for example, a chlorine gas diluted in water in a particular concentration such that the gloves, on the former, are dipped into a liquid chlorine solution. By one approach, the chlorine in the tank is present in the range of between about 500ppm to about 800ppm.

[0031] After the dipping stage shown in FIG. 3, the disposable gloves 10 are inverted so that the treated surface 30 is on the inside of the disposable glove 10 as depicted in FIG. 1. The disposable gloves 10 are then stripped off of the production line, and then sorted, cleaned/washed, processed, packed, inspected and/or sterilized. The resulting disposable gloves 10 possess improved functional characteristics which permit users to wear the

disposable gloves 10 with surgical gowns or other protective garments without suffering from problems relating to glove cuff roll-down.

[0032] All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or language describing an example (e.g., “such as”) provided herein, is intended to illuminate the invention and does not pose a limitation on the scope of the invention. Any statement herein as to the nature or benefits of the invention or of the preferred embodiments is not intended to be limiting. This invention includes all modifications and equivalents of the subject matter recited herein as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context. The description herein of any reference or patent, even if identified as “prior,” is not intended to constitute a concession that such reference or patent is available as prior art against the present invention. No unclaimed language should be deemed to limit the invention in scope. Any statements or suggestions herein that certain features constitute a component of the claimed invention are not intended to be limiting unless reflected in the appended claims. Neither the marking of the patent number on any product nor the identification of the patent number in connection with any service should be deemed a representation that all embodiments described herein are incorporated into such product or service.

What is claimed:

1. A method of making a disposable glove comprising:
forming an untreated glove on a former, the untreated glove including a first area and a second area, the first area including a palm or back area and a plurality of finger receiving receptacles, the second area forming a wrist and forearm area;
dipping the untreated glove into a chlorinated solution such that the palm or back portion and the plurality of finger receiving receptacles and only a lower portion of the wrist and forearm area are treated to yield a relatively lower-friction surface and an upper portion of the wrist and forearm area remain uncoated, thereby retaining a higher level of tackiness;
removing the glove from the former; and
inverting the disposable glove so that the treated surface is disposed on a portion of an interior surface.
2. The method of claim 1 wherein the former is not handed such that the disposable glove is universally handed.
3. The method of claim 1 wherein the forming of the disposable glove comprises dipping the former into a tank of uncured nitrile.
4. A disposable medical examination glove comprising:
a flexible body forming the disposable medical examination glove, the flexible body having a first area including a palm-back area and a plurality of finger receiving receptacles and a second area forming a wrist and forearm area; and
a partially-treated interior, where the partially-treated interior comprises a chlorine-treated surface, and the partially-coated interior is disposed on the first area, and wherein at least a portion of the second area, including a cuff portion, is untreated such that the cuff portion remains resistant to glove cuff roll-down.
5. The disposable glove of claim 4 wherein the glove is universally handed such that the palm-back area of the flexible body is configured to be disposed adjacent a palm or back hand of a user.

6. The disposable glove of claim 6 wherein at least a portion of the flexible body of the disposable medical examination glove is formed of nitrile.
7. A method for using a medical exam glove comprising in any appropriate order:
 - donning a medical gown;
 - placing a first hand in a first universally-handed disposable glove by sliding the first hand into a first chlorine-treated section of the first universally-handed disposable glove;
 - placing a second hand in a second universally-handed disposable glove by sliding the second hand into a second chlorine-treated section of the second universally-handed disposable glove;
 - disposing an untreated, upper portion of each of the first and second universally-handed disposable gloves over sleeves of the medical gown; and
 - cleaning soiled medical tools.
8. A container of disposable medical gloves comprising:
 - a package containing therewith more than two universally-handed disposable gloves;
 - each of the multiple universally-handed disposable gloves having a partially-treated interior having a chlorine treatment applied thereto and an untreated interior area disposed adjacent an opening of the disposable glove, the untreated area including at least a glove cuff.
9. A container according to claim 8, the package comprising and
 - a cardboard box having a tear-away cardboard cutout disposed therein subsequently forming a box opening, through which individual ones of the multiple universally-handed may be withdrawn for use.

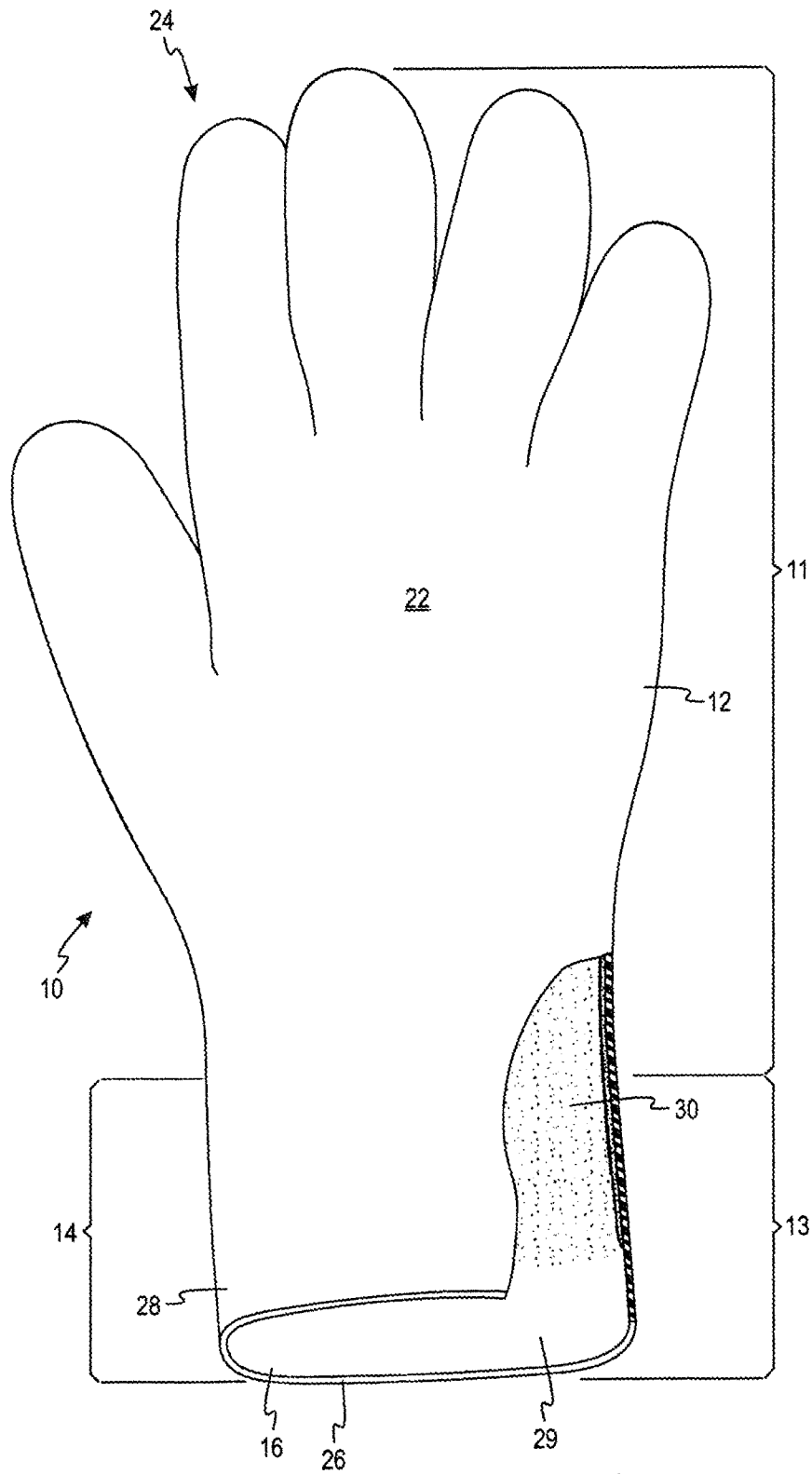
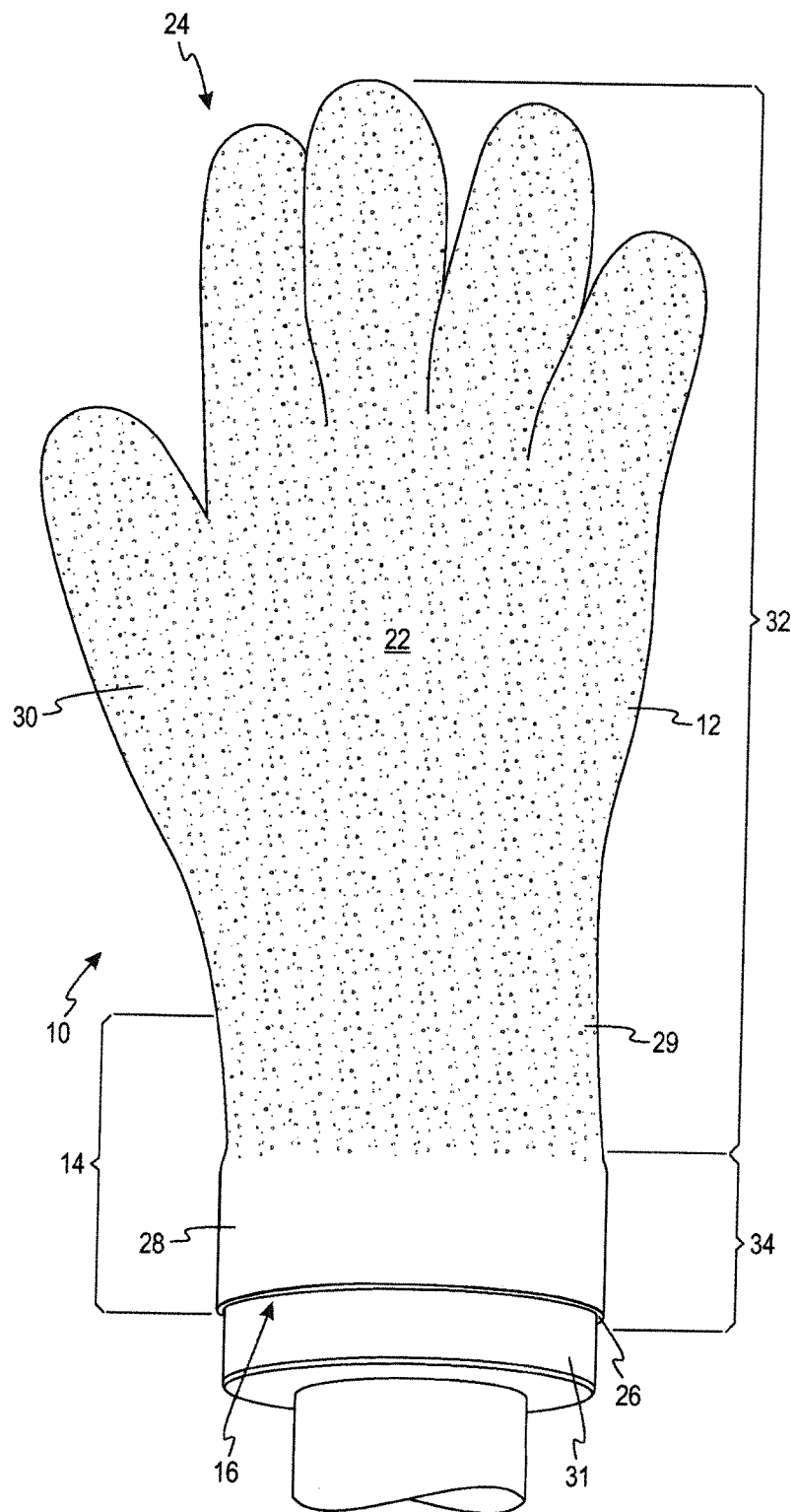


Fig. 1

*Fig. 2*

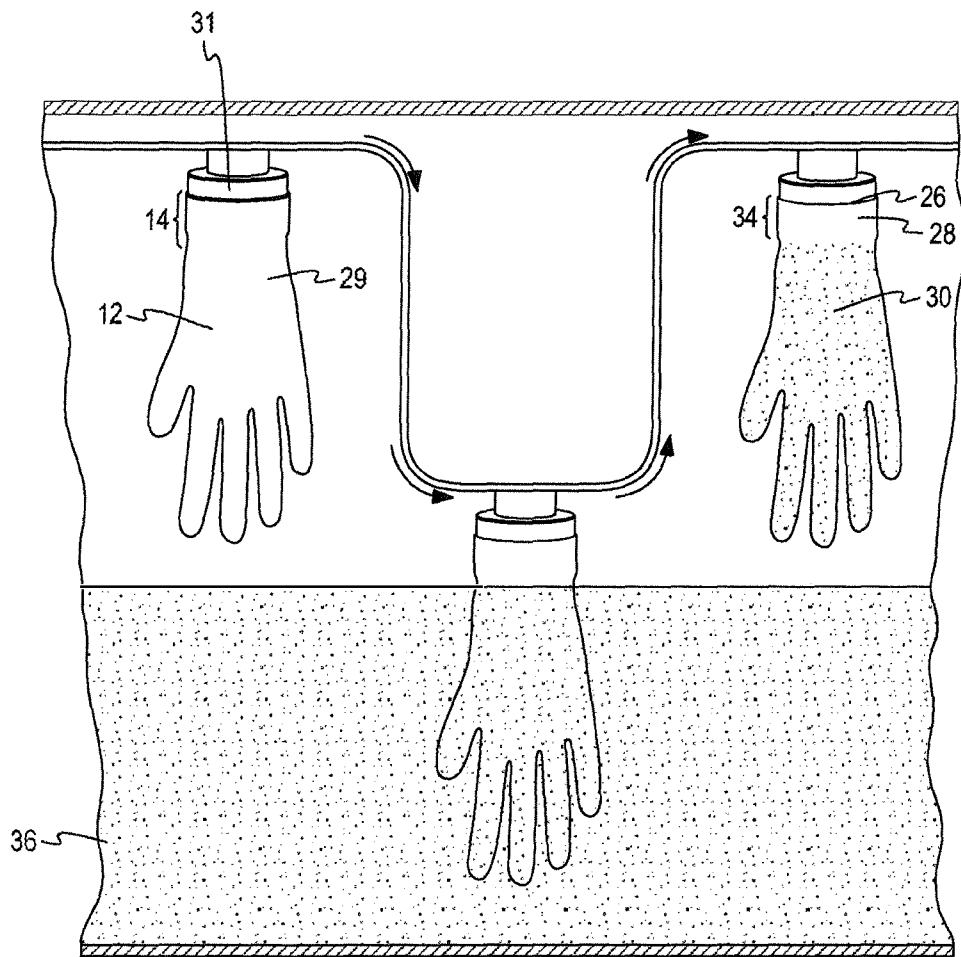
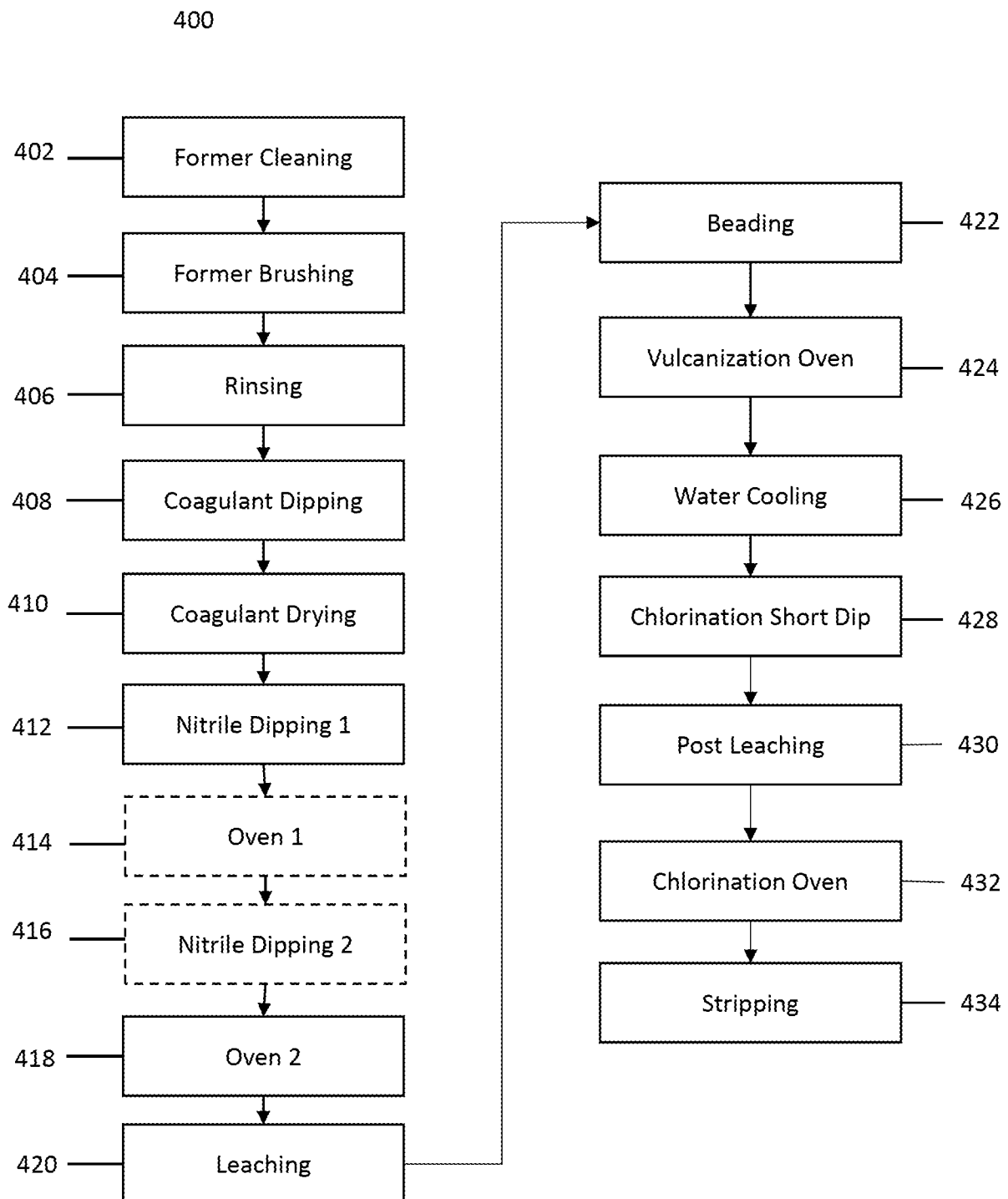


Fig. 3

FIG. 4

Process Flow Diagram

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/064697**A. CLASSIFICATION OF SUBJECT MATTER****A41D 19/00(2006.01)i, A41H 43/00(2006.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A41D 19/00; A61B 19/04; A61K 36/886; B65D 75/54; B65D 85/18; C08K 5/36; C08L 9/00; A41H 43/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & keywords: glove, chlorinate, friction, container, dip, tackiness

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1709879 A2 (MEDLINE INDUSTRIES, INC.) 11 October 2006 See paragraphs 18-27, claim 2, and figures 1, 3.	1-6
A		7-9
X	EP 1863394 B1 (KIMBERLY-CLARK WORLDWIDE, INC.) 03 December 2008 See paragraphs 11-15, claims 6, 9, and figures 1-3.	7
Y		1-6, 8-9
Y	US 2015-0329275 A1 (MEDLINE INDUSTRIES, INC.) 19 November 2015 See paragraphs 30-35, claims 1-2, and figure 1.	8-9
A	JP 2017-508840 A (ANSELL LIMITED) 30 March 2017 See paragraphs 20-26, and figures 1-2.	1-9
A	US 7579028 B1 (YUNG CHU CHENG et al.) 25 August 2009 See column 2, line 53 - column 3, line 43, and figures 2-4.	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

09 April 2019 (09.04.2019)

Date of mailing of the international search report

10 April 2019 (10.04.2019)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea



Facsimile No. +82-42-481-8578

Authorized officer

MIN, In Gyou

Telephone No. +82-42-481-3326



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/064697

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1709879 A2	11/10/2006	CA 2541922 A1 EP 1709879 A3 US 2006-0222688 A1	04/10/2006 04/06/2008 05/10/2006
EP 1863394 B1	03/12/2008	CA 2601409 A1 EP 1863394 A1 JP 2008-534801 A MX 2007011968 A US 2006-0218697 A1 WO 2006-107377 A1	12/10/2006 12/12/2007 28/08/2008 07/12/2007 05/10/2006 12/10/2006
US 2015-0329275 A1	19/11/2015	US 10086975 B2 US 10220979 B2 US 2016-0311577 A1	02/10/2018 05/03/2019 27/10/2016
JP 2017-508840 A	30/03/2017	AU 2015-234680 A1 AU 2015-234680 B2 CN 106459515 A EP 3122816 A1 EP 3122816 A4 US 2015-0272241 A1 WO 2015-143473 A1	07/07/2016 08/11/2018 22/02/2017 01/02/2017 30/08/2017 01/10/2015 01/10/2015
US 7579028 B1	25/08/2009	None	