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(71) Applicant: **Glassford, Adam**
Harrogate, Yorkshire HG3 3ET (GB)

(72) Inventor: **Glassford, Adam**
Harrogate, Yorkshire HG3 3ET (GB)

(74) Representative: **Denнемeyer & Associates S.A.**
Postfach 70 04 25
81304 München (DE)

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(54) PROTECTIVE GARMENTS

(57) A protective garment (10) comprising a pair of arms (12, 14) and a body portion (16) having a vertical split (22) along its length, the body portion further comprising an opening for receiving a user's head (18) there-

through, wherein at least a part of the protective garment is manufactured from a water repellent material comprising a polyester base and polyurethane coating having a weight of 70 grams per square meter.

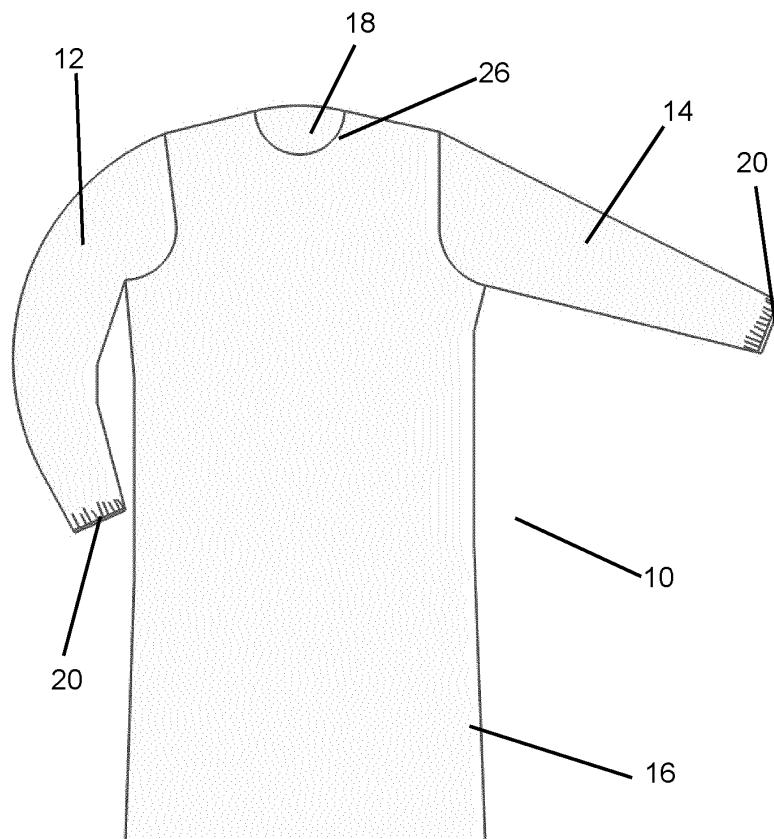


FIG. 1

EP 3 909 455 A1

Description

[0001] The present invention relates to protective garments and more specifically a re-usable gown for protecting its wearer during provision of medical treatment and care.

[0002] Activities such as dentistry, surgery and provision of care to the sick and elderly have an inherent risk of transmission of infection through saliva, blood, and other bodily fluids. To counter this risk, medical and care professionals wear personal protective equipment such as gowns, gloves, face masks and eye protection during aerosol generating procedures (AGP). Such personal protective equipment is typically disposable so as to mitigate the risk of bacterial or viral cells that might be harboured by personal protective equipment if it were to be reused. Most countries have strict safety requirements that must be adhered to if personal protective equipment is to be cleaned and reused. In the United Kingdom for example, gowns and trousers, for example, must: i) be capable of decontamination by washing at 60 degrees Celsius to kill all bacterial and viral cells; ii) be capable of being chemically decontaminated using chemicals such as bleach, hypochlorous acid and isopropyl alcohol; iii) be water repellent; and iv) be CE marked (subject to certain exemptions).

[0003] The 2020 COVID-19 pandemic resulted in critical shortages of personal protective equipment in hospitals globally. In some cases, personal protective equipment was re-used between patients thus increasing the risk of virus transmission to both patients and medical professionals. To plug the gap in availability of PPE, businesses across industry sectors re-purposed their staff to manufacture face masks, gowns and respirators, for example. With limited exceptions, such PPE was intended to be used once and then disposed. The exponential and then likely maintained increase in medical waste will have a serious environmental effect through increased land fill and pollution from incineration of pollutant materials.

[0004] One important item of PPE is a gown that may be used during surgery or administration of medical treatment by medical professionals to maintain a barrier between patient and the medical professional's clothes or exposed arms. Gowns may also be worn by family members of patients during certain medical procedures, i.e., caesarean, and during visits to those that are ill or in care.

[0005] Prior art gowns comprise a pair of arms each sewn to a body portion that is completely open at the back. In use, a wearer inserts their arms into respective arms of the gown and fastens the gown at the back to secure it around their body. Standard gowns are manufactured from an impermeable material or a tightly woven fabric but are not capable of meeting the safety requirements set out by the United Kingdom government for re-use.

[0006] Prior to surgery, or application of medical treatment or care, a medical or healthcare professional dons a surgical gown to provide a safe and effective barrier between the professional and their patient.

[0007] Typically, gowns, whether sterile as used during surgery, or non-sterile as used by other healthcare professionals, are intended for single use. The materials chosen for prior art, single use gowns fulfil the requirement of low unit cost and the ability to be sterilised through a gamma irradiation sterilisation process, in the case of sterile gowns, for example.

[0008] Recyclable gowns exist that comprise a fabric base layer and some form of water-resistant coating. These gowns have a high material weight as measured in grams per square meter. This is perceived as necessary to provide a material that is robust and has the properties necessary to permit repeated washing. Even then, such prior art gowns are not suitable for surgical use due to not being capable of withstanding autoclaving for re-sterilisation. Furthermore, heavy weight gowns can cause restriction of movement and feel very different to the much lighter weight single use gowns.

[0009] It is against this background that the present invention has arisen.

SUMMARY

[0010] One aspect of the invention provides a protective garment comprising a pair of arms and a body portion having a vertical split along its length, the body portion further comprising an opening for receiving a user's head therethrough, wherein at least a part of the protective garment is manufactured from a water repellent material comprising a polyester base and polyurethane coating having a combined weight of 70 to 100 grams per square meter.

[0011] The applicant has identified that a material comprising a polyester base and polyurethane outer coating is suitable to meet the requirements of various governmental health departments for reusability of PPE. In other words, the material is capable of being washed at 60 degrees, can be chemically cleansed, is water repellent and is capable of being CE marked. Use of such material in a PPE gown advantageously contributes to reducing the number of required gowns for a single site and reduces waste while still preventing cross-infection between patients and medical professionals. A weight of 70 to 100 grams per square meter was selected by the applicant to provide a material that is lightweight, breathable, liquid repellent and doesn't materially restrict motion of the wearer while still being able to drop under its own weight and not lift unduly during normal activity. The material is also capable of being repeatedly washed at 60 degrees Celsius and chemically cleansed without losing its water-resistant properties. The material can also be autoclaved to enable sterilisation for surgical purposes. Prior art gowns are generally heavier weight per square meter

as it is assumed that this is necessary for such gowns to possess sufficient resilience to temperature and chemicals so as to make them suitable for re-use. The applicant has surprisingly identified that, contrary to accepted logic, a lighter weight gown manufactured from the materials specified herein can provide the same, if not better, attributes as a heavier weight gown. By way of comparison, many prior art reusable gowns have a weight in excess of 180 grams per square meter. This is a significant increase on the typical 30-45 grams per square meter of single use gowns that are manufactured from lightweight non-woven fabrics and polyethylene films. Gowns manufactured according to the present invention thus provide a feel and experience akin to single use gowns and do not materially impede the medical professional.

[0012] The polyurethane coating may be applied to the polyester base using rotary-screen-printing-coating, roll-coating, flow-coating, foam-coating, spray-coating, blade-coating, transfer-coating or a combination thereof and subjecting the coated polyester base to a temperature such that the polyurethane coating is cross-linked to the polyester base. In some embodiments, the polyurethane coating may be applied to a temporary substrate such as a paper backing.

[0013] The coating techniques listed are conventional techniques for coating a base fabric with an external coating. Advantageously, subjecting the polyester base to temperature to cross link the polyurethane coating to the polyester base improves the water repellent properties of the material and adhesion between the polyester based and polyurethane coating. Cross-linking the polyurethane coating to the polyester base may be achieved by pressing the polyester base and polyurethane coating together at an elevated temperature until the polyurethane coating has cured. The paper backing is then removed to leave a smooth outer finish that does not contain imperfections that might otherwise retain bacteria and waste materials.

[0014] Each arm of the gown may comprise an elastic cuff.

[0015] The interface between a medical professional's hands, which should be covered by disposable gloves, and a gown is a potential source of cross-transmission of infection between patient and medical-professional. Embodiments of the invention utilise an elastic cuff to provide a good seal between arms of the gown and the disposable gloves worn by the medical professional.

[0016] The protective garment may further comprise a fastener for securing the body portion of the protective garment around a wearer's waist. The fastener may comprise a tie formed from a pair of cords, each fixed to a respective part of the body portion of the protective garment on opposing sides of the vertical split thereof.

[0017] Many prior art gowns utilise adhesives, hook-and-loop fasteners, magnets, buttons and the like to fasten each of the opposing parts together. These methods of fastening the gown do not create a good seal around the wearer's midriff. Embodiments of the present invention utilise a tie comprising a pair of cords, each cord fixed to a respective part of the body portion. Knotting of the ties pulls the gown tight around the midriff of the wearer and causes the two parts of the gown to overlap thus creating an effective seal between the wearer's underclothes and the gown.

[0018] The tie may be offset from the vertical split such that each tie is spaced apart from an edge of the body portion.

[0019] Such an arrangement results in the overlap between the two parts of the body portion. The greater the offset of the cords from an edge of the body portion, the greater the overlap therebetween.

[0020] The fastener may further comprise a hook and loop configuration at an upper end of the vertical split.

[0021] Providing a simple to use fastener such as a hook and loop fastener adjacent to the wearer's neck provides a secondary seal at the rear of the gown. Combined with a primary seal provided by the overlaps and tie, this secondary seal provides an additional barrier to bodily fluids contacting the skin or under clothing of the wearer. Each arm may be sewn from a piece of material to form a tubular structure and each arm may be sewn to the body portion, wherein each seam is sealed. Each edge of the protective garment may be rolled and sealed.

[0022] Prior art gowns are typically constructed from a single ply of material having raw edges and seams. Such raw edges and seams are a natural collector for bacterial and viral cells and pose a risk for transmission of infection. By sealing the seams of the protective garment and rolling and sealing the edges, the risk of infection that could be caused through re-use of a protective garment is diminished.

[0023] The adhesion between the polyester base and polyurethane coating may be at least 1.5 daN/5cm.

[0024] The applicant has identified that the adhesion between the polyester base and polyurethane coating is directly associated with the number of times that it can be re-used and its resilience to temperature and chemicals. The applicant has discovered that a water repellent material having good adhesion between layers can be washed repeatedly at 95 degrees Celsius without significantly degrading. Furthermore, the water repellent material is capable of being autoclaved at 120 degrees repeatedly without significantly degrading meaning that protective garments manufactured from the material can be re-used in a surgical, or other sterile, setting. The adhesion value is enabled by virtue of the bond between the polyester base and polyurethane outer coating. This bond is provided by pressing the polyester base and polyurethane coating at an elevated temperature, as described above, until the polyurethane coating has cured.

[0025] The tensile strength of the water repellent material may be at least 9 daN/5cm. The tear strength of the water repellent material may be at least 1 daN. The weight of the polyester base may be 30 grams per square meter. The weight of the polyurethane coating may be 65 grams per square meter.

[0026] The foregoing is a summary and thus, may contain simplifications, generalizations, inclusions, and/or omissions of detail. Consequently, those skilled in the art will appreciate that the summary is illustrative only and is not intended

to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described hereinabove, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

FIGURES

Aspects and embodiments of the invention will now be described by way of reference to the following figures.

Fig. 1 shows a front view of a gown according to aspects and embodiments of the invention.

Fig. 2 shows a back view of a gown according to aspects and embodiments of the invention.

DESCRIPTION

This invention will be more fully understood by reference to the detailed description in conjunction with the following figures; wherein the primary object of the present invention is to provide an item of PPE in the form of a gown that is re-usable while preventing cross-infection between patients and medical professionals and care givers, for example.

Fig. 1 is a frontal view of a gown (10) according to an embodiment of the present invention. The gown briefly comprises a pair of arms (12, 14) and a body portion (16). An opening (18) for a wearer's head is provided at the top of the body portion (16). Each of the arms (12, 14) is elasticated at their respective cuff (20) for providing a seal around the wearer's wrists.

Fig. 2 is a back view of the gown (10) and shows a vertical split (22) running vertically down the entire length of the back of the gown (10) and a fixing means, i.e., a tie, (24) for fixing both sides of the body portion (16) around the body of the wearer. As shown, the tie (24) comprises a pair of cords, one attached to each part of the body portion (16), on opposing sides of the vertical split (22) thereof. In some embodiments, a hook and loop fastener (not shown) provides attachment of the two opposing parts of the body portion (16) adjacent to the collar (26) thereof. One part of the hook and the loop is sewn into one of the opposing sides of the vertical split (22) and the other of the hook and the loop is sewn into the other of the opposing sides of the vertical split (22). In some embodiments, the front of the gown (10), as shown in Fig. 1, is longer than the back of the gown (10), as shown in Fig. 2.

Gowns (10) according to embodiments of the invention are manufactured from a material comprising a fabric base and polyurethane (PU) coating having a combined weight of 70 to 100 grams per square meter. In one embodiment, the fabric base is 100% polyester. In one embodiment, the polyester base has a weight of 30 grams per square meter and the PU coating has a weight of 65 grams per square meter making a combined weight of 95 grams per square meter.

The material is prepared by using a coating process. Examples of coating processes include, but are not limited to, rotary-screen-printing-coating, roll-coating, flow-coating, foam-coating, spray-coating, blade-coating, transfer-coating or a combination thereof to apply the PU coating to the polyester base or to a temporary substrate. In some embodiments, the PU coating is applied to a paper backing. The PU coating may then be laid over the polyester base and pressed until cured. Once cured, the paper backing is removed to leave a smooth outer surface. Curing occurs by subjecting the PU coating to increased temperature such that the PU coating is cross-linked to the polyester base. The adhesion between the polyester base and PU coating is at least 1.5 daN/5 cm. This provides a breathable and liquid repellent material that meets the requirements of various governmental health departments.

The PU coated polyester has the following additional properties:

Tensile strength (length and width)	>9 daN/5cm
Tear strength (length and width)	>1 daN
Seam resistance (length and width)	>6 daN/5cm
% elongation under 30N/5cm (length)	>35%
% elongation under 30N/5cm (width)	>55%
Water vapour permeability	>900 gm ² / 24 hours

The PU coated polyester is provided by the sheet or on a roll and cut to size and shape using a standard pattern. Each gown (10) is manufactured from several pieces of material including at least the arms (12, 14) and the body portion (16). Each of the arms (12, 14) is cut as a substantially rectangular shape and sewn together along its length to form a tubular structure. Elastic is sewn into the cuff (20) of each arm (12, 14). The body portion (16) is shaped such that a cut-

out is provided for each arm (12, 14) to be attached to. The body portion (16) is folded such that the circular cut-out is positioned substantially central when the gown (10) is viewed from the front. The arms (12, 14) are sewn to the body portion (16). All seams of the gown (10) are sealed to mitigate the risk of bacterial or viral cells taking hold in the seams.

[0035] In use, a wearer pulls the gown (10) over their head and inserts it through the opening (18). Each of the wearer's arms is inserted into a respective arm (12, 14) of the gown (10). The two parts of the body portion (16) are pulled together to close the gown (10) at the rear and the tie (24) is knotted to secure the gown (10) tightly around the wearer's midriff. The hook-and-loop fastener is fastened adjacent to the wearers neck. The wearer's hands are protected by way of disposable gloves and their face is protected by a face mask, or similar.

[0036] The present invention is described by way of reference to a gown, whether sterile, or non-sterile. However, a person skilled in the art will appreciate that the material chosen for such a gown may equally be applicable to other medical articles such as drapes, caps and bibs. The principal of the invention remains the same, i.e., use of a lightweight, reusable material that is resilient to temperature and chemicals so as to return a used protective garment or article to a clean, non-sterile condition. Such a protective garment is first washed at a minimum of 60 degrees Celsius, for non-sterile protective garments, and preferably at 95 degrees Celsius, for sterile protective garments. Protective garments according to aspects of the invention may be resterilized through autoclaving at 120 degrees Celsius or by using a gamma irradiation sterilisation process, or similar.

[0037] Although the present invention has been described by way of reference to a material having a polyester base, it will be appreciated that such disclosure is made in the interests of providing one way in which the person of ordinary skill in the art could put the invention into use. In some embodiments, the polyester base may be replaced with an alternative fabric such as microfibre, nylon, or a blend of different materials, in each case providing such materials have equivalent material properties to those described in connection with the present invention.

[0038] The above description is for the purpose of teaching the person of ordinary skill in the art how to practice the present invention, and it is not intended to detail all those obvious modification and variations of which it will become apparent to the person of ordinary skill in the art upon reading this description. It is intended, however, that all such obvious modifications and variations be included within the scope of the present invention, which is defined by the following claims. The claims are intended to cover the claimed components and steps in any sequence which is effective to meet the objectives there intended, unless the context specifically indicates to the contrary.

Claims

1. A protective garment comprising a pair of arms and a body portion having a vertical split along its length, the body portion further comprising an opening for receiving a user's head therethrough, wherein at least a part of the protective garment is manufactured from a water repellent material comprising a polyester base and polyurethane coating having a weight of 70 to 100 grams per square meter.
2. A protective garment according to claim 1, wherein the entirety of the garment is manufactured from the water repellent material.
3. A protective garment according to claim 1 or claim 2, wherein the water repellent material comprises a 100% polyester base.
4. A protective garment according to any preceding claim, wherein the polyurethane coating is applied using rotary-screen-printing-coating, roll-coating, flow-coating, foam-coating, spray-coating, blade-coating, transfer-coating or a combination thereof and subjecting the coated polyester base to a temperature such that the polyurethane coating is cross-linked to the polyester base.
5. A protective garment according to any preceding claim, wherein each arm of the protective garment comprises an elastic cuff.
6. A protective garment according to any preceding claim further comprising a fastener for securing the body portion of the protective garment around a wearer's waist.
7. A protective garment according to claim 6, wherein the fastener comprises a tie formed from a pair of cords, each fixed to a respective part of the body portion of the protective garment on opposing sides of the vertical split thereof.
8. A protective garment according to claim 7, wherein the fastener further comprises a hook and loop configuration at an upper end of the vertical split.

9. A protective garment according to any preceding claim that is configured to be re-used.
10. A protective garment according to any preceding claim wherein each arm is sewn from a piece of material to form a tubular structure and each arm is sewn to the body portion, wherein each seam is sealed.
11. A protective garment according to any preceding claim wherein each edge of the protective garment is rolled and sealed.
12. A protective garment comprising a water repellent material comprising a polyester base and polyurethane coating having a weight of 70 grams per square meter.
13. A protective garment according to claim 12 in the form of a drape, gown or bib used for provision of medical treatment or care.
14. A protective garment according to claim 12 or claim 13, wherein the polyester base comprises a 100% polyester base.
15. A protective garment according to any of claims 12 to 15, wherein the polyurethane coating is applied using rotary-screen-printing-coating, roll-coating, flow-coating, foam-coating, spray-coating, blade-coating, transfer-coating or a combination thereof and subjecting the coated polyester base to a temperature such that the polyurethane coating is cross-liked to the polyester base.

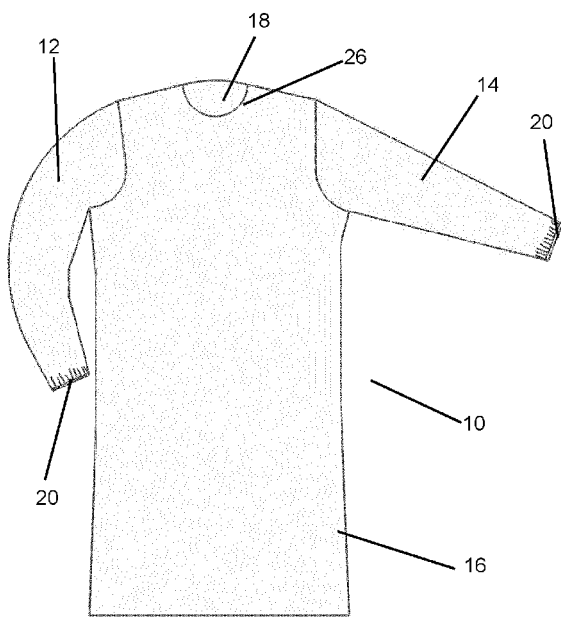


FIG. 1

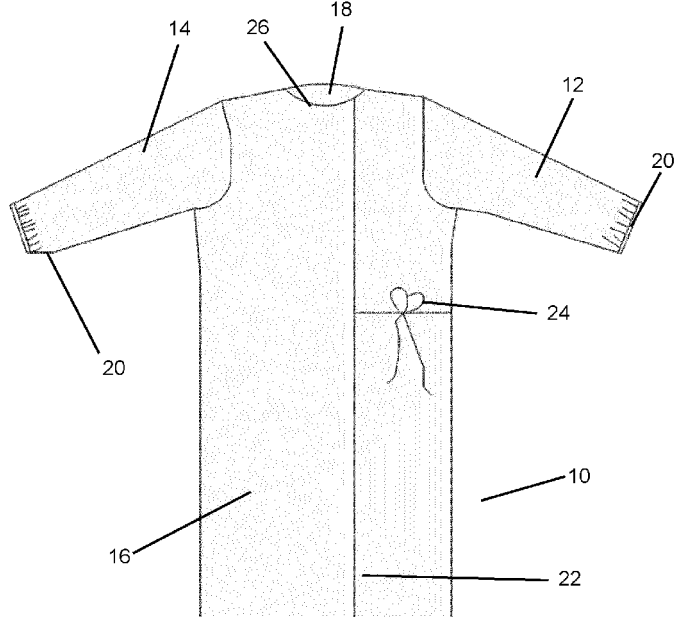


FIG. 2



EUROPEAN SEARCH REPORT

Application Number
EP 20 17 5897

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Place of search The Hague		Date of completion of the search 6 November 2020	Examiner D'Souza, Jennifer
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
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EP 20 17 5897

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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