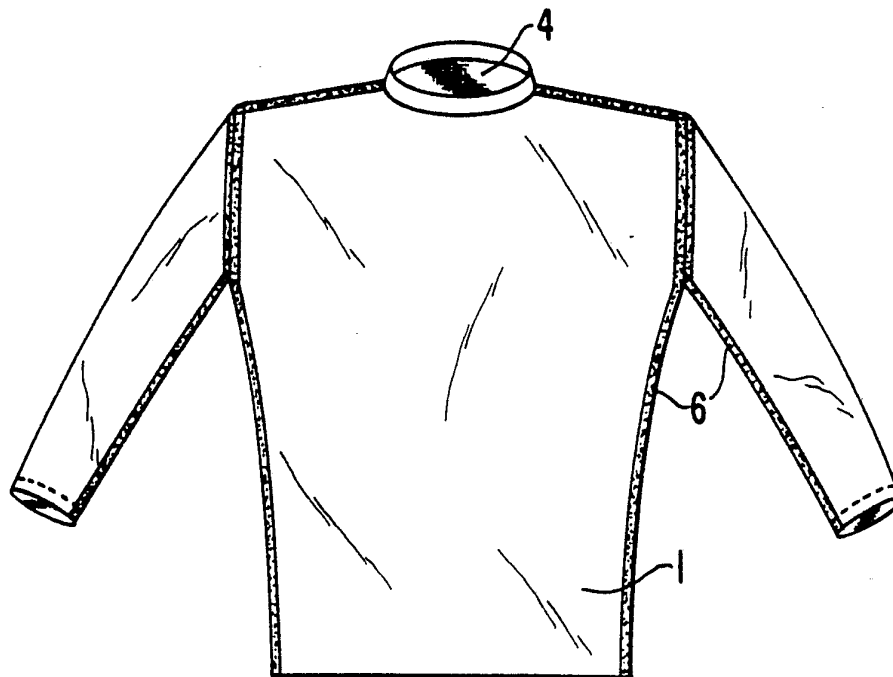




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US92/04291 (22) International Filing Date: 21 May 1992 (21.05.92) (30) Priority data: 704,767 23 May 1991 (23.05.91) US (71) Applicant: W.L. GORE &amp; ASSOCIATES, INC. [US/US]; 551 Paper Mill Road, P.O. Box 9206, Newark, DE 19714 (US). (72) Inventor: NORWELL, Jean ; 30 Park Drive, Newark, DE 19713 (US). (74) Agents: SAMUELS, Gary, A. et al.; W.L. Gore &amp; Associates, Inc., 551 Paper Mill Road, P.O. Box 9206, Newark, DE 19714 (US).</p>	<p>(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE, DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB, GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), SE, SE (European patent).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	

(54) Title: PROTECTIVE UNDERGARMENT



(57) Abstract

A stretchable water penetration resistant moisture-vapor permeable undergarment that protects the body from accidental contact with blood and other body fluids. The underwear provides protection to medical personnel working in non-standard environments such as emergency rooms, accident and natural disaster sites, rescue operations and the like.

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PROTECTIVE UNDERGARMENT  
FIELD OF THE INVENTION

This invention relates generally to garments for protection against accidental contact by blood and other body fluids, in particular to protective undergarments, and to a method for making them.

BACKGROUND OF THE INVENTION

Special clothing and accessories for prevention of contact by blood and other body fluids has long been recognized as necessary in medical environments to protect the health of workers and patients alike. To this end many special protective garments in the form of suits, gowns, drapes, masks, gloves, etc., have been developed and routinely used in hospital and clinic operating rooms, recovery rooms, isolation wards and other like areas.

These areas are typically activity-specific, i.e., they are entered for the purpose of performing specific tasks, for example, surgery, delivery of babies, dressing burn wounds, etc., and are generally not exited until the tasks are completed. The areas also, generally, provide stable conditioned environments in which to do the work. The work itself, although requiring great skill, care, and concentration is usually fairly stationary.

The special medical protective garments currently available are designed and constructed for use in the activities and under conditions described above. They are, typically, outerwear worn over standard work uniforms or street clothing, and are discarded by the wearer after each use for laundering or disposal.

Currently available medical protective garments are not intended, nor are they suited, for use in situations involving changing or hostile work environments, long periods of strenuous activity or exertion requiring full-range limb mobility by the wearer, high risk of damage, contamination, or heavy soiling to outerwear, and in which frequent exchange of protective outerwear is impractical. Such situations are routinely encountered by a large group of medical workers including emergency room personnel, emergency response personnel, paramedics, and the like.

### SUMMARY OF THE INVENTION

The present invention provides a stretchable, body conformable undergarment material which is impermeable to blood and other body fluids. The material is water penetration resistant and has high moisture vapor transmission characteristics. It also has good hand and feel when worn against the skin in order to maximize comfort during long wear periods. It can comprise an undershirt, underpants, one-piece body suit or the like.

The undergarment material is a stretchable laminated material comprising a composite outer layer of a porous hydrophobic polymer which has been coated with a hydrophilic polymer; and a second stretchable inner backing layer which is a knit textile fabric, such as a knit cotton fabric.

The material is patterned, cut and fashioned into undergarments by conventional means, for example, by sewing or other bonding methods, following which the means are sealed to ensure impermeability to blood and other body fluids.

Specifically, the invention provides a garment for underwear comprising a body tight article of clothing that is made of stretchable water penetration resistant, water-vapor permeable membrane laminated to a backing material, said backing material located on the interior side of the article.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross-section of the layered material used in the invention.

Figure 2 is a cross-section of an alternative arrangement of the layers forming the composite layer.

Figure 3 shows the material of the invention in the form of an undershirt.

Figure 4 shows the material of the invention in the form of underpants.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings the article of the invention will be described in detail.

**SUBSTITUTE SHEET**

Referring to Figure 1, the composite outer layer 1 is made up of a layer of porous hydrophobic polymer 2, i.e. a water penetration resistant, water-vapor permeable polymer, preferably the porous expanded polytetrafluoroethylene membrane described in U.S. Patents Nos. 3,953,566, 3,962,153, 4,096,227, and 4,187,390, coated with a hydrophilic layer 3 of a polyurethane as described in U.S. Patent Nos. 4,194,041 and 4,942,214. This combination of layers 2 and 3 is stretchable. The stretchable layer is then bonded to a layer 4 of a stretchable knit textile fabric, preferably of cotton or polyester-cotton blend, with an adhesive 5.

The adhesive 5 may be selected from many known in the art. Suitable adhesives may be found in, but not limited to, the classes consisting of thermoplastics, thermosets, or reaction curing polymers. The adhesives may be applied to the surfaces to be laminated by conventional means, for example, by coating or printing methods.

An alternative embodiment of the composite outer layer 1 is shown in Figure 2. For cost, convenience, or process considerations it may be desirable to bond the composite outer layer 1 to the fabric layer 4 using the hydrophilic polyurethane layer 3 of the composite layer 1 as the adhesive. In this instance, the positioning of the components forming the composite outer layer shown in Figure 1 are reversed with respect to their relationship to the fabric layer 4. There is no loss in the protective function of the material by so doing.

The combination of layers 2 and 3 in the outer layer 1 of either embodiment of the invention provide protection to the body from contact with liquid water, blood, and other body fluids which may be presented to the material regardless of their orientation with respect to each other. Further, such arrangement of layers precludes staining by such liquids and fluids.

Figure 3 depicts an article of clothing made from the material of Figures 1 and 2. The material has been patterned, cut and joined in the form of an undershirt. Joining is typically done by sewing although other methods, for example, adhesive joining, can be used. The fabric layer 4 forms the inside surface of the article and the outer surface of the article is formed by the composite layer 1. The seams at which the material is joined and the

perforations in the material created by sewing are sealed by application of seam sealing tape 6 to preserve the protective integrity of the article.

Although many materials and methods to seal seams and perforations are known in the art, use of tapes comprised of thermoplastic polyurethanes, or other suitable thermoplastic polymers, which fully cover the means and perforations are preferred for the launderability, durability, and strength they impart.

Figure 4 depicts a second embodiment of the invention in which the protective undergarment materials are sewn together in the form of underpants. As in Figure 3, the composite layer 1 forms the outer surface of the article, the fabric layer 4 forms the inner surface, and the seams and perforations are sealed by the application of seam sealing tape 6.

It is understood that the above-depicted forms of the invention are not meant to be limiting and that other forms and designs of protective undergarments, for example, body suits and the like, are included in the scope of the invention.

The forms and materials of the invention must meet important comfort criteria to be suitable for use as undergarments. Knit fabrics of cotton and polyester-cotton blends are widely used in the manufacture of undergarments and are known for their pleasant feel and their ability to conform comfortably to the body without inhibiting motion. Cotton, a natural staple fiber, is also known for its ability to absorb moisture in large amounts, approximately equivalent to its own weight, thus increasing comfort by removing perspiration from the skin. For these reasons, as well as cost and availability considerations, cotton and polyester-cotton blends are preferred as the material for the fabric layer 4 although other materials with similar properties can be used effectively.

A further comfort requirement of the materials of the invention is the ability to provide high moisture vapor transmission rates (MVTR). It has been shown that perceived comfort has a positive correlation with moisture vapor permeability of materials. By providing a means to aid evaporation of perspiration through transmission of its vapor the human body is assisted in regulating the temperature and comfort

is increased. The materials of the invention must have MVTR greater than 5,000, preferably greater than 10,000, more preferably greater than 13,000 grams/square meter/day as measured by the test procedure described in U.S. Patent No. 4,862,730, "Test Method for Determination of Moisture Vapor Transmission Rate."

It is thus seen that the invention provides an undergarment that provides the wearer protection from accidental contact with blood and other body fluids while affording the wearer the opportunity to put on or remove outerwear and accessories without loss of protection to accommodate changing work situations and environments.

I CLAIM:

1. A garment of underwear for protection of the wearer from accidental contact with body fluids comprising a body tight article of clothing that is made of a stretchable water penetration resistant, moisture-vapor permeable composite laminated to a backing material, said backing material located on the interior side of the article.
2. The garment of Claim 1 made in the form of an undershirt.
3. The garment of Claim 1 made in the form of underpants.
4. The garment of Claim 1 made in the form of a body suit.



FIG. 1

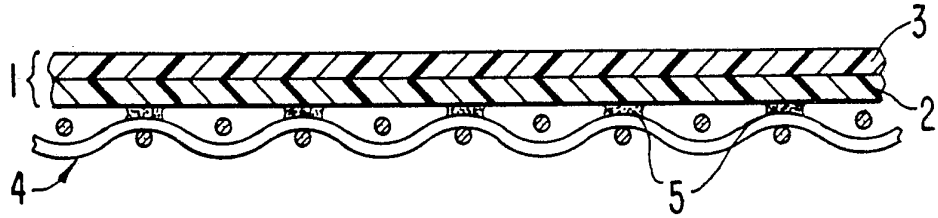


FIG. 2

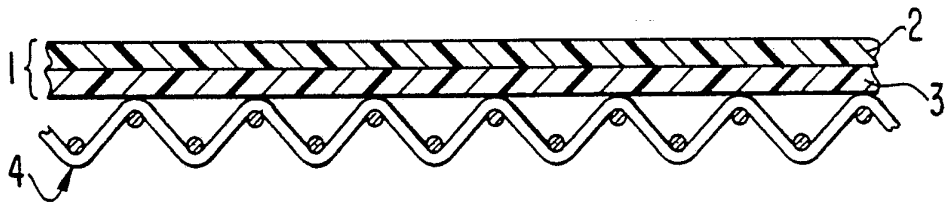


FIG. 3

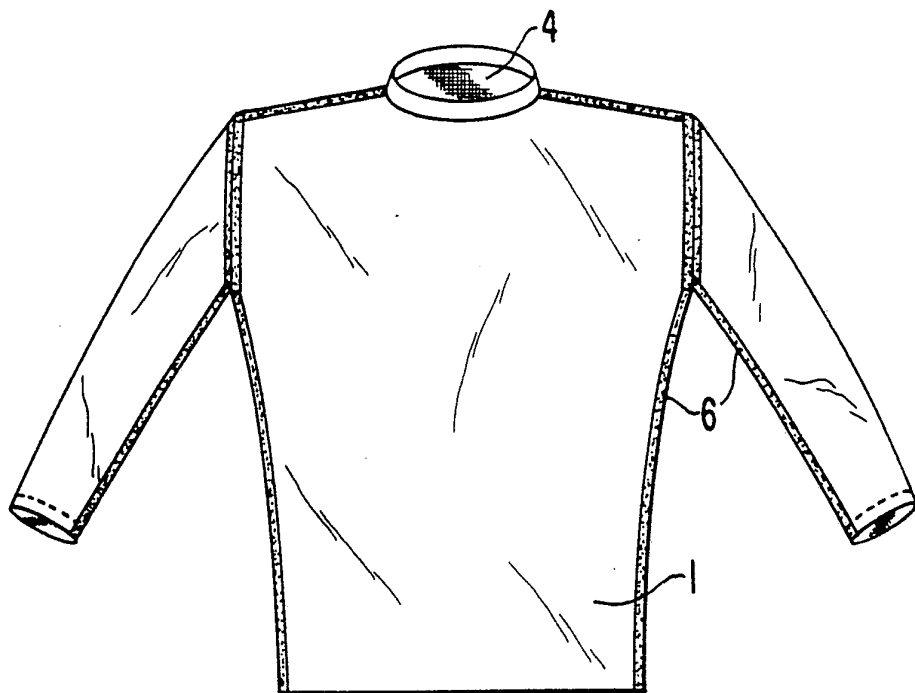
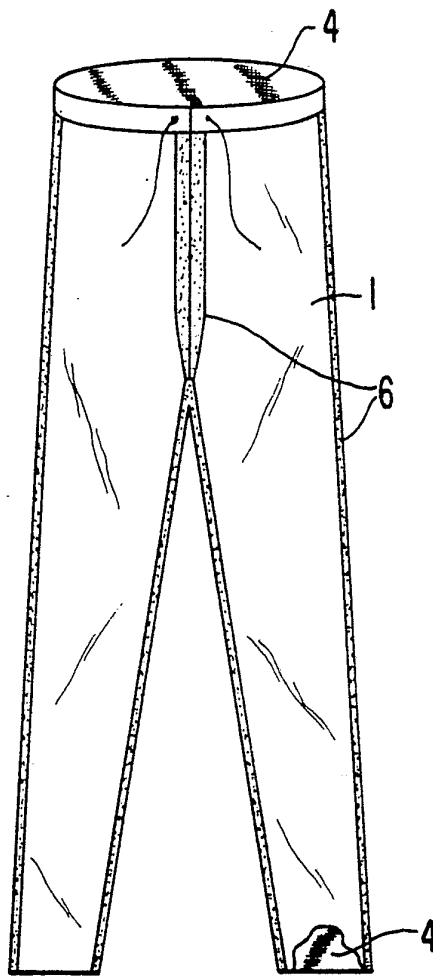


FIG. 4



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 92/04291

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 A41D31/02		
II. FIELDS SEARCHED		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	A41D ; A41B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	EP,A,0 110 626 (W. L. GORE AND ASSOCIATES, INC) 13 June 1984 see page 1, line 1 - line 12 see page 3, line 9 - line 21 see page 4, line 16 - line 22; claims 1,5,6,9-11; figure 1 ---	1-4
X	EP,A,0 313 261 (W. L. GORE AND ASSOCIATES, INC) 26 April 1989 see the whole document ---	1-4
X	DE,A,2 737 756 (W. L. GORE AND ASSOCIATES, INC) 1 March 1979 see page 11 - page 13; claims 1-17,19,20 ---	1-4
X	WO,A,8 907 523 (PORVAIR PLC) 24 August 1989 see page 1, line 1 - page 3, line 13; claims 5,11-13,16,20 ---	1-4
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<sup>10</sup> 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 "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		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
03 SEPTEMBER 1992		24. 09. 92
International Searching Authority EUROPEAN PATENT OFFICE		Signature of Authorized Officer FAIRBANKS S.A.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 157 140 (W. L. GORE AND ASSOCIATES, INC) 9 October 1985 see page 3, line 8 - page 4, line 9; claims 1-8,10; figures 1-12	1-4
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A	US,A,4 821 342 (J. D. TROYER) 18 April 1989 see the whole document	1,3
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. US 9204291  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on  
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82