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(54) Title: STROBEL FOOTWEAR CONSTRUCTION

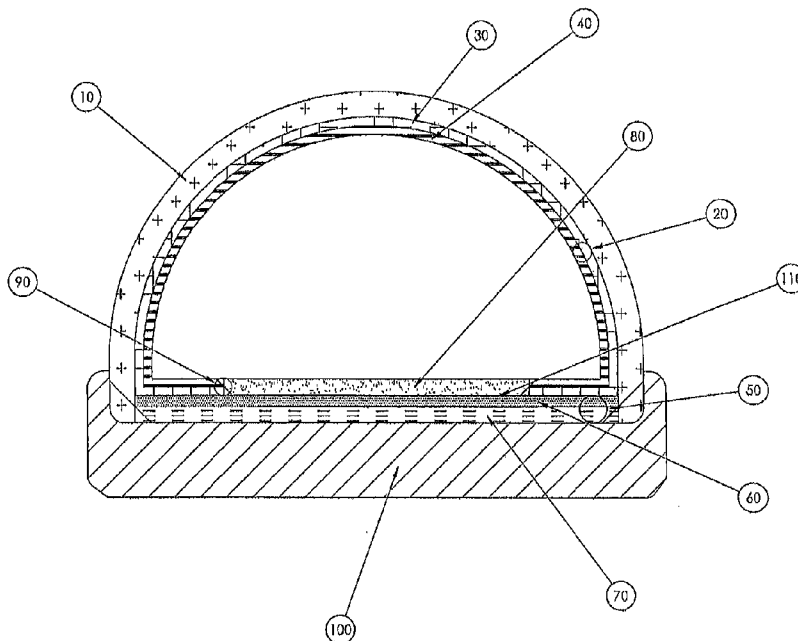


FIG 1

(57) Abstract: Waterproof footwear having a liner material, insole, and sealing carrier are described herein. The sealing carrier includes one or more layers containing a flowable polymer adapted to flow upon application of energy in order to impart a waterproof seal.

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STROBEL FOOTWEAR CONSTRUCTION**RELATED APPLICATION**

The present application is a non-provisional
5 application which claims the benefit of U. S. Provisional
Application No. 61/607,923 filed March 7, 2012.

BACKGROUND

The art is replete with attempts at making waterproof,
10 breathable footwear. Early attempts for making such
footwear included making footwear consisting of upper
materials such as leather treated to make it water
resistant and soles made of rubber. Thus, some
breathability was achieved. However, several problems arose
15 with this type of footwear construction. If the upper
material was to be made truly waterproof, it would lose its
ability to breathe. Moreover, the connecting region between
the waterproof sole and the upper became a major source of
leakage as there was no effective way to make the
20 connecting region waterproof.

An alternative approach to the goal of achieving
comfortable waterproof footwear involved employing a
waterproof insert or bootie into the shoe. This method is
25 particularly useful in machine lasted footwear, as known in
the art. This waterproof insert, if constructed of
appropriate materials had the additional advantage of being
permeable to water vapor so that there was no buildup of
water vapor within the shoe over the time when the shoe was
30 being worn. In the footwear art materials which are both
waterproof and water vapor permeable are commonly referred
to as "functional" materials. Exemplary of such a

functional material is a microporous, expanded polytetrafluoroethylene membrane material available from W. L. Gore and Associates, Inc., Elkton, Md., under the tradename GORE-TEX®. Other functional materials have also
5 been developed and are well known in the art.

Further approaches have included securing, by a lasting process, a waterproof, breathable liner material to the inside of the footwear upper and sealing the liner material to a waterproof gasket or insole. There have been
10 many different attempts at providing a durable, waterproof seal or connection at the region where the liner material is joined with the waterproof gasket or insole. These attempts have resulted in varying degrees of success.

15 One problem which often results when forming such waterproof, breathable footwear is that the insertion of the liner or bootie will often result in a poor fitting shoe (i.e., a smaller fit due to the liner being inserted into the already sized shoe upper) and/or poor attachment
20 between the liner or bootie and the shoe upper material, which results in, among other things, a less than desirable appearance of the inside of the footwear (i.e., the liner appears wrinkled or pulls away from the upper).

25 An additional problem is that because of the multiple extra layers typically needed for manufacturing an article of waterproof footwear, flexibility may be severely compromised. In other words, the typical prior art waterproof shoe is much less flexible than prior art non-
30 waterproof footwear.

Thus, the search continues for waterproof breathable

footwear that is both durably sealed and flexible, yet economical to manufacture.

SUMMARY OF INVENTION

5 Various constructions and methods of manufacture of waterproof footwear and booties are described herein. The waterproof footwear include a liner material having at least a waterproof, water vapor permeable functional layer and perimeter edge portion, and optionally at least one
10 textile layer. During construction, the liner material is secured to an upper material. Additionally, the waterproof footwear construction includes an insole attached to the perimeter edge portion. Further, the waterproof footwear construction includes a sealing carrier adapted for closing
15 the upper material and waterproofing the footwear article. The sealing carrier has a top surface wherein the top surface is attached to at least a portion of the bottom perimeter edge portion of the liner material. Further wherein at least a portion of the top surface is adapted to
20 flow upon application energy to form a waterproof seal with the upper material. Further, upon completion of construction an outer sole is secure to the footwear.

In an embodiment, the sealing carrier includes at least two layers, an upper layer 60 having the top surface
25 110 previously described and a lower layer 70. At least one of the at least two layers includes a polymeric layer having a melting point greater than the other layer or layers (i.e. the lower layer). Conversely, at least one of the other at least two layers includes a polymeric layer
30 having a melting point lower than the other layer or layers (i.e. the upper layer). The polymeric layer may be polyurethane, for example. Of note, when the upper layer

has a melting point lower than the other layer or layers, the top surface 110 or the upper layer 60 is may be adapted to flow as described above as well as other portions of the upper layer.

5 In an embodiment, the waterproof, water vapor permeable functional layer is a polymeric membrane material. Suitable polymeric membrane material include polyurethane, polyester, polyether, polyamide, polyacrylate, copolyether ester, and copolyether amide.
10 Further, the polymeric membrane material could be microporous, expanded polytetrafluoroethylene.

 In an embodiment the sealing carrier and/or the insole may be stretchable in the machine direction and in the cross machine direction.

15 Booties for use within waterproof, footwear constructions are also described. The booties include a liner material having at least a waterproof, water vapor permeable functional layer and perimeter edge portion, and optionally at least one textile layer. Additionally, the
20 bootie includes an insole attached to the perimeter edge portion. Further, a sealing carrier adapted for use in waterproofing a footwear article is provided. The sealing carrier has a top surface wherein the top surface is attached to at least a portion of the bottom perimeter edge
25 portion of the liner material. At least a portion of the top surface is adapted to flow upon application energy to form a waterproof seal with the upper material.

 Methods for making waterproof footwear are also described herein. The method includes providing upper
30 material, providing a liner material having at least a waterproof, water vapor permeable functional layer and an open bottom portion 210. The method also includes securing

an insole material to the open bottom portion 210 of the
liner material 20 to form a bootie and subsequently
locating a shoe last within the bootie to form a bottom
portion of the bootie which includes the insole material 80
5 and a perimeter edge portion 90 of the liner material 20.
The method further includes providing a sealing carrier 50
having an upper layer 60 and a lower layer 70, attaching
the upper layer 60 of the sealing carrier 50 to the bottom
portion of the bootie to cover the insole material and
10 perimeter edge portion, and applying energy to a bottom
surface of the sealing carrier to form a waterproof seal
with the upper material. Finally, an outsole 100 is
attached to the bottom surface of the sealing carrier to
form waterproof footwear.

15

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a cross-sectional view of waterproof footwear
containing a sealing carrier.

20

Fig. 2 is an exploded view of waterproof footwear
containing a sealing carrier.

Fig. 3 is a perspective view of waterproof footwear
25 containing a sealing carrier.

Fig. 4 illustrates viscosity differences within a sealing
carrier.

30 Fig. 5 illustrates the attachment of a sealing carrier to a
bootie and a bootie to an upper.

Fig. 6 illustrates viscosity differences within a sealing carrier.

DETAILED DESCRIPTION

5

The disclosure relates to waterproof footwear and methods for making the same. The footwear utilizes a special sealing carrier 50 rather than a traditional waterproof gasket. The sealing carrier 50 incorporates flowable polymer within one or more layers to make applying adhesive on the bottom of a bootie for securing a waterproof gasket thereto unnecessary. This increases factory efficiency by lowering manufacturing costs.

10 In this regard, manufacturing costs are lowered because traditional strobrel board/waterproof gasket combination and necessary adhesives used therewith are not needed to provide stability and facilitate waterproofness of the shoe. Instead the sealing carrier adheres to the liner and upper to create a waterproof seal by utilization of flowable sealing polymer rather than by a traditional waterproof gasket/strobrel board.

15 Turning to Figures 1-3, as a preliminary matter, the waterproof footwear described herein includes a liner material 20 having a perimeter edge portion 90. It also includes an insole 80 attached to the perimeter edge portion 90. Further, it includes a sealing carrier 50 adapted for closing upper material 10 and waterproofing a footwear article.

20 Turning to Figure 5, described herein is a liner material 20 having an open top portion 200 and an open bottom portion 210. Optionally, seams may be joined together to form the liner material into the general

corresponding shape of a shoe upper. Pieces of liner material can be joined together by sewing, welding, gluing, etc. When pieces of liner are sewn together, the seams can be made waterproof by sealing the seams with known sealing materials, such as GORE-SEAM[®] tape (available from W. L. Gore and Associates, Inc.). Other sealants may be applied to the seams to render them waterproof if they are not inherently waterproof due to welding or gluing. The liner material 20 includes at least one layer of material which is waterproof and water vapor permeable (i.e., a functional material), such as a breathable polymeric membrane. As used herein, "water vapor permeable" and "breathable" are used interchangeably and mean that the functional layer has a water vapor coefficient Ret of less than 200 m² Pa W⁻¹.

Breathable polymeric membranes may be breathable by virtue of pores in the membrane or through a solution diffusion mechanism. Breathable polymeric membranes may be selected from polyurethane, polyester, polyether, polyamide, polyacrylate, copolyether ester and copolyether amides. In an aspect of the invention the waterproof, water vapor permeable membrane is a membrane of microporous polytetrafluoroethylene. In a further aspect of the invention, the microporous polytetrafluoroethylene membrane is a membrane of expanded polytetrafluoroethylene as taught in U.S. Pat. Nos. 3,953,566 and 4,187,390, to Gore. Such membranes of expanded polytetrafluoroethylene are commercially available from W. L. Gore and Associates, Inc., Elkton, Md., under the tradename GORE-TEX[®] fabric.

The liner material will contain at least the above described functional

material. Optionally, it may contain at least one other material attached thereto. In this regard, the liner can include the functional material 30 and a textile material 40 laminated or otherwise joined to at least one side, and often times joined to both sides thereof. Lamination is generally carried out with the use of a discontinuous pattern of suitable adhesive. Thus, water vapor permeability is not significantly affected. The at least one other material can be a textile fabric. Textile fabrics can be woven, knit, mesh, nonwoven, felt constructions, etc. Textiles can be produced from natural fibers such as cotton, or from synthetic fibers such as polyesters, polyamides, polypropylenes, polyolefins, or blends thereof. In an aspect of the invention a textile fabric is laminated to the side of the functional material which will be in contact with the upper material. In a further aspect of the invention a textile fabric is laminated to the side of the functional material which will face the inside of the footwear. In a still further aspect of the invention, textile fabric is laminated to both sides of the functional material, thus providing a three layer liner material.

An insole material 80 is also described herein. The insole material is in the shape, generally, of the bottom of a foot. The insole material can be any suitable material which is capable of being secured to the bottom portion of the laminate liner material to form a bootie. The insole material can be a woven or nonwoven material; or EVA or other polymer foam materials. For example, the first insole material can be polyester, nylon, polyacrylic, polyolefin, polyurethane, polyvinyl, cotton, acetate, rayon, olefin, acrylic, wool, spandex, metallic, etc.

The insole material 80 could also be made from a stretchable material made from at least one substrate and at least one film and is in the shape, generally, of the bottom of a foot. The substrate may be composed of a variety of materials. Non-limiting examples include polyester, nylon, polyacrylic, polyolefin, polyurethane, polyvinyl, cotton, acetate, rayon, olefin, acrylic, wool, spandex, metallic.

10 A film may optionally be included as part of the insole. The film is desirably an extruded film, PVC, rubbers, neoprene, or any other film capable of being stretched in the machine direction to impart flexibility in the insole.

15 The insole material 80 can be secured to the perimeter edge 90 of the liner material by any suitable means. For example, the insole material can be secured to the perimeter edge 90 of the laminate material by stitching, stapling, ultra sonic welding, etc., with stitching being preferred. Upon securing the insole material to the bottom portion of laminate liner material, a bootie is obtained which is formed to be capable of accepting a wearer's foot.

25 Thereafter, the bootie can be secured to the shoe upper shown in Figure 5. Any suitable durable material can be used to form shoe upper such as leather or fabric. Any suitable means can be used for securing the bootie to the shoe upper. In an aspect of the invention, the open top portion 200 of the bootie is secured to a collar portion or any other suitable portion of the shoe upper by stitching.

Upon attaching the bootie to a shoe upper, a sealing carrier 50 is then applied to the bottom surface of the construction. The sealing carrier may include a single film layer, two film layers, multiple film layers, and/or multiple film layers with textile. Regardless of the configuration, the sealing carrier includes at least one layer containing a flowable polymer therein. Exemplary, non-limiting polymers include polyurethane, copolyether polyester, polyester, or polyamide but any polymer that is adapted to flow upon application of energy, for example, heat, pressure, or ultrasonic energy may be used.

In an embodiment of the invention involving a sealing carrier with two layers, an upper layer 60 and a lower layer 70, the top surface 110 of the upper layer 60 will be placed underneath the insole and the upper layer 60 and lower layer 70 will work together to create a waterproof seal because of differences in viscosity of the layers. For example, upon application of energy to the lower layer 70 of the sealing carrier, the upper layer 60 will flow and will bond with the perimeter edge of the liner material 20 and the upper 10 to form a waterproof seal. As illustrated in Figure 4, this works because the lower layer will have a higher melting point than the upper layer and will be more viscous than the upper layer. In other words, the lower layer will be more resistant to flow and will provide stability to the sealing carrier 50. For example, in an embodiment, the lower layer will have a melting point greater than about 120 C and the upper layer will have a melting point lower than about 120 C.

Upon completion of this step, outer sole is attached using conventional methods known in the art.

In marked contrast to prior art constructions, this construction does not require a traditional waterproof gasket to impart a waterproof seal to the footwear construction. Additionally, because there are fewer
5 layers involved in this construction, the footwear construction advantageously provides flexibility believed to previously be found in only non-waterproof footwear.

In an alternative embodiment, the liner material can be constructed such that the liner material is the entire
10 upper without a separate upper material to attach to. In this case, the sealing carrier is secured to the liner material as described above and energy is applied to activate the flowable polymer in the sealing carrier to create a waterproof seal.

15

EXAMPLES

TEST METHODS

20 **Whole Boot Moisture Vapor Transmission Rate Test**

The Whole Boot Moisture Vapor Transmission Rate for each sample was determined in accordance with Department of Defense Army Combat Boot Temperate Weather Specifications.

25 The specifications are as follows:

4.5.4 Whole boot breathability. The boot breathability test shall be designed to indicate the
Moisture Vapor Transmission Rate (MVTR) through the boot by
30 means of a difference in concentration of moisture vapor between the interior and the exterior environment.

4.5.4.1 Apparatus.

- a. The external test environment control system shall be capable of maintaining 23 (± 1) C and 50% $\pm 2\%$ relative humidity throughout the test duration.
- b. The weight scale shall be capable of determining weight of boots filled with water to an accuracy of (± 0.01) gram.
- c. The water holding bag shall be flexible so that it can be inserted into the boot and conform to the interior contours; it must be thin enough so that folds do not create air gaps; it must have much higher MVTR than the footwear product to be tested; and it must be waterproof so that only moisture vapor contacts the interior of the footwear product rather than liquid water.
- d. The internal heater for the boot shall be capable of controlling the temperature of the liquid water uniformly in the boot to 35 (± 1) C.
- e. The boot plug shall be impervious to both liquid water and water vapor.

4.5.4.2 Procedure.

- a. Place boot in test environment.
- b. Insert holding bag into boot opening and fill with water to a height of 12.5cm (5in) measured from inside sole.
- c. Insert water heater and seal opening with boot plug.
- d. Heat water in boot to 35 C.
- e. Weigh boot sample and record as W_i .
- f. Hold temperature in boot after weighing for a minimum of 6 hours.

g. After 6 hours, reweigh boot sample. Record weight as W_f and test duration as T_d .

h. Compute whole boot MVTR in grams/hour from the equation below:

5 $MVTR = (W_i - W_f) / T_d$

4.5.4.3 Method of Inspection. Each boot shall be tested in accordance with the method

described in paragraph 4.5.4.2. The average whole boot MVTR from the 5 boots tested shall be greater than 3.5

10 grams/hour.

Centrifuge Waterproofness Test

Waterproofness for each sample was determined by use
15 of the Centrifuge test described in U.S. Pat. No. 5,329,807 assigned to W.L. Gore and Associates, Inc. and incorporated by reference herein in its entirety. The centrifuge tests were carried out for 30 minutes.

20 Flexibility Testing

Flexibility testing for each sample was carried out in accordance with International Sports Engineering Association's flexibility test described in the article
entitled "Development and reliability quantification of a
25 novel set-up for measuring footwear bending stiffness.

Viscosity Testing

Viscosity of various samples suitable for use in a sealing carrier was tested. These samples included a
30 polyurethane barrier film suitable for use in the lower layer of a sealing carrier, and it includes polyurethane sealing films suitable for use in the upper layer of a

sealing carrier. The barrier film is commercially available from Worthen Industries, Richmond, VA, part number WPS24. Additionally two of the sealing films are commercially available from Worthen Industries, Richmond, VA. These sealing films are Upaco 156 and Upaco 450, known as part numbers Film 450 and Film 156. Additionally polyurethane sealing films referenced as LB25L, LB25M, TBO37, and HM339 are available from W.L. Gore and Associates, Inc. in Elkton, MD.

10 The testing results as illustrated in Figures 4 and 6 show a marked difference in viscosity between polymers suitable for use in the upper layer of a sealing carrier and the lower layer.

A sample of each polyurethane was dried at 70°C in a vacuum oven under approximately 28" Hg vacuum for approximately 24 hours (LB25L, LB25M, TBO37) or 65 hours (Upaco 156 and 450, HM339, and WPS24 barrier film). The dried samples were then pressed into plaques approximately 75 mm x 75 mm x 1.5 mm in a press at 130°C (LB25L), 130°C or 140°C (LB25M), 125°C or 130°C (TBO37), or 120°C (Upaco 156 and 450, HM339, and WPS24 barrier film); the plaques were then stored in a dry nitrogen atmosphere.

Each sample was tested on the TA Instruments Ares G2 rheometer available from TA Instruments, New Castle, Delaware using 25 mm diameter stainless steel parallel plates under nitrogen atmosphere. A thermocouple was attached to each parallel plate; the readout from these thermocouples was used to measure and control sample temperature. The rheometer plates were zeroed at 160°C. Prior to loading each sample, the rheometer oven and test fixture were pre-heated to 160°C. For each rheometer test performed in this study, a sample plaque was removed from

the dry nitrogen atmosphere, a 26 mm disc was punched from the sample plaque, and the remaining sample plaque was returned to the dry nitrogen atmosphere. The rheometer oven was then opened, the 26 mm disc loaded into the test
5 fixture as quickly as possible at approximately 160°C, and the rheometer oven closed. The sample was then held for one minute to allow the sample temperature to equilibrate at 160°C. The top parallel plate was then lowered at 0.02 mm/sec until a sample thickness of 1.25 mm was achieved.
10 The rheometer oven was then opened, excess sample trimmed from the test fixture, and the rheometer oven closed. The sample was then held for approximately one minute prior to experimental run initiation to allow the sample temperature to re-equilibrate at 160°C. Upon experimental run
15 initiation, the rheometer ramped the sample temperature to the initial test temperature of 180°C in approximately one minute. An initial test temperature of 180°C was used to (i) sufficiently melt the sample to ensure the sample was adequately adhered to the rheometer test plates, and (ii)
20 eliminate any sample crystallinity (and thus erase any sample thermal history). For temperature sweeps, the sample was held at 180°C for thirty seconds prior to initiation of sinusoidally oscillating sample deformation and temperature ramping. For all other tests, sinusoidally
25 oscillating sample deformation was initiated once the sample temperature reached the initial test temperature of 180°C. During each experimental run, the rheometer recorded a data point approximately every six seconds. A rheometer gap (i.e., sample thickness) coefficient of
30 thermal expansion correction factor of 2.34 $\mu\text{m}/^\circ\text{C}$ was used for all runs. Testing parameters were as follows:
Nitrogen atmosphere

Sample diameter: 25 mm

Sample thickness: 1.25 mm nominal

Oscillation strain: 5% nominal

Oscillation frequency: 2 radians/second typically, 0.1 -
5 628 rad/sec during frequency sweeps

Axial force control range: 5 g \pm 10 g

Strain control parameters: strain range 0.01% - 5.0%,
torque range 2.0 - 1,000 g·cm (temperature sweeps), 2.0 -
200 g·cm (all other tests)

10 For each temperature sweep test, sample temperature
was ramped from 180°C to 40°C at 5°C/minute, then from 40°C
to 180°C at 5°C/minute. Graphs of complex viscosity versus
temperature for each polyurethane examined in this study
while cooling from 180°C to 40°C at 5°C/minute and while
15 heating from 40°C to 180°C after being cooled from 180°C to
40°C at 5°C/minute are presented in Figure 6.

Example 1

20 Waterproof footwear was made with upper material
available from God Speed, DONGGUAN CITY, China, part number
GS14-721 Mesh non-wicking. The upper materials were stitched
together to form the upper of the waterproof footwear.
Liner materials were then made. The liner materials were
25 made of expanded polytetrafluoroethylene and a textile,
part number KBHX 600A available from W.L. Gore and
Associates, Inc in Elkton, MD. The liner parts were
stitched together to form a partial bootie. A 0.8 mm
polyester insole material made from available from Jiu Run,
30 DONGGUAN CITY, China part number J018 was attached to the
bottom of the partial bootie to form a bootie construction.

The bootie was then joined to the upper by stitching the bootie to the upper at the collar portion of the upper.

A two layer sealing carrier was then stitched to the bottom of the upper to form a closed upper to form a partial footwear construction. The first layer of the
5 sealing carrier was made from polyurethane Upaco part number WPS24 and had a melting point in the range of about 160 to 170 C. The second layer of the sealing carrier was made from polyurethane, Upaco Film 450, and had a melting
10 point in the range of about 85 - 125 C.

A shoe last, as known in the art, was then placed inside the partial footwear construction. The sealing carrier was then heated and placed into a hydraulic sole press to drive flowable polyurethane into the bottom of the
15 bootie including the perimeter edge region to form a waterproof seal. The hydraulic system of the sole press was set at 40 kg/cm² and had a silicon pad to conform to the shape of the bottom of the upper. The sole press was actuated.

20 Finally an outsole 100 made of rubber available from Zhanhui in DONGGUAN CITY, China, part number MRS-865-1 rubber outsole was attached to the bottom of the upper by use of adhesive available from Nanpao in Huang Jiang Town, China, part number WA17 Adhesive Cement Glue.

25 The footwear construction was tested utilizing the Whole Boot Moisture Vapor Transmission test method described above and it achieved a breathability of 7.4/g/m²/h.

The footwear construction tested for waterproofness
30 according to the test for waterproofness described above. The footwear construction passed the test.

The footwear was then tested for flexibility according to the test for flexibility described above. Test results indicated a mean stiffness of 0.0699993989 Nm/° which is similar to the mean stiffness described below in Comparative Example 1 which is a non-waterproof shoe. Conversely, the waterproof shoe described in Comparative Example 2 below was substantially stiffer than the shoe described in the Example or Comparative Example 1. This demonstrates that the current construction achieves high flexibility while maintaining breathability and waterproofness.

Comparative Example 1

Non-waterproof footwear was made with upper material available from God Speed, DONGGUAN CITY, China, part number GS14-721 Mesh non-wicking. The upper materials were stitched together to form the upper of the non-waterproof footwear. Liner materials were then made. The liner materials were made of textile, part number GS11-C + 2mm Foam + 20 gram Tricot available from Godspeed Industrial Group, Dongguan, China. The liner is stitched together.

The liner was then joined to the upper by stitching the liner to the upper at the collar portion of the upper.

A strobil board 180grams/m² Vidona Strobil available from Jinjiang Chenxu Shoes Material Trade Co., Ltd, Jinjiang City, Fujian Province, China was then stitched to the bottom of the upper to form a closed upper. A shoe last, as known in the art, was then placed inside the partial footwear construction.

Finally an outsole made of rubber available from Zhanhui in DONGGUAN CITY, China, part number MRS-865-1

rubber outsole was attached to the bottom of the upper by use of adhesive available from Nanpao in Huang Jiang Town, China, part number WA17 Adhesive Cement Glue.

The footwear was tested for flexibility according to
5 the test for flexibility described above. Test results indicated a mean stiffness of 0.067304555.

Comparative Example 2

10 Waterproof footwear were made substantially in accordance with the teachings of U.S. Pat. No., 6,935,053 assigned to W.L. Gore and Associates, Inc and hereby incorporated by reference in its entirety. The footwear
15 was tested for flexibility according to the test for flexibility described above. Test results indicated a mean stiffness of 0.082768711.

CLAIMS

1. Waterproof footwear comprising:

a liner material comprising at least a waterproof, water vapor permeable functional layer, and perimeter edge portion, the liner material further being secured to an upper material;

an insole attached to the perimeter edge portion; and

a sealing carrier adapted for closing the upper material and waterproofing the footwear article, said sealing carrier comprising a top surface wherein the top surface is attached to at least a portion of the bottom perimeter edge portion of the liner material, and further wherein at least a portion of the top surface is adapted to flow upon application of energy to form a waterproof seal with the upper material.

2. The footwear of claim 1, wherein the sealing carrier comprises at least two layers.

3. The footwear of claim 2, wherein at least one of the at least two layers comprises a polymeric layer comprising a melting point greater than the other layer or layers.

4. The footwear of claim 2, wherein at least one of the at least two layers comprises a polymeric layer comprising a melting point lower than the other layer or layers.

5. The footwear of claim 1, wherein the waterproof,

water vapor permeable functional layer comprises a polymeric membrane material.

6. The footwear of claim 5, wherein the polymeric membrane material is selected from the group consisting of polyurethane, polyester, polyether, polyamide, polyacrylate, copolyether ester, and copolyether amide.

7. The footwear of claim 5, wherein the polymeric membrane material comprises microporous, expanded polytetrafluoroethylene.

8. The footwear of claim 3, wherein the polymeric layer is a polyurethane.

9. The footwear of claim 4, wherein the polymeric layer is a polyurethane.

10. The footwear of claim 1, wherein the liner material comprises at least one waterproof, water vapor permeable functional layer and at least one textile layer.

11. The footwear of claim 1, wherein an outer sole is secured to the footwear.

12. The footwear of claim 1, wherein the sealing carrier is stretchable.

13. The footwear of claim 1, wherein the insole is stretchable.

14. Waterproof footwear comprising:

a liner material comprising at least a waterproof, water vapor permeable functional layer and a textile layer, the liner material further being secured to an upper material and comprising a perimeter edge portion;

an insole attached to the perimeter edge portion; and

a sealing carrier adapted for closing the upper material and waterproofing the footwear article, said sealing carrier comprising a first layer with a top surface wherein the top surface is attached to at least a portion of the bottom perimeter edge portion of the liner material, and further wherein at least a portion of the top surface is adapted to flow upon application of energy to form a waterproof seal with the upper material, and comprising a second layer comprising a melting point greater than the first layer.

15. A bootie for use within waterproof footwear, the bootie comprising

a liner material comprising at least a waterproof, water vapor permeable functional layer, and a perimeter edge portion;

an insole attached to the perimeter edge portion; and

a sealing carrier, said sealing carrier comprising a top surface wherein the top surface is attached to at least a portion of the bottom perimeter edge portion of the liner

material, and further wherein at least a portion of the top surface is adapted to flow upon application of energy.

16. The bootie of claim 15 wherein the liner material further comprises a textile.

17. The footwear of claim 15, wherein the sealing carrier comprises at least two layers.

18. The footwear of claim 17, wherein at least one of the at least two layers comprises a polymeric layer comprising a melting point greater than the other layer or layers.

19. The footwear of claim 17, wherein at least one of the at least two layers comprises a polymeric layer comprising a melting point lower than the other layer or layers.

20. The footwear of claim 15, wherein the waterproof, water vapor permeable functional layer comprises a polymeric membrane material.

21. The footwear of claim 20, wherein the polymeric membrane material is selected from the group consisting of polyurethane, polyester, polyether, polyamide, polyacrylate, copolyether ester, and copolyether amide.

22. The footwear of claim 20, wherein the polymeric membrane material comprises microporous, expanded polytetrafluoroethylene.

23. The footwear of claim 18, wherein the polymeric layer is a polyurethane.

24. The footwear of claim 19, wherein the polymeric layer is a polyurethane.
25. A method for making waterproof footwear comprising:
Providing upper material;
providing a liner material comprising at least a waterproof, water vapor permeable functional layer and a non waterproof bottom portion;
securing an insole material to the non waterproof bottom portion of the laminate liner material to form a bootie;
locating a shoe last within the bootie to form a bottom portion of the bootie which includes the insole material and a perimeter edge portion of the laminate liner material;
providing a sealing carrier comprising a top surface and a bottom surface, and further wherein at least a portion of the top surface is adapted to flow upon application of energy to form a waterproof seal with the upper material;
attaching the top surface of the sealing laminate to the bottom portion of the bootie, the sealing laminate covering the surface of the first insole material and at least a portion of the perimeter edge portion of the laminate liner material to form a waterproof bootie;
applying energy to the sealing laminate at the bottom surface to form a waterproof seal with the waterproof, water vapor permeable functional layer; and
attaching an outsole to the bottom surface to form waterproof footwear.

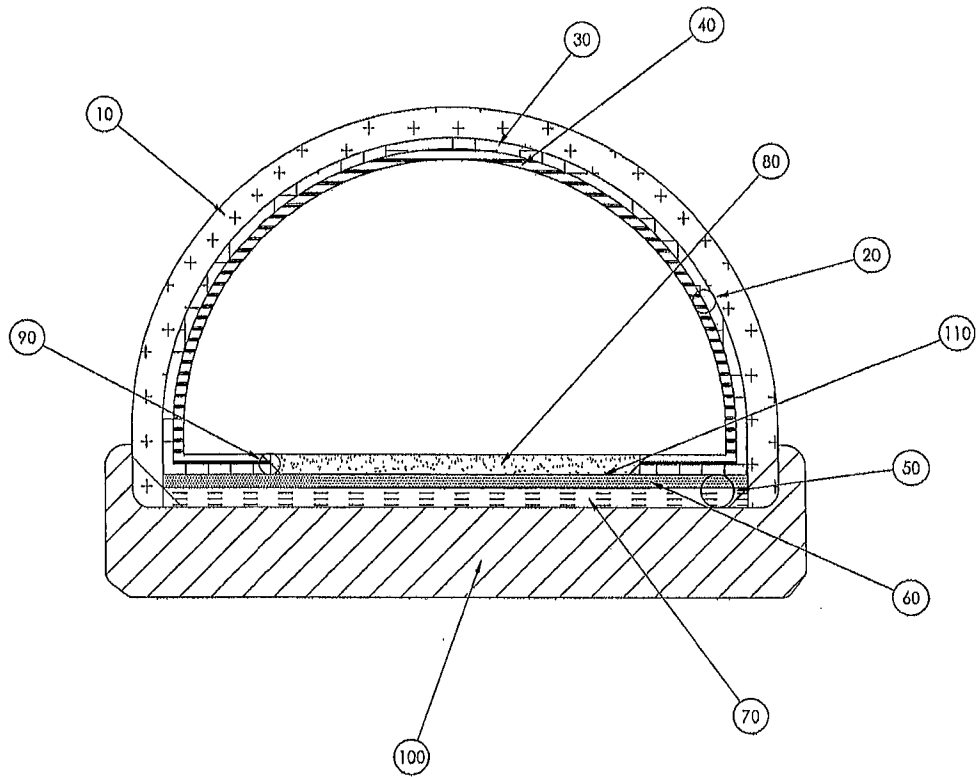


FIG 1

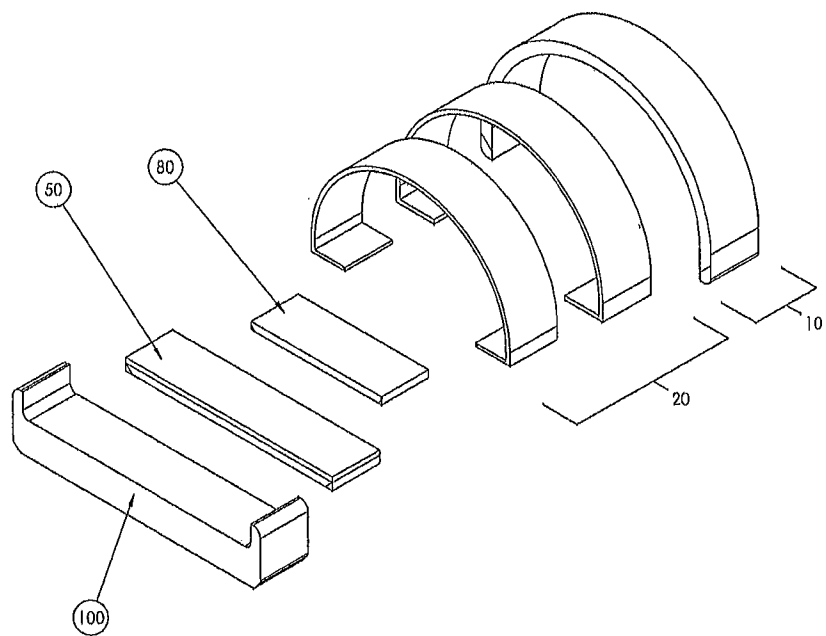


FIG 2

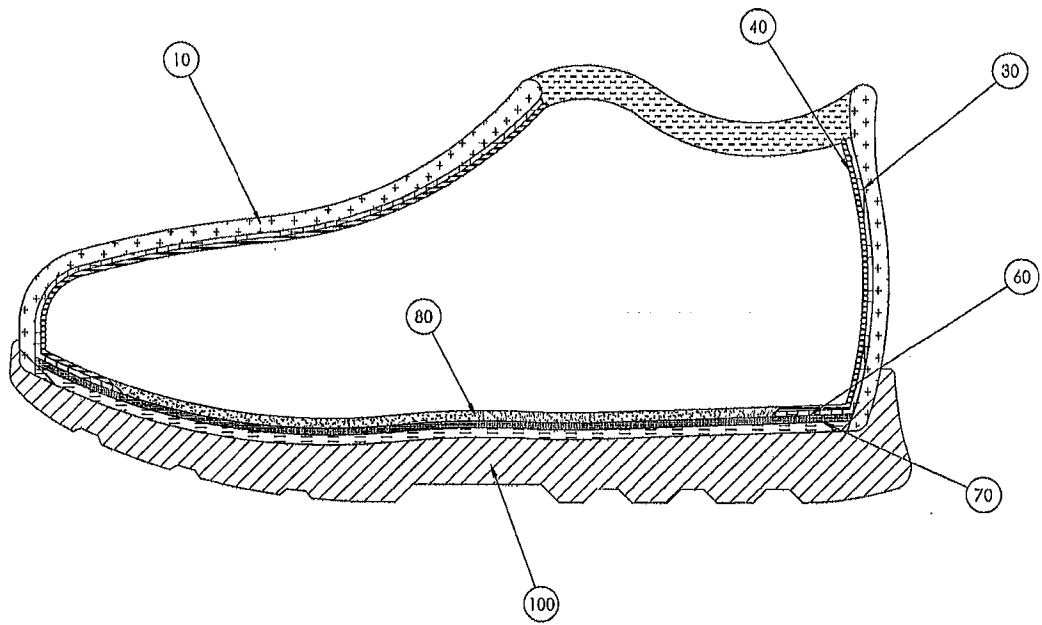


FIG 3

Viscosity Differences at 120°C – Barrier Film vs. Sealing Films

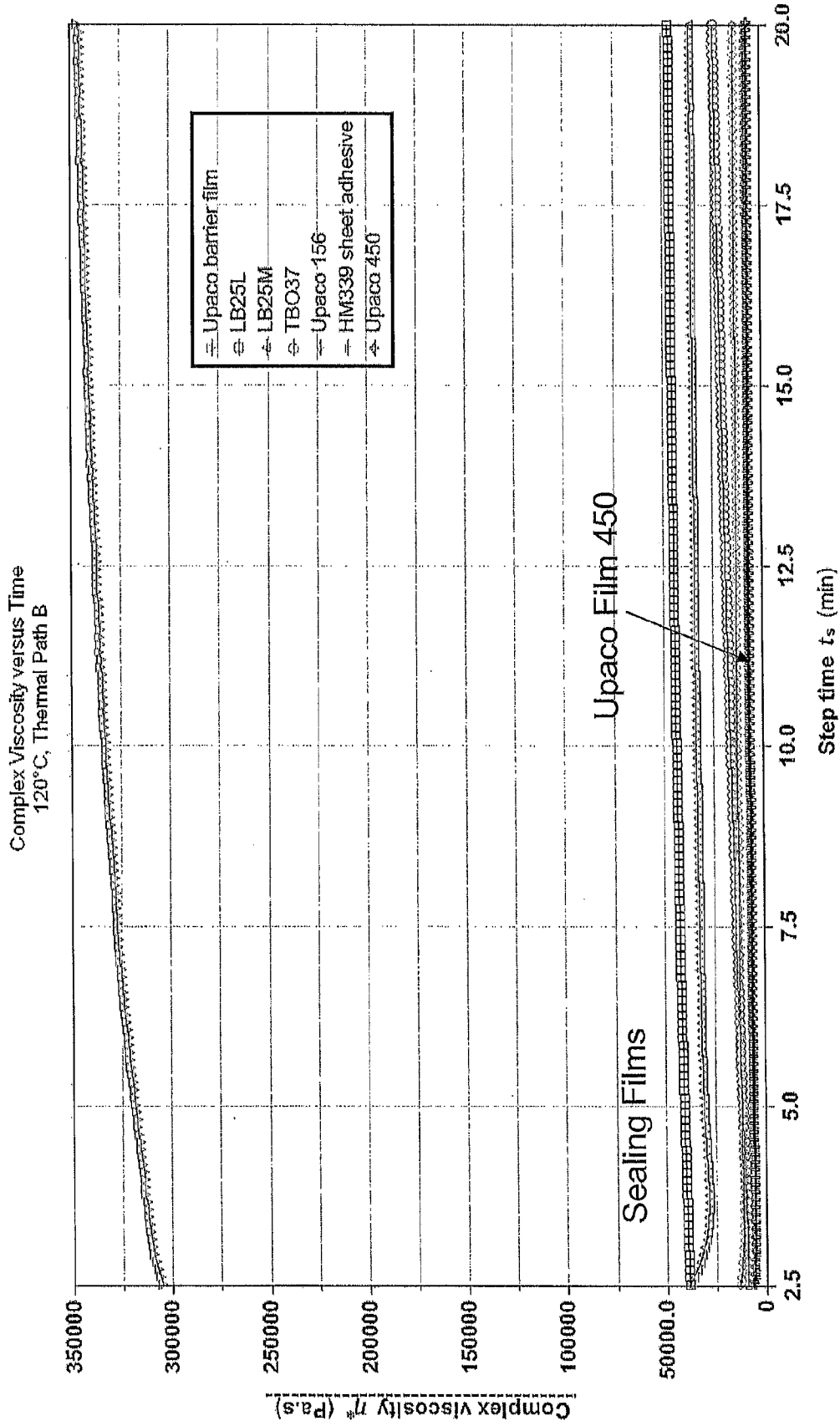


Fig. 4

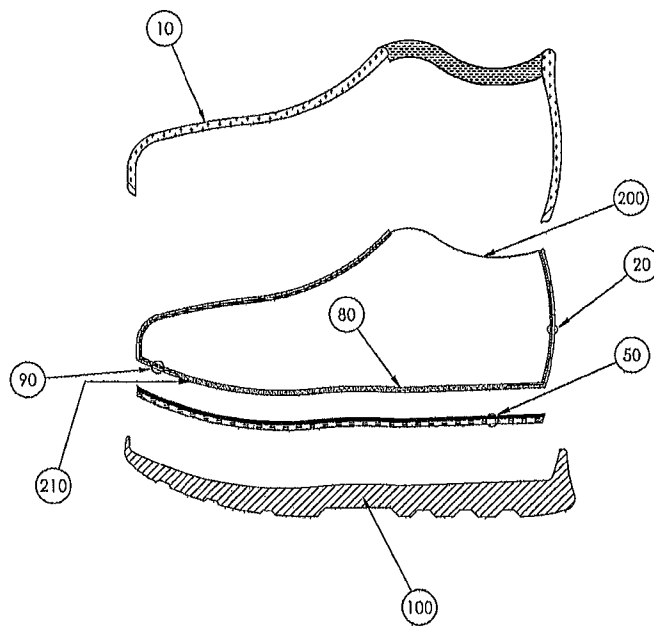


FIG 5

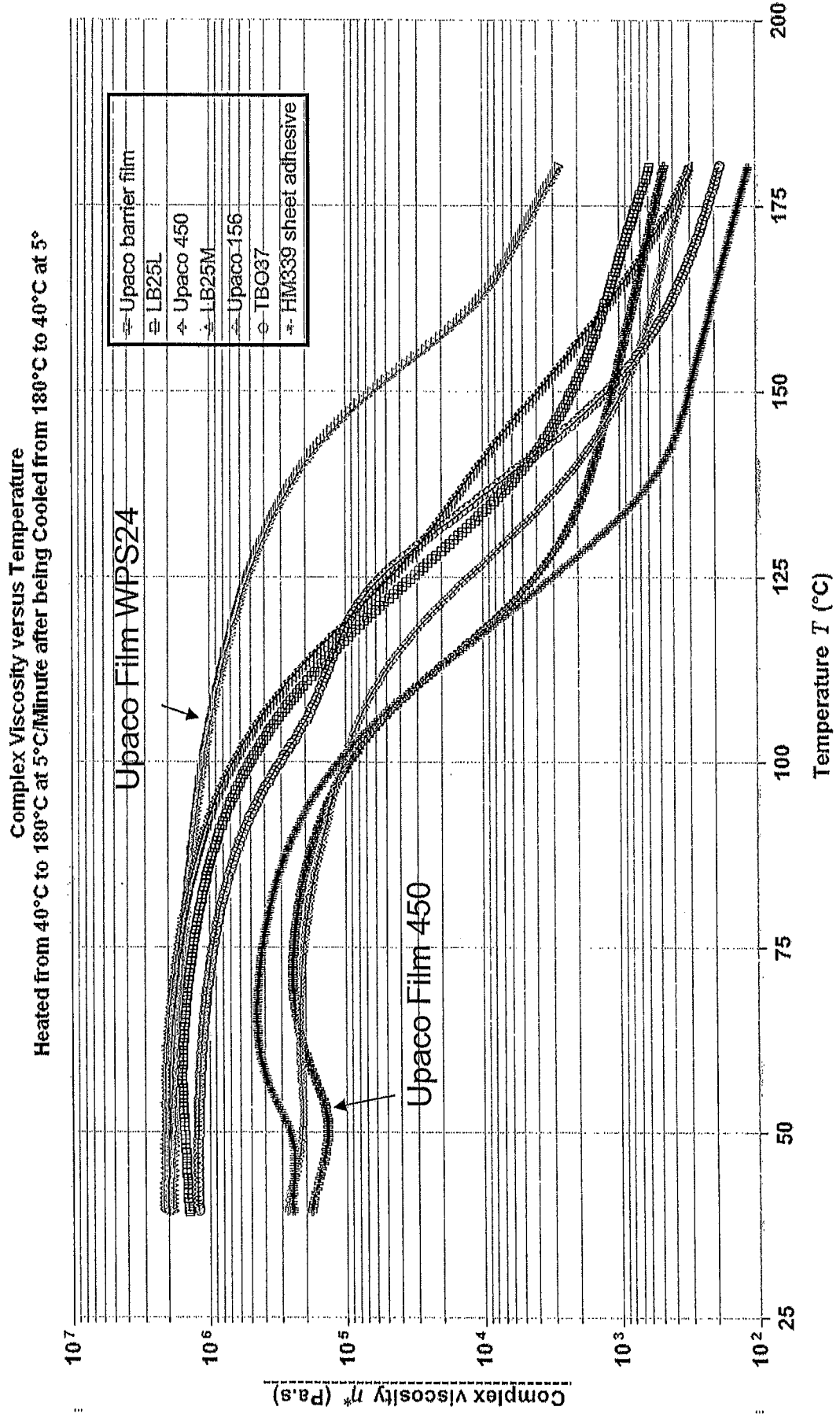


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No PCT/US2013/029472

A. CLASSIFICATION OF SUBJECT MATTER INV. A43B7/12 ADD.		
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) A43B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 195 100 A1 (GORE W L & ASS SRL [IT]) 10 April 2002 (2002-04-10)	1-14, 16-25
Y	paragraphs [0001], [0043] - [0046]; claims 10-14; figures 1, 3 -----	15
Y	US 2004/139628 A1 (WIENER ROBERT J [US]) 22 July 2004 (2004-07-22) paragraphs [0030], [0033]; figure 3 -----	15
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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	"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	
"E" earlier application or patent but published on or after the international filing date	"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	
"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)	"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	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
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Date of the actual completion of the international search	Date of mailing of the international search report	
4 June 2013	18/06/2013	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Gkionaki, Angeliki	

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Information on patent family members

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