SPA COVER WITH METALIZED MOISTURE BARRIER AND METHOD OF MANUFACTURE

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Publication Classification

Int. Cl. .......................... E04H 4/00
U.S. Cl. .......................... 4/498

ABSTRACT

A moisture barrier for a rigid insulating panel of a spa cover is a laminate bag of at least two layers. A first layer of polyethylene plastic film is bonded with at least a second and inner layer of metalized plastic film to form the laminate bag. A third layer of polyester is optionally provided and which is enveloped within second layer as an additional moisture barrier. The laminate bag has at least an open end which is adapted for receiving the panel and which is sealed. The sealed laminate bag can be evacuated for additional insulating characteristics.
SPA COVER WITH METALIZED MOISTURE BARRIER AND METHOD OF MANUFACTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority of Canadian Patent Application 2,454,775, filed Jan. 5, 2004, the entirety of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] This invention relates to moisture barriers for a spa cover and methods of manufacturing spa or hot tub covers. More particularly, a spa cover incorporates a foam core encased in a bag formed of at least an inner layer of metalized polyester glued to an outer layer of polyethylene which is heat sealed to form a moisture resistant and vacuum-retaining bag. In another aspect, the invention comprises a cast core for forming a close-cell, moisture-resistant core.

BACKGROUND OF THE INVENTION

[0003] A conventional insulating cover for a hot tub or spa, a spa cover, comprises a single piece or several pieces of rigid, thermally insulating material or panels, encased in a water-resistant sheet material. The rigid material is sized and shaped to cover the top opening of a particular design of spa. Handles are attached to the encasing sheet material to aid removal of the cover, and securing tabs are similarly attached to secure the cover onto the top opening of the spa. The cover prevents entry of debris into the spa and avoids any accidental injury of children and others who might fall into the spa. Because spas are often located outside any protective structure, the cover also prevents the entry of natural elements such as rain, snow, sleet and hail into the spa.

[0004] More importantly, the water in the spa is heated and the spa cover insulates to minimize heat loss. Water vapor is constantly present in the air space between the heated water and the spa cover.

[0005] Most manufacturers use polyethylene plastic alone as the water-resistant sheet material, however this material still allows gases to exchange therethrough including moisture. Over time, all such polyethylene-only covered foam inserts absorb moisture. Compromised spa covers lose their ability to insulate properly as a result of moisture absorption, and they become very heavy and hard to manage for the spa owner.

SUMMARY OF THE INVENTION

[0006] The present invention is a superior moisture barrier for the rigid panels of a spa cover. The design and method of construction of the barrier results in a completely moisture-proof spa cover. In one embodiment, a foam core is completely encapsulated in a envelope or bag of polyethylene which is heat sealed as a first barrier against moisture penetration into the spa cover. An adjacent and inner layer of metalized plastic film are bonded to the polyethylene. The metalized plastic film is impervious to gas transfer and moisture transfer through the layer. The two layers are bonded with adhesive and any moisture which may pass through the polyethylene layer cannot accumulate between the metalized layer and the polyethylene. One or more additional layers can be added for additional characteristics including, an intermediate layer of nylon as a puncture resistant layer or additional vapor-resistant inner layers of polyester.

[0007] In a broad aspect, a moisture barrier for a rigid thermally insulating spa cover panel is provided comprising: a first envelope of polyethylene having at least one open periphery for accepting the panel therein; and a second envelope of metalized plastic film, enveloped within the first envelope and having at least one open periphery adapted for accepting the panel therein; wherein the first and second envelopes are bonded together, and the at least one open periphery is heat sealed to form a bag with the panel therein for forming a barrier against the transfer of moisture through the first envelope to within the second envelope.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1a is a partial perspective view of a moisture barrier according to one embodiment of the invention illustrating two-layers of a laminate material prior to bonding; FIG. 1b is a side cross-sectional view of a moisture barrier according to one embodiment of the invention and a close up of the moisture barrier which illustrates three-layers of a laminate material formed into a bag and a rigid panel installed through an open periphery; and FIG. 1c is a side cross-sectional view of the moisture barrier of FIG. 1b with the panel therein and being vacuum evacuated over the rigid panel and sealed at peripheries of the bag.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] Generally, a spa cover comprises an insulating panel, such as a rigid insulation panel, preferably formed of foam, which is encapsulated in a moisture barrier such as water-tight spa cover bag. The bag is typically protected by an outer vinyl cover (not shown) which is conventional in its form and manufacture. Typically, two different types of vinyl cover are used; a first type of vinyl on the underside of the cover which is closest to the water of the spa, and which is very durable and chemical resistant; and the second type of vinyl on the top of the cover being more decorative, and which can come in many colors and is UV resistant for exposure to sunlight.

[0012] More particularly, as shown in FIG. 1c, a moisture-resistant bag 10 for a panel 11 comprises a heretofore unknown and advantageous combination of layers to avoid moisture penetration. In addition to the known and outer polyethylene (PE) film or layer 12, a novel arrangement is provided comprising an inside layer of low moisture transmissibility metalized plastic film 13 which can be further enhanced with an additional inner layer 14 of plastic film adjacent the foam core.

[0013] More particularly, and with reference to FIGS. 1a and 1b, at least a first envelope or outer layer 12 is provided which is amenable to sealing. In one embodiment of the invention, as others have done, PE film is used as the first outer layer 12 which can be heat sealed or taped. A suitable thickness for the polyethylene is about 60 um. The use of a sealed bag 10 allows for a vacuum to be drawn inside the bag itself. A true vacuum is the best form of insulator as, inside
a vacuum, molecules cannot easily make contact with one another which is necessary for the transfer of heat. With this type of PE material, and process, a partial vacuum can be created inside the bag around the rigid panel. This significantly improves the R-value or insulating value of the spa cover.

[0014] However, Applicant has determined that the outer layer 12 of PE material has a significant transmission rate through which allows an unacceptable amount of gas and moisture into the bag 10. Accordingly, a second envelope 13 or inner layer of metalized plastic film is located adjacent the rigid panel 11 and which is enveloped within and bonded to first envelope 12 of PE to form a laminate 15, subsequently formed into the bag 10 to minimize moisture transmission to the panel 11. The metalized plastic film also provides an added benefit of providing heat reflection in the case of heated waters in a spa for further energy savings. A suitable second envelope 13 of metalized plastic film is a 12 um thickness of polyester which is metalized such as by vacuum metalization with aluminum (VMPET). Other metalized plastic films could be employed using zinc or any alloy. This second envelope 13 of metalized plastic film substantially prevents the transfer of gases and steam, leaving the rigid panel 11 dry and thus maintaining the panel’s insulating properties.

[0015] As a measure of relative transmission rates, consider the case of the food packaging industry where transmission of a gas such as oxygen is preferably excluded by the film packaging; the rate at which gas passes through the film being termed the Oxygen Transmission Rate or OTR. As set forth by Polyprint Inc., Tucson Ariz., www.polyprint.com/tag_otr.htm, oriented polyester (OPET) which has been metalized has 520-1600 of the transmission rate of non-metalized OPET and only 520,000 the transmission rate of high density polyethylene (HDPE).

[0016] The second envelope 13 of metalized plastic film can be bonded to other plastic layers using adhesive lamination such as using adhesive XH-750A (model) which is particularly suitable for polyester, and which is manufactured by “XINHUI CHEMICAL PRODUCTS CO. LTD.”

[0017] As shown in FIG. 1a, a minimum of two envelopes, the first outer PE envelope 12 and the second inner metalized plastic film envelope 13, are used to vapor-seal the rigid panels of the spa cover.

[0018] With reference to FIG. 1b, optionally, a third envelope 14 or inner layer of PET (Polyester light film) can be enveloped by and laminated within the inner surface of the second envelope 13 of metalized plastic film which then lies adjacent the rigid panel 11. PET has the characteristics of a high density, vapor-proof layer. A 12 um thickness is a typical thickness suitable for the PET third envelope 14.

[0019] Accordingly, in one preferred embodiment of the invention, three envelopes 12,13,14 or layers of plastic film are glued or bonded into one multi-layer sheet or laminate 15 which is thereby manufactured into the bag 10. The layers are assembled into the laminate 15 having, for example, a bottom, middle and a top layer prior to forming the sheets into the bag 10.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Material</th>
<th>Feature</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top (inner)</td>
<td>PET (Polyester - light film)</td>
<td>High density, relatively vapor-proof</td>
<td>12 um</td>
</tr>
<tr>
<td>Middle</td>
<td>VMPET (Vacuum Metal Polyester Light Film)</td>
<td>Heat reflecting &amp; highly vapor-proof</td>
<td>12 um</td>
</tr>
<tr>
<td>Bottom (outside)</td>
<td>PE (Polyethylene)</td>
<td>Good for heat sealing, bonds easily and holds together</td>
<td>66 um</td>
</tr>
</tbody>
</table>

[0020] The thickness of the PE can be readily adjusted to vary the overall thickness of the laminate 15. It is preferred to use PE thicknesses of greater than 30 um to minimize manufacturing difficulties in heat sealing.

[0021] The laminate 15 is glued or bonded together in either one or two steps. With less sophisticated machinery, two envelopes or layers can be combined as follows: the first envelope 12 as a bottom, outer layer of PE and a second envelope 13 or middle layer of VMPET are bonded together using an appropriate adhesive. Finally, the third envelope 14 or top, inner PET is bonded to the middle layer 13 forming the tri-layer laminate 15. The laminate 15 is passed through a solidifying process to keep the adhesive stable and firm. The laminate 15 is cut into required dimensions for forming a suitable sized top sheet 16 and bottom sheet 17 for the bag. There are machines currently available for combining all three layers simultaneously.

[0022] Further, as shown in FIG. 1b, the sheets 16,17 are sized according to the size of the rigid panel 11. For a rectangular rigid panel or foam insert, a heater seals the top and bottom sheets 16,17 to one another on three rectilinear sides or peripheries 18, leaving at least one side open to form the bag 10 with an open side along its periphery for accepting insertion of the rigid panel 11. The bag 10, whether formed of two or three layers, is formed by heat sealing the envelopes 12,13 or 12, 13, 14 together at the peripheries and forming the bag 10 with at least one open end 19. The heat sealing may be of all layers or of the PE layer alone. The rigid panel 11 is inserted through the open end 19 after which the open end 19 is subsequently and almost completely sealed while keeping a small vacuum hole open (not shown) which is adapted for accepting a vacuum pump pipe. Air is pumped out of the bag 10.

[0023] With reference to FIG. 1c, after a vacuum V is achieved in the bag, the vacuum hole opening is sealed.

[0024] While not shown, it is usual to also apply conventional vinyl covers to envelop the laminate bag 10, the vinyl covers often also being formed into an envelope such as through sewing or re-closeable fasteners for removable installation over the bag 10.

[0025] In yet another embodiment, and optionally to resist tearing and puncturing which defeats the moisture barrier, a puncture resistant envelope such as a layer of biax nylon can be provided. A layer of biax nylon can be used between the first and second envelopes 12,13. The biax nylon makes the material much more durable and resistant to puncture. In such embodiments, a suitable construction includes an inside layer of 0.48 mil metalized plastic film, an adhesive, an intermediate layer of 0.60 mil biax nylon, an adhesive,
and an other layer of 2.0 mil PE. Other suitable puncture resistant materials include the outer vinyl envelope or thin rigid plastic sheets or fiberglass sheets as required and which could also be positioned outside the first envelope 12 of PE. Therefore, a more puncture resistant bag includes a tri-layer laminate of the first and outer envelope of PE, an inner envelope of Biax nylon and the second envelope of metalized plastic film. Another puncture resistant bag includes a four layer laminate of a first outer envelope of PE, an inner envelope of Biax nylon, an inner metalized plastic film and an inside layer of polyester.

[0026] Rigid Panel

[0027] In one embodiment, the rigid panels 11 comprise a single piece of foam such as expanded polystyrene or expanded polyurethane foam.

[0028] As described, the bag 10 is a moisture barrier enveloping the rigid panels 11. The panels 11 are inserted into the envelope or bag 10. Further advantage is gained through the particular form and treatment of the rigid panels 11. When standard foams are cut, the closed nature of the closed cell foam is actually opened and moisture can more easily be absorbed. Therefore it is preferable to avoid cutting the foam insert to fit the bag 10 as there is the risk of opening cells of the foam which would otherwise remain closed and more resistant to moisture.

[0029] As a result, and in another embodiment of the invention, Applicants have cast the panel 11 as a single sheet of foam of a particular size and shape, and thus the closed cell nature of the foam is far better maintained and moisture absorption is slowed significantly should any moisture pass the laminate 15. One type of castable foam material used for the panel 11 is expanded polystyrene ("EPS" e.g. Styrofoam™ The Dow Chemical Company).

[0030] Special molds are made for each size of spa cover insert. Accordingly, the foam of the rigid panel 11 is cast in the mold to the final form and the bag 10 is slotted over the insert without a need for cutting.

[0031] In another embodiment for improving the insulating value of the panel 11, the panel 11 can be manufactured of polyurethane or a combination of polyurethane and a strong core such as an expanded polystyrene core encapsulated within polyurethane foam. Where the panel 11 is a combination of an encapsulating polyurethane and Styrofoam™, the polyurethane is injected around a core of Styrofoam™ to strengthen the core of the panel 11. The resulting rigid foam panel 11 has a higher R-value than expanded polystyrene and is more resistant to moisture absorption.

[0032] It is understood that regardless of the foam used, the panels 11 can be sealed using the multiple layer bag 10 embodiments described above.

[0033] Molds are manufactured according to the dimension of the cover provided by the spa manufacturer. The mold is formed of aluminum and comprises two parts, a top and a bottom. Each mold possesses a feed opening and cooling water openings. Cooling water is applied to the sides of the mold and there are hundreds of tiny steam holes formed all about the mold.

[0034] Simplistically, a fully open mold is closed and bolted down to form a chamber shaped like the finished foam insert. In the case of molding of EPS, the mold is filled with polystyrene and expanded using heat, such as through the injection of steam, cured and then the rigid foam insert is released from the mold.

[0035] There are a variety of methodologies for improving the efficiency of the expansion step which are not critical to the resulting rigid foam, cast insert or panel. EPS raw material is in the form of tiny beads which expand when put into the machine and steam is injected. The size of the EPS beads can affect the quality of the product. An EPS pre-expander can process the raw EPS material to form pre-expanded beads. The pre-expanded EPS beads can then be aged resulting an alteration of the characteristics of the EPS to possess much better elasticity and improve the quality of the rigid foam.

[0036] In the manufacture of the specific foam rigid panel, galvanized steel or aluminum metal channels (1 mm thickness, metal channel) are strategically positioned and are temporarily affixed in place in the molds with a little foam to ensure the channels stay in an unmovable position during filling and expanding of the beads. The mold is filled. A pre-heating process using steam is employed to remove air between the beads. Further, steam heating, is applied in a unilateral manner, flows in a diagonal direction to fuse the beads inside the product. Steam is supplied bi-laterally from both sides of the mold with closed drains to fuse a suction point near an upper surface. Finally, in auxiliary heating (reversed unilateral heating), steam is supplied in the reverse direction of the initial unilateral heating.

[0037] Cooling-water supplied to the sides of the mold through the cold-water openings cools the mold and product panels. The temperature of the cooling water is maintained consistently (about 60° C.) for minimizing shrinking of the panel. Natural cooling or vacuum cooling eliminates use of sprayed water and leaves the panel dry while cooled. Moisture generated from the process can be removed by drying in this manner. Preferably, the moisture of the end product panel 11 is less than 6%. Finally, the molded rigid foam insert or panel 11 is removed from the mold and is ready for insertion in the bag 10.

We claim:
1. A moisture barrier for a rigid thermally insulating spa cover panel comprising:
   a first envelope of polyethylene having at least one open periphery for accepting the panel therein; and
   a second envelope of metalized plastic film, enveloped within the first envelope and having at least one open periphery adapted for accepting the panel therein, wherein
   the first and second envelopes are bonded together, and
   the at least one open periphery is sealed to form a bag with the panel therein for forming a barrier against the transfer of moisture through the first envelope to within the second envelope.
2. The moisture barrier of claim 1 wherein the first and second envelopes are bonded together with adhesive.
3. The moisture barrier of claim 1 further comprising:
   a third envelope of polyester enveloped within the second envelope and having at least one open periphery for
accepting the panel therein and wherein the second and third envelopes are bonded together.

4. The moisture barrier of claim 3 wherein the second and third envelopes are bonded together with adhesive.

5. The moisture barrier of claim 1 further comprising:
   a puncture resistant envelope of biax nylon sandwiched between the first and second envelopes having at least one open periphery for accepting the panel therein and wherein the puncture resistant envelope is bonded to the first and second envelopes are bonded together.

6. The moisture barrier of claims 5 wherein the first, the biax nylon and second envelopes are bonded together with adhesive.

7. The moisture barrier of claim 6 further comprising:
   a third envelope of polyester enveloped within the second envelope and having at least one open periphery for accepting the panel therein and wherein the second and third envelopes are bonded together.

8. The moisture barrier of claims 7 wherein the second and third envelopes are bonded together with adhesive.

9. The moisture barrier of claims 8 wherein the first and second envelopes are bonded together with adhesive.

10. A cover for spa comprising the moisture barrier of claim 1 wherein,
    the panel further comprises a foam insert.

11. The spa cover of claim 10 wherein the foam insert is expanded polystyrene.

12. The spa cover of claim 10 wherein the foam insert is polyurethane.

13. The spa cover of claim 10 wherein the foam insert further comprises polyurethane encapsulating a core of expanded polystyrene.

14. The moisture barrier of claim 1 wherein the bag is evacuated.

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