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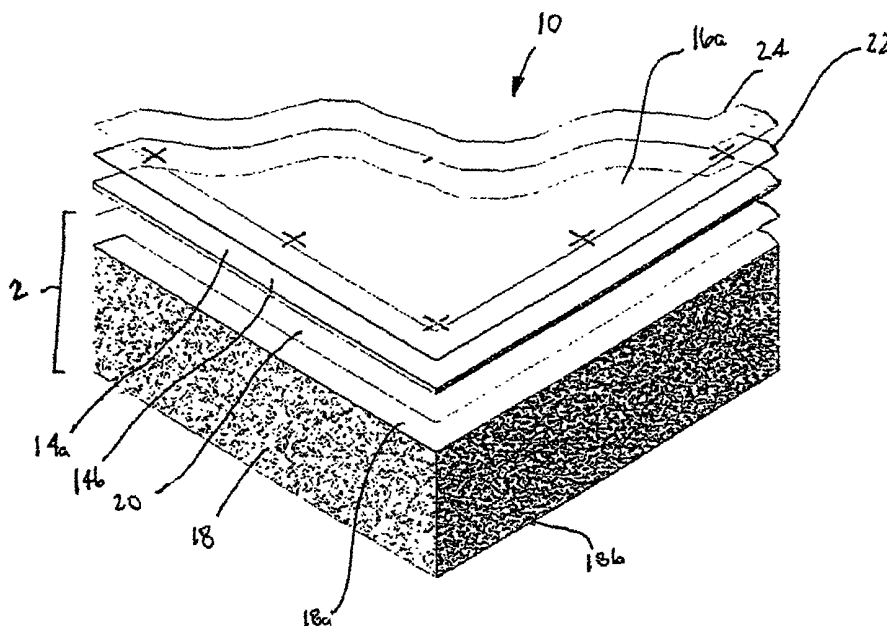
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DRY-ERASE LAMINATE STRUCTURE AND METHOD FOR MAKING SAME



(57) Abstract: A dry-erase laminate structure (10) includes a rigid substrate (12), a thin plastic sheet (14) adhered to the substrate, the plastic sheet having a substantially smooth, hard upper surface, and a nonporous "UV" hardcoat film (16) bonded to the upper surface of the plastic sheet, thereby providing a glass-like exposed writing surface (16a). The substrate includes a tileboard panel (18), and optionally a thin steel sheet (115) between the plastic sheet and tileboard to provide a magnetic laminate structure (110). A white colorant may be provided within the laminate structure to render the exposed surface opaque, and indicia, such as lines, grid, and the like, may be printed within the laminate structure that are visible through the exposed surface.

DESCRIPTION

DRY-ERASE LAMINATE STRUCTURE AND METHOD FOR MAKING SAME

5

FIELD OF THE INVENTION

The present invention relates generally to erasable marker boards, and more particularly to dry-erase laminate board structures that have enhanced writing surface finishes and/or dent-resistance, and to methods for making such laminate structures.

BACKGROUND

"Dry-erase" marker boards are often used to provide a writing surface that may be written upon, erased, and rewritten upon using dry-erase markers that may be erased from the surface with a simple wipe. Traditionally, dry-erase surfaces have been formed from porcelain, baked-on enamel or similar glazed coatings that are applied to a flat substrate, such as a fiberboard panel. These coatings provide a very smooth glass-like finish, although they may be brittle, prone to chipping, or otherwise relatively fragile.

Because of the relative difficulty and expense in making such boards, painted marker boards have generally replaced porcelainized boards. These marker boards have a layer of high

gloss paint applied to a fiberboard panel to provide a dry-erase writing surface. Although less expensive to make, the finish on painted marker boards may not be as smooth as a porcelainized board. Further, conventional powder-coat paints and the like may
5 be porous, resulting in small amounts of marker ink seeping into the writing surface during use, progressively deteriorating the quality of the writing surface over time. Plastic coatings have been suggested, such as polyurethane or acrylic polymers, that may be applied to fiberboard panels and the like as an
10 alternative to paints. Similar to paints, however, these boards merely include a thin coating for the writing surface that may be easily scratched, dented or nicked.

In addition, the fiberboard panels themselves may exacerbate this risk of indenting or scratching because of their relative
15 softness. To provide enhanced dent-resistance, steel or other metal sheets may be used as a substrate upon which a paint or other coating may be applied. These coatings, however, may not adhere as well to metals, and the resulting message board may be undesirably bulky because of the weight of the metal sheet.

20 Accordingly, it is believed that a dry-erase laminate board that improves on some of these problems may be considered useful.

SUMMARY OF THE INVENTION

The present invention is directed to dry-erase laminate structures, and to methods for making them. In accordance with one aspect of the present invention, a dry-erase laminate
5 structure is provided that includes a substantially rigid substrate, a substantially rigid plastic sheet attached to the substrate, the plastic sheet having a substantially smooth upper surface, and a substantially nonporous film bonded to the upper surface of the plastic sheet. The film, preferably a "UV"
10 hardcoat film, provides a glass-like exposed writing surface for the laminate structure.

In a non-magnetic embodiment, the substrate is preferably a wood tileboard panel, possibly including a paint seal and/or moisture seal on its exposed surfaces. In a second magnetic
15 embodiment, the substrate includes a layer of magnetic material, such as a thin steel sheet, between the tileboard panel and the plastic sheet, allowing magnetic accessories to be attracted to the writing surface.

A colorant, such as a white pigment or paint, may be
20 provided in the plastic sheet, the film, and/or the adhesive used to bond the film to the plastic sheet. The colorant preferably renders the exposed surface of the film substantially opaque in

appearance, thereby facilitating visibility of any writing applied to the exposed surface. Optionally, indicia may be provided on a lower surface of the film or a lower surface of the plastic sheet, the indicia being visible through the exposed
5 surface of the film.

The dry-erase laminate structure is preferably made by applying a thermally-activated adhesive to the film, applying the film to the upper surface of the plastic sheet, and heating the film and plastic sheet to activate the adhesive, for example,
10 using a thermal laminator. The bonded film and plastic sheet may then be adhered to the substrate, for example, using a water-based adhesive or a hot-melt glue. If the laminate structure includes a layer of magnetic material, the magnetic material may be adhered first to the plastic sheet, and then the tileboard
15 panel may be adhered to the magnetic material, for example, using a hot-melt glue.

The colorant may be added to the film, the plastic sheet and/or the thermal adhesive when they are initially formed or applied during manufacture of the laminate structure. If
20 desired, indicia may be printed or otherwise provided on a lower surface of the film or the plastic sheet. If indicia are provided, any layers between the indicia-containing surface and

the exposed surface of the film are preferably substantially transparent.

The resulting laminate structure may then be formed into one or more marker board panels, for example, by cutting the laminate
5 structure into smaller panels and/or mounting the laminate structure within a frame, as is well known in the art.

Because of the combination of the "UV" hardcoat film and underlying plastic sheet, the exposed writing surface of the resulting laminate structure is substantially glass-like and
10 nonporous, thereby providing a durable writing surface that may not absorb ink or otherwise deteriorate substantially during use, as compared to previous dry-erase marker boards.

Other objects and features of the present invention will become apparent from consideration of the following description
15 taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a first preferred embodiment of a dry-erase laminate structure, in accordance with
20 the present invention.

FIG. 2 is an exploded perspective view of a second preferred embodiment of a dry-erase laminate structure, in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning to the drawings, FIG. 1 shows a first preferred embodiment of a dry-erase laminate structure 10, in accordance with the present invention. Generally, the laminate structure 10 includes a substantially rigid substrate 12, a plastic sheet 14 attached to the substrate 12, and a "UV" hardcoat film 16 bonded to the plastic sheet 14.

The substrate 12 is a flat panel of substantially rigid material that provides structural support for the laminate structure 10. In the preferred embodiment shown, the substrate 12 is a wood tileboard panel 18 having a paint seal 20 applied to its upper and lower surfaces 18a, 18b. Tileboard panels having a thickness of between about 0.125 inch (3 mm) and about 0.50 inch (12.5 mm), and more preferably between about 0.25 inch (6 mm) and about 0.50 inch (12.5 mm), are presently preferred, as they may provide a relatively lightweight and inexpensive substrate 12 for the laminate structure 10. Alternatively, other conventional

materials, such as wood or metal sheets or composite structures, may be used, as will be appreciated by those skilled in the art.

The lower surface 18b of the tileboard panel 18 may include a moisture seal (not shown) to substantially seal the substrate 12, particularly if the substrate 12 includes wood materials that may warp if exposed to moisture. Mylar foil, wax paper, plastic sheets or coatings may provide appropriate materials for the moisture seal. Alternatively, other exposed surfaces of the substrate 12 may also include a moisture seal (not shown).

10 The plastic sheet 14 is a substantially rigid layer of plastic, such as acrylonitrile butadiene styrene (ABS), styrene butadiene styrene (SBS), or polyvinyl chloride (PVC), having a substantially smooth, hard upper surface 14a. The plastic sheet 14 may be provided from rolls or individual sheets, having a
15 thickness of between about 0.005 inch (0.13 mm) and about 0.100 inch (2.5 mm), more preferably between about 0.010 inch (0.25 mm) and about 0.050 inch (1.25 mm), and most preferably between about 0.020 inch (0.50 mm) and about 0.030 inch (0.75 mm). An important feature of the plastic sheet 14 is that the upper
20 surface 14a be substantially smooth such that a substantially glass-like writing surface 16a may be achieved for the finished laminate structure 10. Further, because of the hardness of the

plastic material, the upper surface 14a of the plastic sheet 14 may also be substantially dent-resistant and/or scratch-resistant. Presently, ABS plastic is most preferred for the plastic sheet 14.

5 The "UV" hardcoat film 16 is a substantially nonporous finish material that is bonded to the upper surface 14a of the plastic sheet 14. The "UV" hardcoat film 16 is an ultraviolet-cured resin 22 (hence the term "UV") bonded to a thin polyester film 24, providing the substantially glass-like upper surface 16a
10 for the laminate structure 10. The "UV" hardcoat film 16 preferably has a thickness of between about 0.001 inch (0.025 mm) and about 0.005 inch (.125 mm), and more preferably between about 0.0015 inch (0.038 mm) and about 0.002 inch (0.050 mm), and may be available in rolls or individual sheets. The "UV" hardcoat
15 film 16 is presently manufactured by Protect-All of Darien, Wisconsin. Because of its proprietary nature, no additional information is available on the "UV" hardcoat film 16, although it is known in the print industry for providing surface finishes for high-gloss printed paper products, such as magazines,
20 brochures and other high-quality publications. It may also be possible to manufacture the "UV" hardcoat film using a polypropylene film rather than a polyester film.

To manufacture the laminate structure 10, an adhesive (not shown) may be applied to a lower surface 16b of the "UV" hardcoat film 16 and/or to the upper surface 14a of the plastic sheet 14. In a preferred form, the adhesive is a thermally-activated
5 adhesive, such as an acrylic adhesive, that is applied to the lower surface 15b of the "UV" hardcoat film 16. The "UV" hardcoat film 16 is then placed into contact with the upper surface 14a of the plastic sheet 14, and the film 16 and plastic sheet 14 are then directed through a thermal laminator (not
10 shown). A thermal laminator is a well-known device that includes a pair of rollers, one or both of which are heated to a predetermined temperature. The heat from the rollers activates the adhesive and substantially permanently bonds the film 16 to the upper surface 14a of the plastic sheet 14, while providing a
15 substantially uniform thickness laminated assembly. In a preferred method, the thermal laminator is heated to a predetermined temperature of between about 225°F (107°C) and about 275°F (135°C) in order to activate the adhesive without causing any discoloration or damage to the materials being
20 laminated.

The bonded film 16 and plastic sheet 14 assembly are then attached to the substrate 12, for example, using a layer of

adhesive (not shown) that may be applied to the upper surface 12a of the substrate 12 and/or the lower surface 14b of the plastic sheet 14. The lower surface 14b of the plastic sheet 14 is then placed into contact under pressure with the upper surface 12a of the substrate 12, and the adhesive cured or allowed to dry. In a preferred embodiment, the adhesive is a water-based glue that may simply air-dry. Alternatively, a hot-melt glue may be applied to minimize exposure of the substrate 12 to moisture.

To provide an opaque finish, such as a white finish, for the laminate structure 10, a colorant (not shown) may be added to one or more of the layers. For example, pigment may be added to the adhesive used to bond the "UV" hardcoat film 16 to the plastic sheet 14. Alternatively, pigment may be added to the plastic material of the plastic sheet 14, to the polyester film 24 and/or to the resin 22 of the "UV" hardcoat film 16 during their manufacture.

Optionally, an ultraviolet inhibitor (not shown) may be added to the upper surface 14a of the plastic sheet 14 or incorporated into the plastic material itself to provide resistance to yellowing, which may occur due to exposure to fluorescent lights and the like during use of the laminate structure 10.

In an alternative embodiment, indicia, such as a grid, horizontal guidelines, a calendar, a project planner, individual letters, and the like (not shown), may be provided within the laminate structure 10 that are visible through the writing surface 16a. For example, indicia may be printed on the lower surface of the polyester film 24 before the "UV" hardcoat film 16 is bonded to the plastic sheet 14. Alternatively, indicia may be printed, embossed or otherwise provided on the lower surface 14b of the plastic sheet 14, the indicia not interfering with the smooth finish of the upper surface 14a.

If such indicia are provided on a surface, any materials between the indicia surface and the finished writing surface 16a are preferably substantially transparent to facilitate observation of the indicia by anyone writing on the writing surface 16a. Thus, for example, if indicia are provided on the lower surface 14b of the plastic sheet 14, a substantially clear adhesive, which may not discolor substantially during manufacturing or use, may be used to bond the "UV" hardcoat film 16 to the plastic sheet 14, and the materials of the "UV" hardcoat film 16 and the plastic sheet 14 may be substantially transparent.

The resulting laminate structure 10 may then be formed into one or more marker board panels. For example, the laminate structure 10 may be die or saw cut into smaller panels and/or may be mounted within a frame, as is well known in the art.

5 Because of the combination of the underlying plastic sheet 14 and the "UV" hardcoat film 16, the finished writing surface 16a of a laminate structure 10 in accordance with the present invention is substantially glass-like and nonporous, thereby providing an effective writing surface that will not absorb ink
10 or otherwise deteriorate substantially during use. Further, the hardness of the plastic sheet 14 provides a finished writing surface 16a that is durable, i.e., substantially dent-resistant, without substantially increasing the weight of the laminate structure 10.

15 Turning to FIG. 2, a second preferred embodiment of a laminate structure 110 is shown that generally includes a substantially rigid substrate 112, a plastic sheet 114 attached to the substrate 112, and a "UV" hardcoat film 116 bonded to an upper surface 114a of the plastic sheet 114. These layers are
20 generally similar to the like layers of the first embodiment described above, except as distinguished below.

Unlike the first embodiment described above, the laminate structure 110 includes a layer of magnetic material 115 that is disposed between the plastic layer 114 and the substrate 112. Preferably, the layer of magnetic material 115 is a thin sheet of
5 cold rolled steel, galvanized steel, or like ferrous material, for example, having a thickness of between about 20 gauge and about 33 gauge, preferably between about 24 gauge and about 30 gauge, and more preferably about 26 gauge. The layer of magnetic material 115 provides a laminate structure 110 having a writing
10 surface 116a to which magnetic accessories may be attached, as is known to those skilled in the art.

Because of the extra rigidity provided by the layer of magnetic material 115, a plastic sheet 114 may be used for the laminate structure 110 that is relatively thin compared to the
15 first (non-magnetic) embodiment. For example, a PVC sheet having a thickness of between about 0.005 inch (0.125 mm) and about 0.030 inch (0.75 mm), and preferably about 0.006 inch (0.150 mm), may be used. The plastic sheet 114 preferably provides a durable, substantially smooth upper surface 114a, similar to the
20 first embodiment described above.

To make the laminate structure 110, the plastic sheet 114 is initially attached to the layer of magnetic material 115. For

example, a thermally-activated adhesive may be applied to a lower surface 114b of the plastic sheet 114 and/or to an upper surface 115a of the layer of magnetic material 115, and the surfaces 114b, 115a directed against one another. The "UV" hardcoat film 116 may be bonded to an upper surface 114a of the plastic sheet 114, for example, using the thermally-activated adhesive described above. Thus, the "UV" hardcoat film 116, plastic sheet 114, and layer of magnetic material 115 may be fed together through a thermal laminator to bond the "UV" hardcoat film 116 to the plastic sheet 114, the thermal laminator being heated to a predetermined temperature similar to the first embodiment described above. Alternatively, the "UV" hardcoat film 116 may be bonded to the plastic sheet 114 before attaching the layer of magnetic material 115.

The substrate 112 is then attached to a lower surface 115b of the layer of magnetic material 115, for example, using an adhesive. Preferably, a layer of hot-melt glue (not shown) is applied to the lower surface 115b of the layer of magnetic material 115 and/or to the upper surface of the 112a of the substrate 112. Hot-melt glue may more effectively adhere a steel sheet used for the layer of magnetic material 115 to the substrate 112 than a water-based adhesive.

The laminate structure 110 may include an opaque colorant, a "UV" inhibitor, and/or indicia, similar to the first embodiment described above. The laminate structure 110 may then be incorporated into one or more marker boards, using conventional materials and methods.

While the invention is susceptible to various modifications, and alternative forms, specific examples thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents and alternatives falling within the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A dry-erase laminate structure, comprising:
a substantially rigid substrate;
a plastic sheet attached to the substrate, the plastic sheet
5 having a substantially smooth upper surface; and
a substantially nonporous film bonded to the upper surface
of the plastic sheet, the film comprising a glass-like exposed
surface.
- 10 2. The dry-erase laminate structure of claim 1, wherein
the film comprises a "UV" hardcoat film.
3. The dry-erase laminate structure of claim 1, further
comprising a thermally-activated adhesive layer bonding the film
15 to the plastic sheet.
4. The dry-erase laminate structure of claim 1, wherein
the plastic sheet comprises ABS, PVC, or SBS plastic.
- 20 5. The dry-erase laminate structure of claim 1, wherein
the substrate comprises a layer of magnetic material between the
plastic sheet and a wood panel.

6. The dry-erase laminate structure of claim 5, wherein the layer of magnetic material comprises a steel sheet.

5 7. The dry-erase laminate structure of claim 1, wherein the substrate comprises a wood panel comprising at least one of a paint seal and a moisture seal on an exposed surface thereof.

10 8. The dry-erase laminate structure of claim 1, further comprising a colorant provided in one of the plastic sheet, the film, and an adhesive bonding the film to the plastic sheet, the colorant rendering the exposed surface of the film substantially opaque.

15 9. The dry-erase laminate structure of claim 1, further comprising indicia provided on one of a lower surface of the film and a lower surface of the plastic sheet, the indicia being visible through the exposed surface of the film.

20 10. A dry-erase laminate structure, consisting of:
a substantially rigid substrate;
a layer of adhesive;

a plastic sheet adhered to the substrate by the layer of adhesive, the plastic sheet having a substantially smooth upper surface; and

a substantially nonporous film bonded to the upper surface
5 of the plastic sheet, the film providing a glass-like exposed surface.

11. The dry-erase laminate structure of claim 10, wherein the film comprises a "UV" hardcoat film.

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12. The dry-erase laminate structure of claim 10, wherein the film comprises a thermally-activated adhesive on a lower surface thereof for bonding the film to the plastic sheet.

15

13. The dry-erase laminate structure of claim 10, wherein the plastic sheet is formed from a substantially hard plastic material selected from the group consisting of ABS, PVC, and SBS plastic.

20

14. The dry-erase laminate structure of claim 10, wherein the substrate comprises a layer of magnetic material attached to

a wood panel, the layer of magnetic material being disposed adjacent the plastic sheet.

15. The dry-erase laminate structure of claim 10, wherein
5 the substrate comprises a wood panel including at least one of a paint seal and moisture seal on an exposed surface thereof.

16. The dry-erase laminate structure of claim 10, wherein a
colorant is provided in one of the plastic sheet, the film, and
10 an adhesive bonding the film to the plastic sheet, the colorant rendering the exposed surface of the film substantially opaque.

17. The dry-erase laminate structure of claim 10, wherein
indicia are provided on one of a lower surface of the film and a
15 lower surface of the plastic sheet, the indicia being visible through the exposed surface of the film.

18. A method for making a dry-erase laminate, comprising:
providing a substantially rigid substrate;
20 adhering a plastic sheet to the substrate, the plastic sheet having a substantially smooth upper surface; and

bonding a substantially nonporous film to the upper surface of the plastic sheet, the film comprising a glass-like exposed surface.

5 19. The method of claim 18, wherein the step of bonding the film to the plastic sheet comprises:

applying a thermally-activated adhesive to a lower surface of the film;

10 placing the lower surface of the film in contact with the upper surface of the plastic sheet; and

heating the film and plastic sheet to activate the adhesive.

20. The method of claim 18, further comprising adding a colorant to one of the film, the plastic sheet and an adhesive
15 used to bond the film to the plastic sheet, the colorant rendering the exposed surface of the film substantially opaque.

21. The method of claim 18, further comprising providing indicia on a lower surface of one of the film and the plastic
20 sheet, the indicia being visible through the exposed surface of the film.

22. The method of claim 18, wherein the step of providing a substrate comprises:

providing a wood panel; and

attaching a layer of magnetic material to the wood panel,
5 the layer of magnetic material being disposed adjacent the plastic sheet when the plastic sheet is adhered to the substrate.

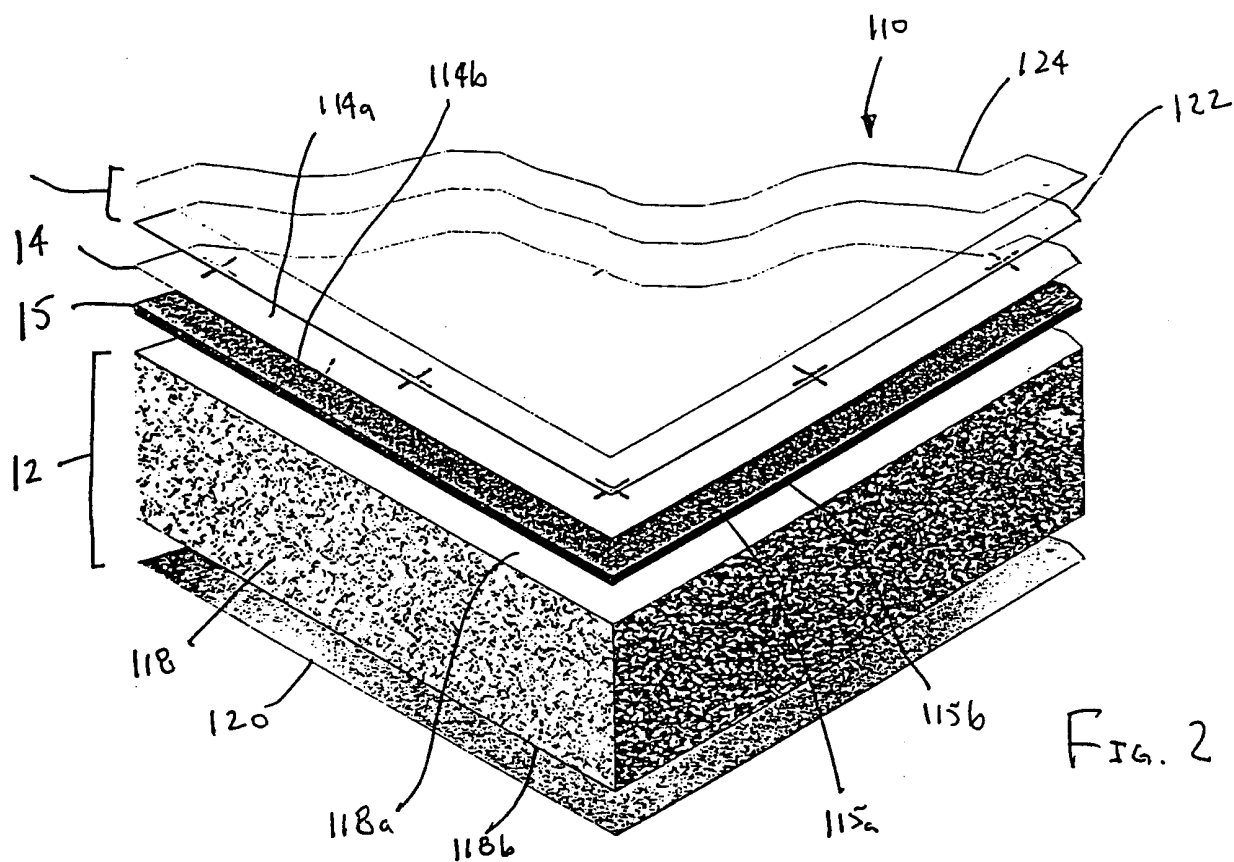
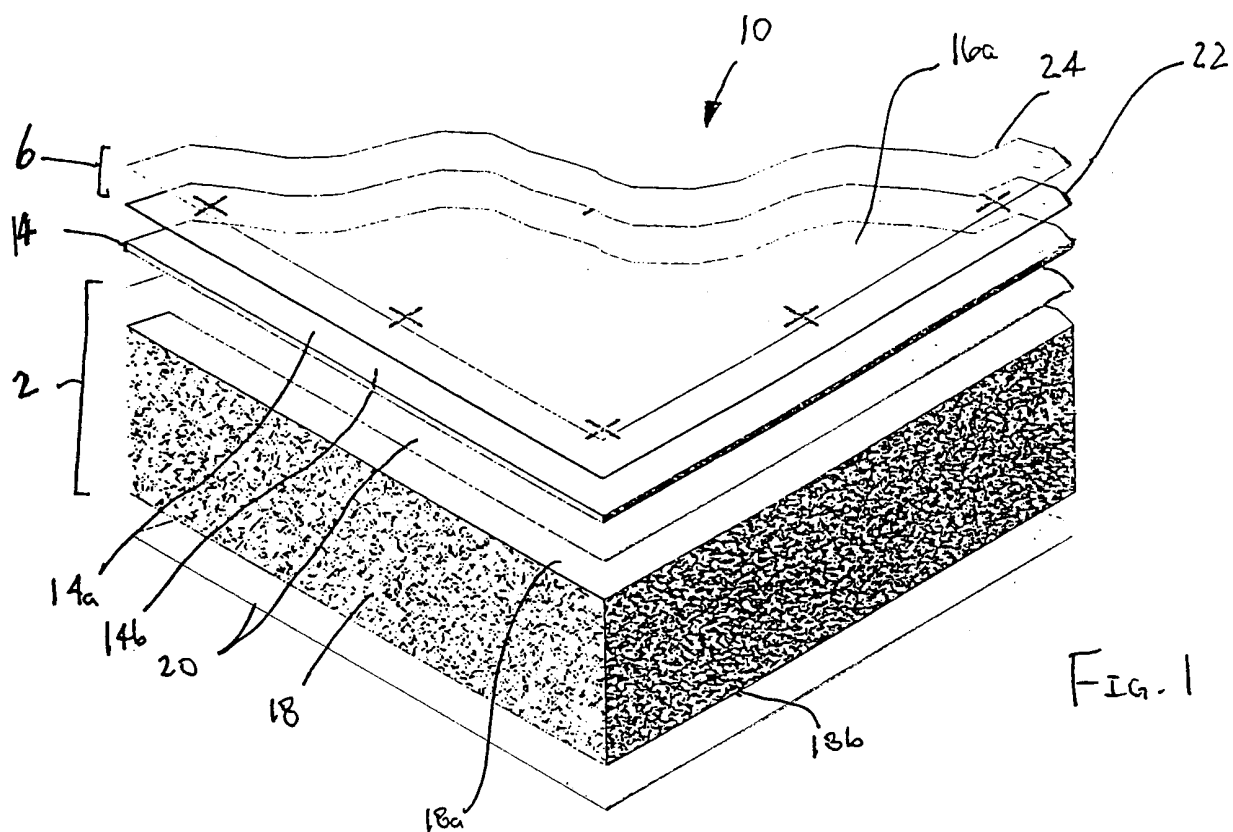
23. The method of claim 22, wherein the layer of magnetic material comprises a steel sheet, and wherein the step of
10 adhering the plastic sheet to the substrate comprises:

applying a hot-melt adhesive to at least one of a lower surface of the plastic sheet and an upper surface of the steel sheet; and

placing the lower surface of the plastic sheet in contact
15 with the upper surface of the steel sheet.

24. The method of claim 18, further comprising applying a moisture seal to an exposed surface of the substrate.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B32B 15/08, 15/10, 15/18, 21/04, 27/06, 27/08
US CL : 428/461, 464, 500, 511, 515, 537.1

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)
U.S. : 428/461, 464, 500, 511, 515, 537.1

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)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,422,155 A (SPENCE, JR.) 06 June 1995 (06.06.1995), abstract, column 1, lines 43-57, column 5, lines 21-32, column 6, lines 1-6 and lines 43-52.	1-2, 7-8, 10-11, 15-16 ----- 1-20
X --- Y	US 5,361,164 A (STELIGA) 01 November 1994 (01.11.1994), abstract, column 2, lines 17-52, column 4, lines 19-36, column 5, lines 3-16 and 54-56.	1-4, 8, 10-13, 16, 18-20 ----- 1-20
Y, P	US 6,067,266 A (DONELAN) 23 May 2000 (23.05.2000), abstract, column 1, lines 4-26)	1-20
A	US 5,300,331 A (SCHAEFFER) 05 April 1994 (05.04.1994).	1-20
A	US 5,827,072 A (NEUFER et al) 27 October 1998 (27.10.1998).	1-20

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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