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A20T16 A20T9

(56) Documents Cited:

WO 1994/025249 A1 **US 5662996 A**
US 5571355 A

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INT CL⁷ **B29C, B29D, B60J, B60R**
Other: **Online & other databases: WPI EPODOC**

(54) Abstract Title: **Vehicle door interior panels and methods of making same**

(57) An interior trim panel (12) for a vehicle door (10)(figure 1-not shown) is provided according to alternative methods. The interior trim panel (12) includes a bolster (16) to which a polyurethane skin (28) is molded by a spraying operation. Expanded polyurethane foam (32) is sprayed over the polyurethane skin (28) and a backing panel (50, 56) is either integrally formed or assembled to the polyurethane foam layer (32).

The bolster may be vacuum formed before being inserted into a mould in which the spraying steps are performed to form the bolster/skin/foam assembly. The substrate may be assembled by applying an adhesive layer between the foam layer and the substrate, or by placing the substrate on the foam layer whilst it is curing or by placing the assembly in a reaction injection mould and injecting polyurethane in the presence of chopped glass fibre or glass fibre mat 42.

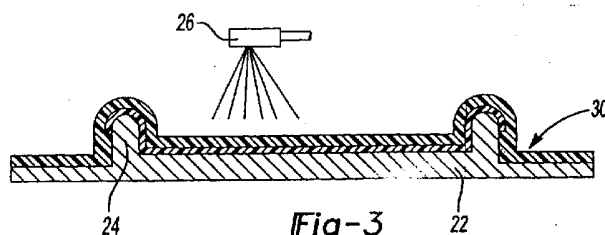


Fig-3

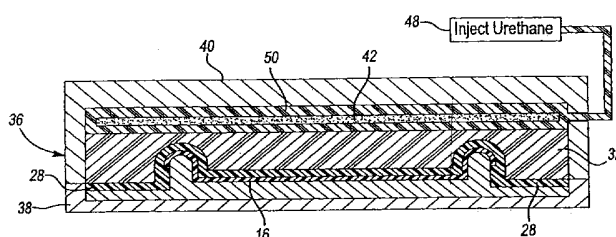
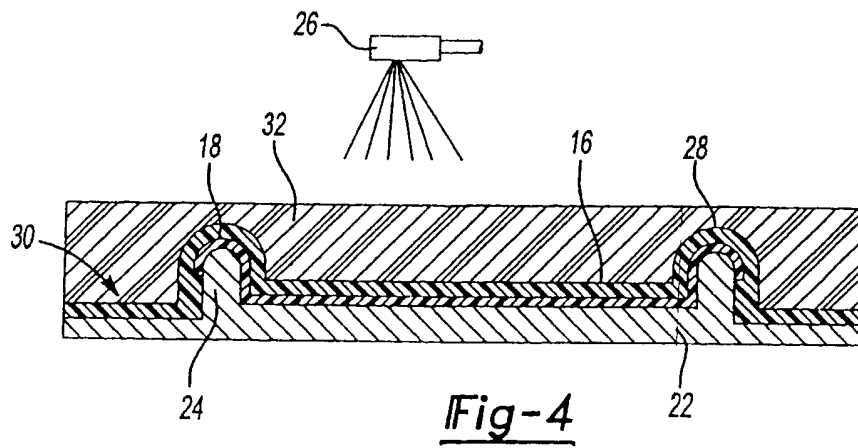
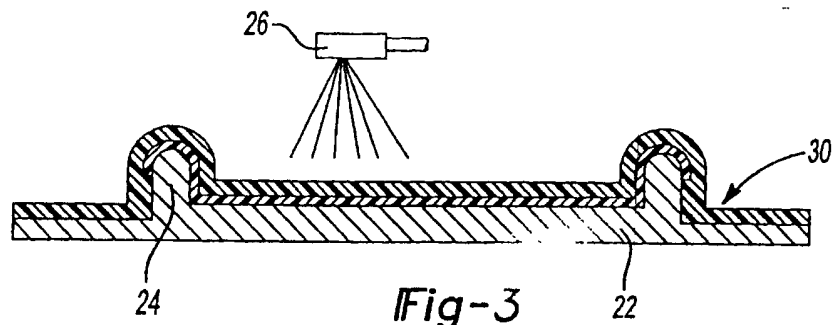
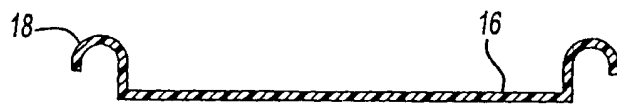
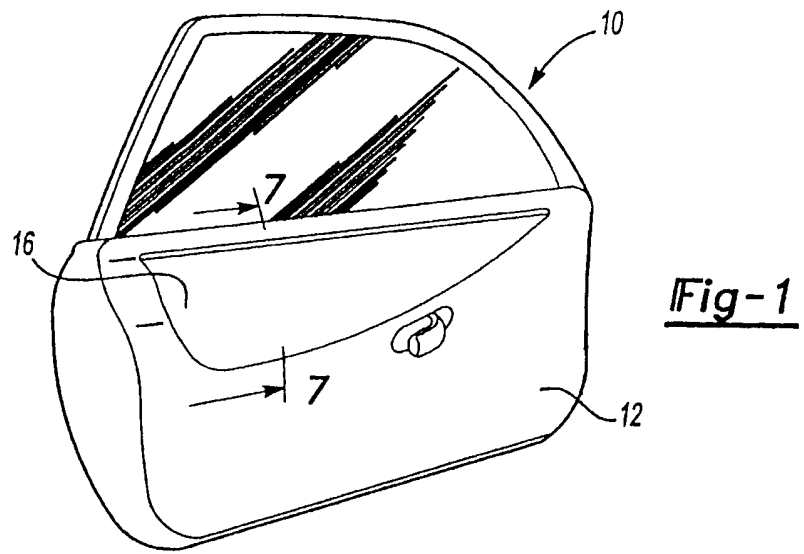


Fig-6



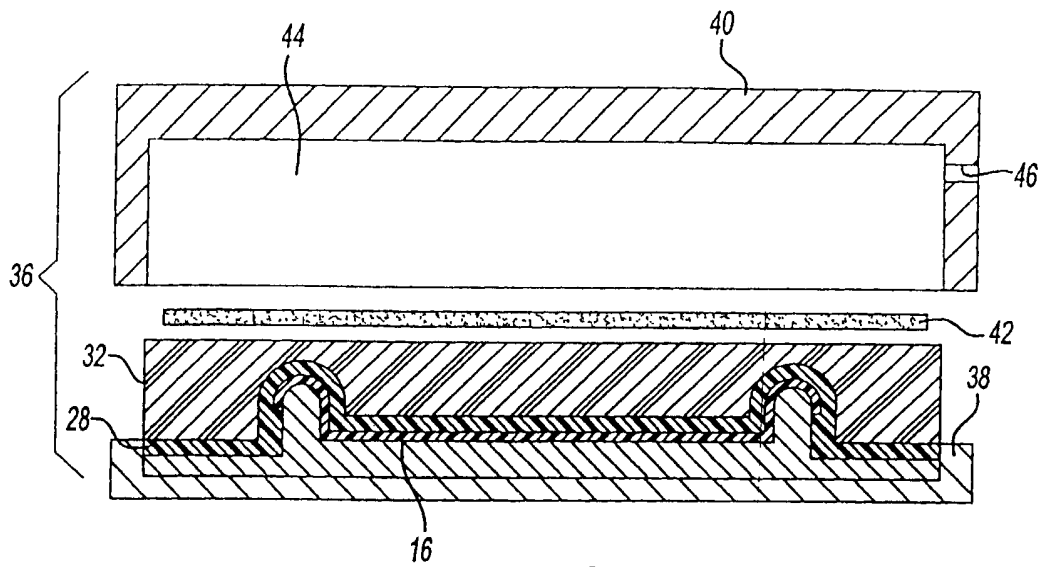


Fig-5

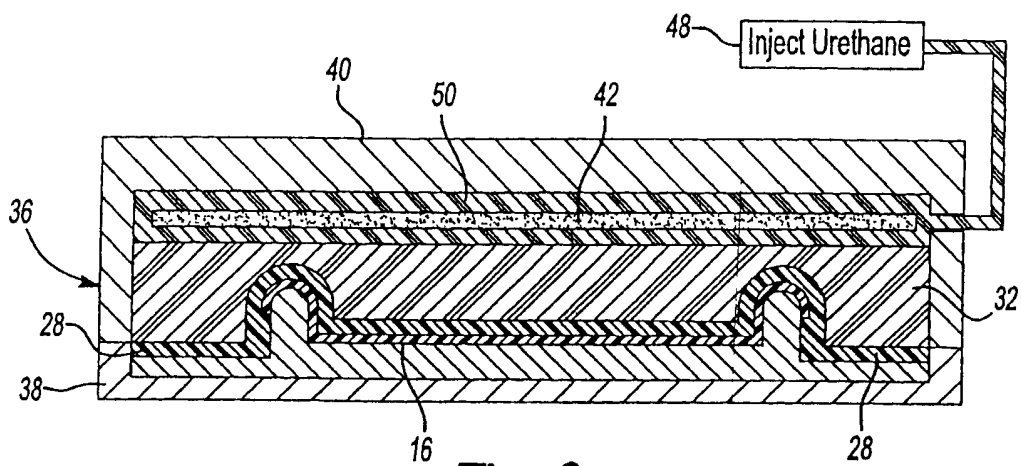


Fig-6

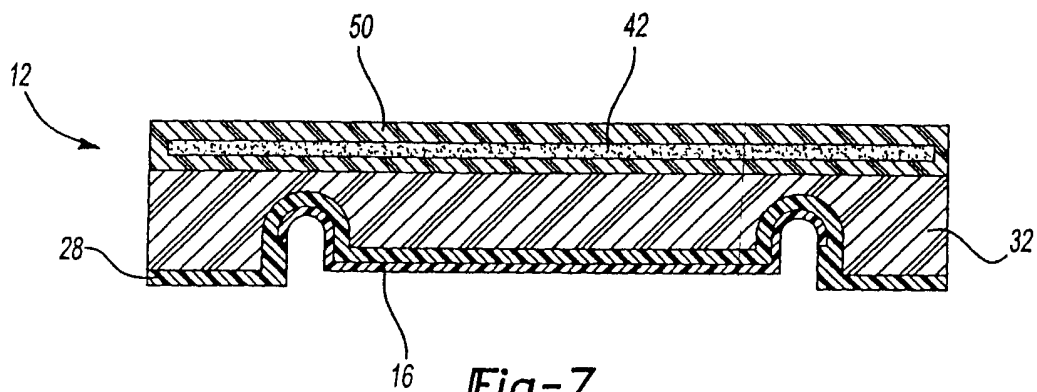


Fig-7

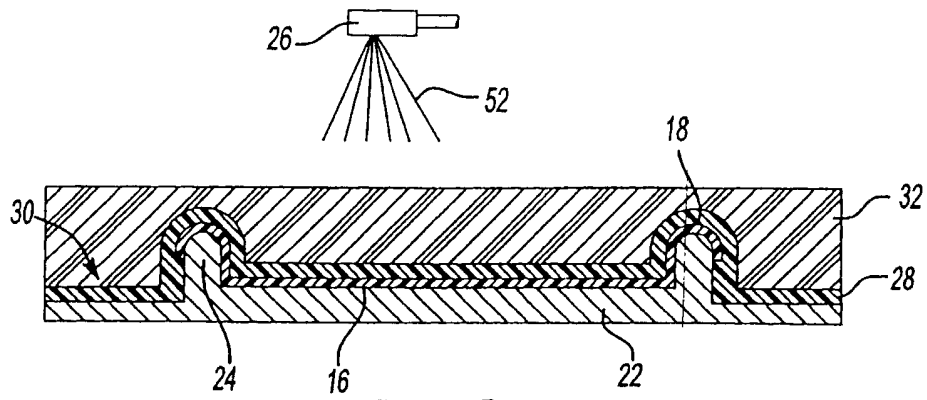


Fig-8

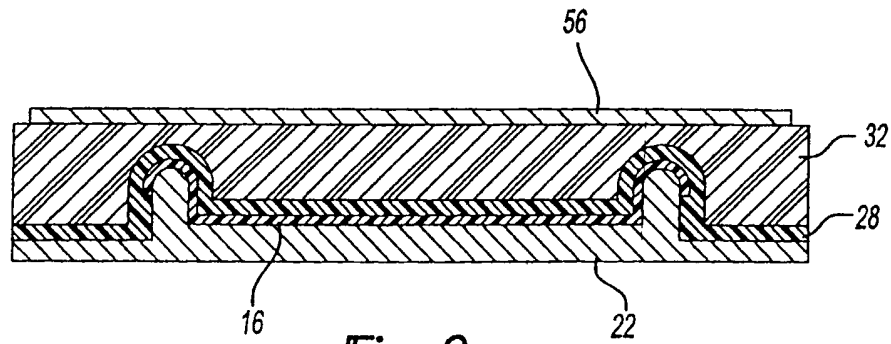


Fig-9

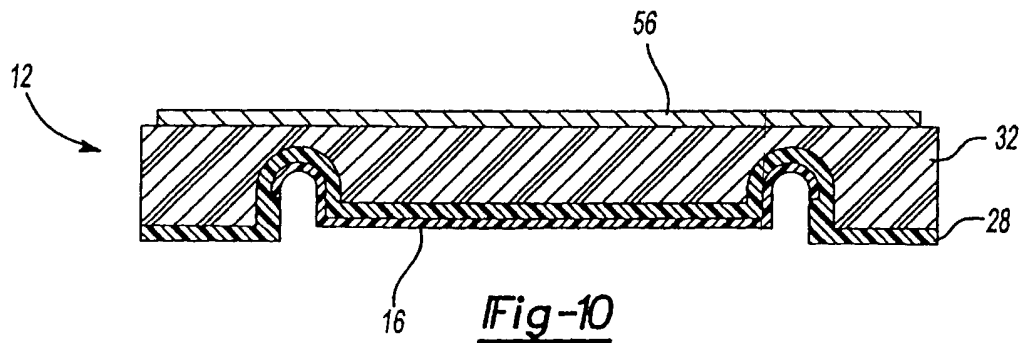


Fig-10

METHOD OF MAKING AN INTERIOR PANEL FOR A DOOR AND AN
ARTICLE MADE THEREBY

5 The present invention relates to an interior trim panel for a vehicle door and a method of making an interior trim panel.

10 Vehicle designers may design the specified interior trim for vehicle doors that include trim and bolster portions and other soft padded areas. Padding is frequently specified in certain areas, such as in areas near arm rests or in areas where vehicle occupants make contact with their hands or arms. Interior trim is frequently designed with
15 multiple appearance effects and feel by providing different areas with different trim finishes. For example an interior trim panel of a door may have wood appearance portions, cloth surfaces, leather portions, and various textile coverings.

20 Panel portions having different physical characteristics may require multiple assembly operations to join adjacent parts together by sealing or in conjunction with adhesives. Labor costs generally tend to increase as
25 the number of assembly operations required to prepare an interior trim panel for a door increase. Secondary manufacturing operations require additional tooling, fixtures and labor expense.

30 There is a need for an interior trim panel for a door and a method of making an interior trim panel having different portions that have a combination of different surface finishes. Some surface coverings may be supported by a relatively rigid bolster panel. There is a further

need to provide such a method and article in a one-piece construction that minimizes material and labor costs. It is important that a high quality interior panel be provided that reduces assembly time and the number of assembly
5 operations required to provide the interior trim panel for a door. There is also a need for an interior trim panel that provides an alternative or improvements generally to conventional panels.

10 It is therefore desirable to provide an improved trim panel and method of making an interior trim panel which addresses the above described problems and/or which offers improvements generally.

15 According to the present invention there is provided an interior trim panel and method of making an interior trim panel as described in the accompanying claims.

In an embodiment of the invention there is provided
20 a method of making an interior trim panel for a vehicle door. The method may comprise the steps of vacuum forming a bolster and inserting the bolster into a mold. A polyurethane skin is sprayed onto the mold and over one side of the bolster to form a skin/bolster assembly. An
25 expandable polyurethane elastomer is sprayed onto the polyurethane skin. The elastomer/skin/bolster assembly is inserted into a reaction injection mold. A glass fiber material is inserted into the reaction injection mold and polyurethane is then injected into the reaction injection
30 mold to bond an elastomer/skin/bolster assembly and the glass fiber to form a glass fiber-reinforced layer/foam/skin/bolster assembly.

The glass fiber material may be a glass fiber mat or,

alternatively, a quantity of chopped glass fiber. The bolster may have a decorative element on the side opposite to the side on which the polyurethane skin is sprayed.

5 An alternative method of making an interior trim panel of a vehicle door may comprise forming a bolster in a vacuum forming process, inserting the bolster in a mold and spraying a urethane skin onto the mold over one side of the bolster to form a skin/bolster assembly. An expandable
10 polyurethane elastomer layer may then be sprayed onto the polyurethane skin to form a foam/skin/bolster assembly. In the alternative method, a substrate is assembled to the elastomer layer of the foam/skin/bolster assembly.

15 The latter alternative, the step of assembling the substrate may further comprise placing the substrate on the foam layer while the elastomer layer is curing so that the plate becomes adhered to the foam layer. Alternatively, the step of assembling the substrate may further comprise
20 applying an adhesive between the foam layer of the foam/skin/bolster assembly and the substrate.

 According to another aspect of an embodiment of the invention, an interior trim panel for a vehicle door is
25 provided. The interior trim panel includes a bolster, a urethane skin layer covering one side of the bolster. A portion of the skin layer extends outwardly from the bolster. An expanded polyurethane layer is bonded to the opposite side of the urethane skin layer from the bolster
30 and a backing layer is attached to the opposite side of the expanded polyurethane layer from the urethane skin layer.

 Other aspects of the invention as it relates to an interior trim panel for a vehicle door may include

providing a glass fiber-reinforced layer of relatively rigid polyurethane that is applied in a reaction injection molding operation. A cross-section of the trim panel at the bolster may comprise a multi-layered structure comprising

5 the relatively rigid bolster panel, the urethane skin layer applied over the bolster panel, the expanded polyurethane layer, and the cover layer that is attached over the expanded polyurethane layer. A cross-section of the trim panel outboard of the bolster may comprise a multi-layered

10 structure including the urethane skin layer, the expanded polyurethane layer, and the fiber-reinforced urethane layer that is attached to the expanded polyurethane layer. A cover layer is also attached over the fiber-reinforced urethane layer. Alternatively, the portion of the trim

15 panel outboard of the bolster may comprise a multi-layered structure comprised of the urethane skin layer, the expanded polyurethane layer, the fiber-reinforced urethane layer bonded to the expanded polyurethane layer, and the cover layer that is attached over the fiber-reinforced

20 urethane layer.

These and other aspects of the present invention will be better understood in view of the attached drawings and the following detailed description of the preferred embodiments.

5

The present invention will now be described by way of example only with reference to the following figures in which:

FIGURE 1 is an interior perspective view of a vehicle door having an interior trim panel made according to the present invention;

FIGURE 2 is a cross-sectional view of a bolster panel;

FIGURE 3 is a cross-sectional view of a bolster panel in a mold on which a polyurethane skin layer is sprayed;

FIGURE 4 is a diagrammatic cross-sectional view showing the bolster panel in a mold to which a polyurethane skin layer and an expanded polyurethane foam layer is applied;

FIGURE 5 is a diagrammatic cross-sectional view showing a cross-sectional view of a foam/skin/bolster assembly being placed in an open reaction injection molding die with a glass fiber reinforcement;

FIGURE 6 is a diagrammatic cross-sectional view of the mold shown in Figure 5 and its closed position and also illustrates the injection of urethane into a cavity containing the glass fiber reinforcement;

FIGURE 7 is a diagrammatic cross-section view taken along the line 7-7 in Figure 1 of an interior trim panel after completion of the molding step illustrated in Figure 6;

FIGURE 8 is a diagrammatic cross-sectional view showing the bolster panel in a mold to which a polyurethane skin layer and an expanded polyurethane foam layer is applied;

FIGURE 9 is a diagrammatic cross-sectional view showing a mold in which an injection mold plate is secured to the foam/skin/bolster prior to removal from the tool; and

5 FIGURE 10 is a diagrammatic cross-sectional view showing the assembled plate and foam/skin/bolster assembly.

Referring to Figure 1, a vehicle door 10 is shown from
10 the inside to illustrate the interior trim panel 12. Interior trim panel 12 includes a bolster 16 which is a pre-formed insert. The bolster 16 is a styling design element of the door that may have a different composition and surface finish than other parts of the interior trim
15 panel 12. The bolster may be formed, for example, by a vacuum-forming process and may have a wood-like appearance, a metallic layer, or glossy finish.

Referring to Figure 2, a bolster 16 is shown to
20 include an edge rib 18. Edge rib 18 appears to be raised relative to the other portions of the bolster 16, but in actuality defines an indentation in the interior trim panel 12. Such indentations may be used to simulate sewing seams in interior panel designs. When the bolster 16 is attached
25 to the interior trim panel 12, the edge rib 18 appears as a recess in the interior trim panel 12.

Referring to Figures 3 and 4, the bolster 16 is loaded
into an open mold forming tool 22 with the edge rib 18
30 being received onto protrusions 24 in the tool 22. A spray gun 26 sprays or otherwise dispenses a polyurethane reactant mixture to form an polyurethane skin 28 over the bolster 16 and on outboard areas 30 of the forming tool 22. This subassembly may be referred to as a skin/bolster

assembly.

Referring to Figure 4, the spray gun 26 dispenses expanded foam polyurethane 32 to form a layer of foam polyurethane on the opposite side of the skin 28 from the bolster 16. The spray gun 26 may be the same spray gun used to dispense the skin or may be an interchangeable spray head. If an interchangeable spray head is used, an articulated robot arm may be used to manipulate either spray head.

Referring to Figure 5, a closed mold 36 is provided that may receive the foam/skin/bolster assembly. The foam/skin/bolster assembly must be removed from the tool 22 and loaded onto a lower mold 38 of the closed mold 36. An upper mold 40 is also provided as part of the closed mold 36. A glass fiber reinforcement 42 comprising either a glass fiber mat or chopped glass fiber is loaded into a cavity 44 defined by the upper mold 40. A port 46 is provided in the upper mold 40 for the injection of a reactant polyurethane mixture.

Referring to Figure 6, the mold 36 is shown in its closed position with the upper mold 40 engaging the lower mold 38. A source of polyurethane 48 is provided to inject a reactant polyurethane mixture into the cavity 44. The reactant polyurethane mixture binds to the glass fiber reinforcement 42 and also adheres to the expanded foam polyurethane layer 32.

30

Referring to Figure 7, the completed interior trim panel 12 is shown to include a bolster 16 over which a skin layer is molded. The skin layer 28 extends outboard of the bolster 16. An expanded foam polyurethane layer 32 is

bonded to the polyurethane skin 28. The glass fiber reinforced layer 50, including the glass fiber reinforcement 42, is molded over and bonded to the expanded foam polyurethane layer 32 to complete the basic structural elements of the interior trim panel 12. Other components may then be assembled to the trim panel 12.

Referring to Figure 8, an alternative embodiment is illustrated. The steps illustrated in Figures 2-4 are repeated, resulting in the structure illustrated in Figure 8. The tool 22 supporting the bolster 16 has been coated with the polyurethane skin 28 that is in turn covered by the expanded polyurethane layer 32. The spray gun 26 (or another adhesive applicator) may be used to dispense an adhesive 52 onto the expanded foam polyurethane layer 32.

Referring to Figure 9, a preformed plate that may be an injection molded plate is secured to the expanded foam polyurethane layer 32 by the adhesive 52 applied in the step shown in Figure 8. Alternatively the plate 56 could be assembled to the expanded foam polyurethane 32 without an adhesive if it is placed on the expanded foam polyurethane layer 32 before it is cured and still inherently adhesive.

Referring to Figure 10, the completed interior trim panel 12 is shown to include a bolster 16 to which a polyurethane skin 28 is molded. A layer of expanded foam polyurethane 32 is applied to the polyurethane skin 28. Finally, the plate 56 is adhered by adhesive or by inherent adhesive properties to the expanded foam polyurethane layer 32.

While embodiments of the invention have been illustrated and described, it is not intended that these

embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without
5 departing from the scope of the invention as defined in the accompanying claims.

CLAIMS

1. Method of making an interior trim panel for a vehicle door, comprising:

- 5 forming a bolster;
 inserting the bolster into a mold;
 spraying a polyurethane skin onto the mold and over one side of the bolster to form a skin/bolster assembly;
 spraying an expandable polyurethane elastomer layer
10 onto the polyurethane skin to form a foam/skin/bolster assembly; and
 assembling a substrate to the elastomer layer of the foam/skin/bolster assembly.

- 15 2. The method of claim 1 wherein the step of assembling the substrate further comprises placing the substrate on the elastomer layer while the elastomer layer is curing wherein the plate becomes adhered to the elastomer layer as it cures.

- 20 3. The method of claim 1 or 2 wherein the step of assembling the substrate further comprises applying an adhesive between the elastomer layer and the substrate.

25 4. Method of making an interior trim panel for a vehicle door, comprising:

- forming a bolster;
 inserting the bolster into a mold;
 spraying a polyurethane skin onto the mold and over
30 one side of the bolster to form a skin/bolster assembly;
 spraying an expandable polyurethane elastomer onto the polyurethane skin to form a foam/skin/bolster assembly;
 inserting the foam/skin/bolster assembly and a glass fiber material into a reaction injection mold; and

injecting polyurethane into the reaction injection mold that bonds to the foam/skin/bolster assembly and the glass fiber to form a glass fiber-reinforced layer/foam/skin/bolster assembly.

5

5. The method of claim 4 wherein the glass fiber material is a glass fiber mat.

6. The method of claim 4 wherein the glass fiber
10 material is a quantity of chopped glass fiber.

7. The method of any preceding claim wherein the bolster is vacuum formed and has a decorative element on the side opposite the one side on which the polyurethane
15 skin is sprayed.

8. An interior trim panel for a vehicle door, comprising:

a bolster;

20 a urethane skin layer covering one side of the bolster and having a portion extending outwardly from the bolster;

an expanded polyurethane layer bonded to the opposite side of the urethane skin layer from the bolster; and

a backing layer attached to the opposite side of the
25 expanded polyurethane layer from the urethane skin layer.

9. The interior trim panel of claim 8 wherein a bolster portion of the trim panel is a multilayered structure comprised of the relatively rigid bolster panel,
30 the urethane skin layer applied over the bolster panel, the expanded polyurethane layer that is sprayed over the urethane skin layer, and the cover layer that is attached over the expanded polyurethane layer.

10. The interior trim panel of claim 9 wherein the portion of the trim panel outboard of the bolster is a multilayered structure comprised of the urethane skin layer, the expanded polyurethane layer, and the fiber-reinforced urethane layer attached to the expanded polyurethane layer and the cover layer that is attached over the fiber-reinforced urethane layer.

11. The interior trim panel of any one of claims 8 to 10 wherein the portion of the trim panel outboard of the bolster is a multilayered structure comprised of the urethane skin layer, the expanded polyurethane layer, the fiber-reinforced urethane layer bonded to the expanded polyurethane layer, and the cover layer that is attached over the fiber-reinforced urethane layer.

12. The interior trim panel of any one of claims 8 to 11 wherein the backing layer further comprises a glass fiber-reinforced layer of relatively rigid polyurethane that is applied in a reaction injection molding operation.

13. The interior trim panel of claim 12 wherein the fiber-reinforced urethane section is rigid glass reinforced urethane.

14. The interior trim panel of claim 12 wherein the backing layer is an injection molded member.

15. A method of making an interior trim panel substantially as hereinbefore described with reference to, and/or as shown in figures 1 to 10.

16. An interior trim panel made by the method of any one of claims 1 to 7 or 15.

17. An interior trim panel substantially as hereinbefore described with reference to, and/or as shown in figures 1 to 10.



INVESTOR IN PEOPLE

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Application No: GB0515920.7

Examiner: Monty Siddique

Claims searched: 1-33

Date of search: 28 September 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
Y	1 at least	WO94/25249 A1 (ATOMA) forming bolster laminate 124, applying polyurethane elastomer 130 on the bolster and then applying a substrate 134 thereon
Y	1 at least	US5571355 A (ATOMA) forming bolster laminate 124, applying polyurethane elastomer 130 on the bolster and then applying a substrate 134 thereon
Y	1 at least	US5662996 A (RECTICEL) column 3 and lines 43-56; column 4 and lines 21-28, 57-58 etc.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^x :

B5A; E1J

Worldwide search of patent documents classified in the following areas of the IPC⁰⁷

B29C; B29D; B60J; B60R

The following online and other databases have been used in the preparation of this search report

WPI EPODOC