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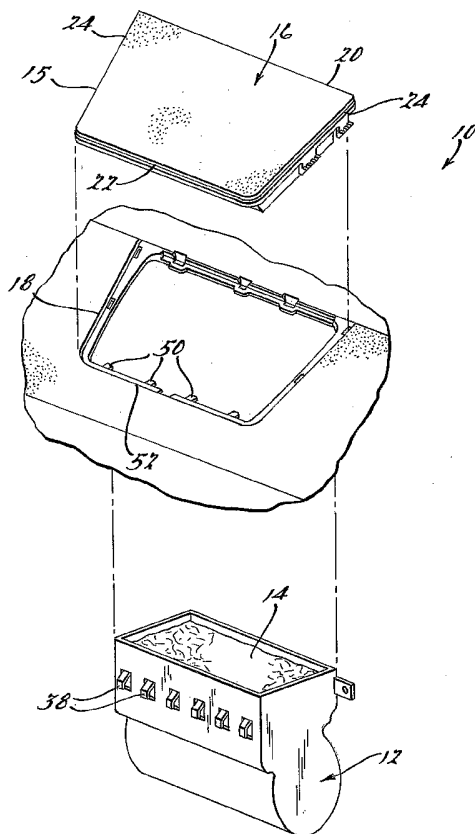
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(54) Title: AIRBAG MODULE DOOR ASSEMBLY



(57) Abstract: An airbag module assembly (10) contains a module housing (12) closed by an airbag module door assembly (15). A panel (16) forms an airbag module door for release of an airbag (14) upon activation of module assembly (10). Attachment members (28) and (30) are connected to opposing peripheral edges (20) and (22) of the panel (16). In another aspect, a tear seam (46) may be incorporated on an attachment member (30) adjacent the peripheral edge (22) of the door (16), rather than on the panel (16). By providing upwardly angled slots (48) within the attachment member (30) and adjacent the edge (22), that converge toward the edge (42) and interface with corresponding instrument panel arms (52) protruding from the vehicle structure (18). The combination therefor provides enhanced leverage for a smooth tear along the attachment member (30) and a smooth deployment of the airbag (14). The tear seam (46) need not therefor be conventionally formed within the panel (16).

WO 2004/091973 A2



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AIRBAG MODULE DOOR ASSEMBLY

FIELD OF THE INVENTION

The present invention relates generally to safety restraint systems using airbags and particularly to an airbag module door having a structure that minimizes manufacturing scores or blemishes.

BACKGROUND AND SUMMARY OF THE INVENTION

Airbag modules include airbag safety devices and are normally closed by an airbag module door or panel that gives way to airbag pressure upon activation thereof. Known airbag module covers or doors are often manufactured from thermoplastic and/or thermoset materials in known processes, rapid injection molding for example. Although many airbag doors have been designed that function as desired, the manufacturing process often results in marks, scores, or blemishes on the product thereby necessitating painting.

In general, the airbag module door includes a panel that opens upon activation of the airbag, thereby releasing the airbag for protection of the occupant. Typically, structural and/or attachment members extend from the underside of the door or panel and are therefore not visible to the occupant upon assembly within the vehicle. However, integration of the structural/attachment members on the underside of the panel often results in scores lines on the top of the panel reflecting the interface of those members on the underside of the door. Furthermore, residual gas deposition during the molding process may add further blemishes to the appearance of the unpainted door. Accordingly, the door must often be painted to improve the appearance of the finished product. As such, overall manufacturing costs are increased due to costs associated with the paint, waste paint disposal, energy

required to heat and cure the paint, and the added step during the manufacturing process.

An airbag module door cover that minimizes blemishes and/or scores attendant to the manufacturing process addresses the above-referenced concerns. The door includes a panel that contains a periphery having a front edge relative to the vehicle, a rear edge closest to the occupant, and two side edges. In a preferred embodiment, a hinge member integral to the front edge extends generally orthogonal to the front edge and facilitates a swinging movement of the panel upon airbag deployment. A first attachment member extends from the hinge member and is generally coextensive therewith thereby providing a first attachment means to an associated module housing. A second attachment member opposite the first attachment member extends from the rear edge, generally orthogonal therewith, and thus provides a second attachment means to an opposite side of the associated module housing. If desired, a first support member extends from the first attachment member to the second attachment member but is not attached to the underside of the panel. Similarly, a second support member opposite the first support member also extends from the first attachment member to the second attachment member thereby providing lateral support for the attachment members without attachment to the underside of the panel. By attaching the structural/attachment members to the peripheral edges rather than the underside of the panel, manufacturing scores and blemishes are minimized, thereby obviating the need for painting of the finished part. It should be appreciated that the hinge member may be oriented on either the rear or front edge, as determined by design criteria.

Additionally and/or alternatively, the tear seam of the cover may be located on the second attachment member adjacent the rear edge of the door to eliminate the need to manufacture the seam within the panel. Oftentimes, when manufactured within the door panel, the seam is either visibly apparent, or, the presence of the tear seam is indicated by a discoloration in the finished part, for example. As such, a plurality of slots contained along the length of

the second attachment member engages a corresponding plurality of arms extending from the vehicle structure or instrument panel. The arms extend inwardly into a vehicle cavity designed for placement of the airbag module. Stated another way, the vehicle cavity formed (within an instrument panel for example) for placement of the airbag module therein is roughly congruent or equal in distance along its periphery with the periphery defined by the edges of the door panel cover. When the arms are placed within the slots, the arms provide enhanced leverage as pressure develops on the underside of the door panel upon airbag activation. The tear seam is thus readily and quickly separated thereby assuring a smooth deployment of the airbag as the door swings away from the airbag trajectory.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood from the detailed description and the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of an airbag module assembly in accordance with the present invention.

Figure 2 is a rear perspective view of an airbag module door in accordance with the present invention.

Figure 3 is a sectional view of an airbag module door in accordance with the present invention.

Figure 4 is a front view of the airbag module door in accordance with the present invention.

Figure 5 is a sectional side view of the airbag module door in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

As shown in the figures, an airbag module assembly 10 generally
5 contains a housing 12 for containment of a gas generator (not shown) and an
airbag 14, and an airbag module door assembly 15 for closure of the housing
12. During normal vehicular activity, a top panel 16 of the door assembly 15
seals the contents of the airbag module 10 and also provides aesthetic appeal
relative to the vehicle interior. Oftentimes, the panel or door 16 once
10 assembled to the airbag module 10 is integrated as part of the vehicle
instrument panel or other interior structure 18.

In a preferred embodiment, the panel or cover 16 contains a periphery
having a front edge 20, a rear edge 22, and two opposing side edges 24. A
hinge member 26 extends orthogonally and integrally from and along the
15 length of the front edge 20, and provides a pivot for the door 16 once the
airbag 14 is activated and the door 16 is released. A first attachment member
28 extends from and is integral to the hinge member 26, and attaches the
door 16 to the module housing 12 associated therewith. A second
attachment member 30 opposite the first attachment member 28 extends
20 from and is integral to the rear edge 22, and also attaches the door 16 to the
module housing 12 associated therewith. In general, each attachment
member is somewhat orthogonal to the underside of the panel 16. If desired,
a first support member 32 integrally extends from the first attachment
member 28 to the second attachment member 30 but is not attached to the
25 panel 16. Similarly, a second support member 34 opposite the first support
member 32 also integrally extends from the first attachment member 28 to
the second attachment member 30 but is not attached to the panel 16.
Accordingly, attachment member 30 also provides lateral support for the
attachment members.

In a preferred embodiment, a first plurality of slots 36 extend along the length of the first attachment member 28 and interface with a corresponding first plurality of hooks 38 or appendages on the associated module housing 12. A second plurality of slots 40, opposite the slots 36, extends along the length of the second attachment member 30 and interfaces with a corresponding second plurality of hooks 42 or appendages, also on the module housing 12. Once the slots are snapped in place over the hook members 42 the cover 16 is snugly fixed to the module housing 12. It should be noted, however, that the hook members 42 preferably "float" within the slots 40. Stated another way, the hook members 42 are preferably biased against one or more of the inner walls 41 of the slots 40 but not necessarily against all of the inner walls 41. As such, a given spatial tolerance between the hooks and slots is provided thereby ensuring an acceptable fit within various vehicle interiors once the cover 16 is snapped in place. Once the airbag is deployed, engagement of the hook members 38 and 42 with the slots 36 and 40, respectively, enhances the leverage needed to tear away the panel 16. A third plurality of hooks 44 may also be included along the periphery of the door 16 whereby one or more of the edges 20 and 24 has at least one hook extending therefrom. The resilient or flexible nature of the hooks 44 facilitates a snap fit as the module cover 16 is seated within or mated with a designated part of the vehicle interior such as the instrument panel 18.

In yet another aspect of the invention, the second attachment member 30 preferably contains a tear portion 46 or a plurality of tear portions 46 adjacent the rear edge 22, thereby facilitating release of the airbag door 16 from the housing 12 once the airbag 14 is activated and pressure bears upon the underside 17 of the door 16. The door 16 then pivots about the hinge member 26 on the opposite first attachment member 28. In conjunction therewith, the second attachment member 30 contains a third plurality of slots 48 extending along the length of the second attachment member 30 adjacent the rear edge 22. A corresponding plurality of appendages or arms 50 extends from an instrument panel edge 52 that interfaces with the rear

edge 22 of the cover 16. Upon assembly, each of the plurality of arms 52 is lodged within a corresponding slot within the third plurality of slots 48, thereby further fixing the airbag door 16 over the housing 12 and also mitigating any vibrational noise or rattling during vehicular movement.

5 It should be noted that other embodiments may incorporate other known instrument panel fasteners including clips in accordance with the present invention. Fasteners, then, could be employed with an embodiment having the attachment members extend from the edges of the cover 16 as described above. Alternatively, and by way of example, the door panel 16
10 may in fact have a tear seam extending across its middle, in a manner known in the art. The median tear seam, then, could also be employed with an embodiment having the attachment members extend from the edges of the cover 16 as described above. In essence, these embodiments and others, painted or unpainted, all feature a reduction in manufacturing blemishes, and
15 therefore improve the overall appearance in accordance with the present invention.

As shown in the figures, the depth of the third plurality of slots 48 preferably exceeds that of the first and second plurality of slots 36 and 40. Furthermore, it should be emphasized that each of the third plurality of slots
20 48 is preferably angled upwardly and outwardly thereby converging toward the rear edge 22. Stated another way, the slots are angled upwardly from an inside portion 54 of the attachment member 30 toward an outside portion 56 thereof. Accordingly, the interface between the arms 52 and the third plurality of slots 48 results in an interference fit thereby creating leverage
25 once airbag pressure is applied to the underside of the panel 16. As the pressure increases, the added leverage facilitates a more rapid tear along the tear seam 46 thereby providing a smoother release of the door 16 and the associated airbag 14. Because the tear seam 46 is incorporated along the upper edge of the second attachment member 30, no tear seam is visible from
30 the visible or upper side of the panel 16. It should be noted, however, that if

desired, the tear seam might still be incorporated within the door panel 16 by methods known in the art.

In essence, the present invention improves the state of the art by providing a door panel 16 that has at least one attachment member extending
5 from its peripheral edge. If desired, the door panel 16 may include a tear seam 46 on an attachment member that is readily torn upon airbag deployment by virtue of the leverage provided by the interface of the instrument panel arms 52 and the angled plurality of slots 48 on the same attachment member. Either feature of the invention, that is incorporating
10 attachment members along the peripheral edges of the door panel, or, incorporating a tear seam readily torn by enhanced leverage of the arms 52 and slots 48 interface will alone provide a reduction in manufacturing blemishes. Either or both features may be incorporated within the door 16 as per design criteria. Accordingly, depending on design criteria, the panel may
15 or may not be painted upon removal from the mold.

A door panel 16 in accordance with the present invention is preferably made from thermoplastic materials in a rapid injection molding (RIM) process. Known process parameters and the details thereof will be appreciated by those of ordinary skill. Thermoplastic olefins, polyethylene, polypropylene,
20 and other thermoplastics are preferred. However, other suitable materials such as thermoset plastics, and other known processes, may also be employed. U.S. Patent Nos. 6,296,802, 6,042,140, 6,179,604, 6,328,554, 6,159,000, and 5,378, 138, each incorporated herein by reference, exemplify known processes and equipment.

It should be noted that extending the attachment members from the
25 edges of the door panel also lends itself to process advantages. Optimizing the appearance of the finished product can be enhanced by first gating the molten plastic into the integral attachment members prior to plastic deposition within the panel area of the mold. Accordingly, the gas residue normally
30 attendant in the RIM process is plated out on the attachment members and support members, or, on areas not otherwise viewed by the occupant. As will

be appreciated by one of ordinary skill in the art, gas residue may be further eliminated by providing cold wells within the mold tunnel thereby plating out gas residue prior to release from the gate. By eliminating the gas residue in the molten plastic prior to deposition of the plastic within the panel portion of the part cavity within the mold, the appearance of the part can be markedly enhanced.

The structure of the present door inherently offers several advantages. Because manufacturing blemishes are substantially eliminated from the face of the door panel visible to vehicle occupants, the door panel need not be painted prior to assembly. Rather, the door panel may be molded in a color designed for the interior of the respective vehicle, ready for assembly. As a result, manufacturing is simplified given the absence of the painting step. Furthermore, costs associated with painting including the costs of paint, of paint waste disposal, and of heat and energy costs associated with curing the paint are virtually eliminated. From an environmental standpoint, the aggregate reduction in paint waste solids results in a product much more responsive to the constant drive to improve our environment.

While specific embodiments of the instant invention have been described in detail, those with ordinary skill in the art will appreciate that various modifications and alternatives to those details could be developed in light of the overall teachings of this disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of the invention, which is to be given the full breadth of the appended claims and any and all equivalents thereof.

WHAT IS CLAIMED IS:

1. An airbag module door assembly connected to an airbag module housing, said door assembly comprising:
a panel forming an airbag module door, said panel having a peripheral edge, a bottom, and a top; and
at least one attachment member integral with and extending from the peripheral edge, said at least one attachment member connecting said door to said housing,
wherein said panel does not contain structure attached to the bottom.

2. The airbag module door assembly of claim 1 further comprising:
a hinge member connecting said panel to said first attachment member for pivoting said panel upon activation of said airbag module door; and
a second attachment member opposite to said first attachment member, said second attachment member integral with and extending from the peripheral edge, said second attachment member connecting said door to said housing.

3. The airbag module door assembly of claim 2 further comprising:
a first support member extending from said first attachment member to said second attachment member and integral with both attachment members; and
a second support member opposite said first support member, said second support member extending from said first attachment member to said second attachment member,
wherein neither the first support member nor the second support member is fixed to the panel.

4. An airbag module door assembly connected to an airbag module housing, said door assembly comprising:
 - a panel forming the airbag module door, said panel having a bottom, a top, and a periphery comprising a front edge and a rear edge;
 - a first attachment member integral with and extending from the front edge, said first attachment member connecting said door to said housing; and
 - a second attachment member integral with and extending from the rear edge, said second attachment member connecting said door to said housing,wherein said panel contains no structure attached to the bottom.

5. An airbag module door connected to an airbag module housing, said door comprising:
 - a panel forming the airbag module door, said panel having a bottom, a top, and a periphery comprising a front edge and a rear edge;
 - a hinge member integral with and extending from the front edge, said hinge member providing a pivot for said door upon module activation;
 - a first attachment member integral with and extending from the hinge member, said first attachment member connecting said door to said housing; and
 - a second attachment member integral with and extending from the rear edge, said second attachment member connecting said door to said housing,wherein said panel does not contain any structure attached to the bottom.

6. An airbag module door assembly connected to an airbag module housing, both seated within a predetermined cavity in the vehicle, said door assembly comprising:
- a panel forming the airbag module door, said panel having a bottom, a top, and a first periphery comprising a first edge and an opposite second edge;
 - an attachment member integral with and extending from the second edge, said attachment member connecting said door to said housing;
 - a tear seam integral to said attachment member and extending adjacent to said second edge;
 - a plurality of slots extending along the length of said attachment member adjacent said tear seam, said plurality of slots angled upwardly and converging toward said second edge;
 - a second periphery defining a vehicle cavity for insertion of said airbag module housing, said vehicle cavity having a third edge; and
 - a plurality of arms extending from said third edge, inwardly within said cavity, each of said arms corresponding to one of said plurality of slots,
- wherein upon assembly of the airbag module door assembly, each of the arms of the third edge are lodged within a corresponding slot within the plurality of slots.
7. An airbag module door assembly connected to an airbag module housing, both seated within a predetermined cavity in the vehicle, said door assembly comprising:
- a panel forming the airbag module door, said panel having a bottom, a top, and a first periphery comprising a first edge and an opposite second edge;

an attachment member integral with and extending from said panel,
said attachment member connecting said door to said housing;
a tear seam integral to said attachment member and extending adjacent
to said second edge;

a plurality of slots extending along the length of said attachment
member adjacent said tear seam, said plurality of slots angled
upwardly and converging toward said second edge;

a second periphery defining a vehicle cavity for insertion of said airbag
module housing, said vehicle cavity having a third edge; and

a plurality of arms extending from said third edge, inwardly within said
cavity, each of said arms corresponding to one of said plurality of
slots,

wherein upon assembly of the airbag module door assembly, each of
the arms of the third edge are lodged within a corresponding slot
within the plurality of slots.

