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Vehicle interior trim panel assembly

Abstract

A vehicle includes a vehicle body and a trim panel supported by the vehicle body. An airbag is between the trim panel and the vehicle body. The trim panel includes a back side facing the vehicle body. The trim panel includes a base portion and a distal portion. The trim panel includes a weakened area between the base portion and the distal portion on the back side. An elastomeric member is connected to the back side at the base portion and the distal portion. The elastomeric member extends across the weakened area from the base portion to the distal portion.

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Background/Summary

BACKGROUND
(1) Vehicles are equipped with airbag assemblies that include an airbag and an inflator. In the event of a vehicle impact, the inflator activates and provides inflation medium to the airbag. This pressurizes the airbag to control the kinematics of an occupant during the vehicle impact. The airbag assemblies may be located at various positions in passenger compartment of the vehicle. Vehicles may include airbags supported on a dash, side air curtains mounted to roof rails, seat-mounted airbag, etc.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a side view of an occupant cabin of a vehicle with an airbag in an uninflated position behind a trim panel assembly.
(2) FIG. **2** is the side view of FIG. **1** with the airbag in an inflated position.
(3) FIG. **3** is a perspective view of the trim panel assembly and an airbag viewed from a back side of a trim panel of the trim panel assembly.
(4) FIG. **4** is a perspective view of the trim panel assembly.
(5) FIG. **5** is an exploded view of the trim panel assembly.
(6) FIG. **6** is another example of the trim panel assembly.
(7) FIG. **7** is a cross-section along line **7** in FIG. **6**.
DETAILED DESCRIPTION
(8) With reference to the Figures, wherein like numerals indicate like parts throughout the several views, a vehicle **10** includes a vehicle body **12** and a trim panel **14** supported by the vehicle body **12**. An airbag **16** is between the trim panel **14** and the vehicle body **12**. The trim panel **14** includes a back side **18** facing the vehicle body **12**. The trim panel **14** includes a base portion **20** and a distal portion **22**. The trim panel **14** includes a weakened area **24** between the base portion **20** and the distal portion **22** on the back side **18**. An elastomeric member **26** is connected to the back side **18** at

the base portion **20** and the distal portion **22**. The elastomeric member **26** extends across the weakened area **24** from the base portion **20** to the distal portion **22**.

(9) During inflation of the airbag **16** from an uninflated position (FIG. **1**) to an inflated position (FIG. **2**), the trim panel **14** bends at the weakened area **24** and the distal portion **22** rotates relative to the base portion **20**. Since the weakened area **24** is on the back side **18** of the trim panel **14**, the weakened area **24** is not visible to occupants of the vehicle **10**. Due to the elastic properties of the elastomeric member **26**, as discussed further below, the elastomeric member **26** allows the trim panel **14** to bend at the weakened area **24**, and since the elastic member is connected to the base portion **20** and the distal portion **22**, the elastomeric member **26** retains the distal portion **22** to the base portion **20** as the airbag **16** rotates the distal portion **22** relative to the base portion **20**. This configuration allows for compact design of the trim panel **14** and packaging of the airbag **16** to accommodate packaging and styling constraints in the vehicle **10** as a well as constraints on mounting the trim panel **14** to the vehicle body **12**.

(10) The vehicle **10** may be any suitable type of automobile, e.g., a passenger or commercial automobile such as a sedan, a coupe, a truck, a sport utility, a crossover, a van, a minivan, a taxi, a bus, etc. The vehicle **10** defines an occupant cabin **28**. With reference to FIG. **1**, the vehicle **10** defines a vehicle-longitudinal axis L extending between a front end (not numbered) and a rear-end (not numbered) of the vehicle **10**. The vehicle **10** defines a vehicle-lateral axis extending cross-vehicle from one side to the other side of the vehicle **10**. The vehicle **10** defines a vertical axis V extending through the floor and roof **30** of the vehicle **10**. The vehicle-longitudinal axis L, the vehicle-lateral axis, and the vertical axis V are perpendicular relative to each other.

(11) The vehicle **10** includes a vehicle body **12**. As an example, the vehicle body **12** may be of a unibody construction in which a vehicle frame and the vehicle body **12** are a unit (including frame rails, pillars, roof rails, etc.), and as another example, the vehicle body **12** and a vehicle frame may have a body-on-frame construction (also referred to as a cab-on-frame construction) in which the vehicle body **12** and vehicle frame are separate components, i.e., are modular, and the vehicle body **12** is supported on and affixed to the frame. Alternatively, the vehicle body **12** may have any suitable construction. The vehicle body **12** may be of any suitable material, for example, steel, aluminum, and/or fiber-reinforced plastic, etc.

(12) The vehicle body **12** includes body panels. The body **12** panels may include structural panels, e.g., rockers, pillars, roof rails, etc. The vehicle body **12** defines the occupant cabin **28** to house occupants of the vehicle **10**.

(13) The vehicle **10** includes a floor and may include a roof **30**. The roof **30** may define the upper boundary of the occupant cabin **28** and may extend from the front end of the occupant cabin **28** to the rear end of the occupant cabin **28**. The roof **30** may include roof rails elongated along the vehicle-longitudinal axis L, roof beams elongated along the vehicle-lateral axis between the roof rails, and a roof panel supported by the roof rails and/or the roof beams. The floor is below the roof **30**. The floor defines the lower boundary of the occupant cabin **28** and may extend from the front end of the occupant cabin **28** to the rear end of the occupant cabin **28**. The floor may include a floor panel and may include a covering, e.g., carpet. The seat **34** is supported by the floor, i.e., the weight of the seat **34** is borne by the floor. Specifically, the seat **34** is supported by the floor panel of the vehicle body **12**.

(14) The vehicle body **12** includes the doors **44** openable for occupants to enter and exit a passenger cabin. The roof rails contact a top edge of the doors **44** when the doors **44** are closed. The door **44** includes a window opening that may be completely closed by a window of the window is in a fully raised position.

(15) The vehicle **10** may include a headliner **32** mounted to the roof **30** and providing a class-A surface to the roof **30**. The headliner **32** may be upholstered. In some examples, the headliner **32** may be of a known type. The headliner **32** may be designed to deform during inflation of the airbag **16** from the uninflated position to the inflated position, as shown in the example in FIG. **2**. The

headliner **32** may be designed for any type of roof structure and features, including moonroofs, sunroofs, panoramic roofs, etc.

(16) The vehicle **10** includes one or more seats **34** in the occupant cabin **28**. The vehicle **10** may include any suitable number of seats **34**. The seats **34** may be arranged in the occupant cabin **28** in any suitable position, i.e., as front seats, second-row seats, third-row seats, etc. The seats **34** may be of any suitable type, e.g., a bench seat, a bucket seat, etc. In the example shown in the Figures, the trim panel **14** is on a rear pillar **42** adjacent to the third-row seats. In other examples, the trim panel **14** may be on any suitable part of body **12**, e.g., other pillars. The trim panel **14** is shown on a left side of the vehicle **10**. The vehicle **10** may include a second trim panel **14** on the right side of the vehicle **10**, in which examples the second trim panel **14** may be a mirror image of the trim panel **14**.

(17) The seat **34** defines at least one occupant-seating area **36**. The occupant-seating area **36** is the space occupied by an occupant properly seated on the seat **34**. The occupant-seating area **36** is seat-forward of a seatback of the seat **34** and above a seat bottom of the seat **34**. The occupant-seating area **36** of the seat **34** is adjacent the trim panel **14**. In other words, the trim panel **14** is next to the occupant-seating area **36** with no other components between the trim panel **14** and the occupant-seating area **36**.

(18) The vehicle **10** includes an airbag assembly **38** including the airbag **16** and an inflator **40**. The airbag **16** is a side curtain airbag **16**. The inflator **40** inflates the airbag **16** to the inflated position. The airbag **16** in the uninflated position is supported by the roof **30**. The airbag **16** may, for example, include connectors such as clips, threaded fasteners, etc., for attaching the airbag **16** to the roof **30**. The airbag **16** may be rolled and/or folded in the uninflated position. The airbag **16** in the uninflated position may be between the roof **30** and the headliner **32**, as shown in FIG. **1**. A portion of the airbag **16** extends between the trim panel **14** and the vehicle body **12**, e.g., the rear pillar **42**, in the uninflated position, as shown in FIG. **1**. Specifically, a portion of the airbag **16** is between the distal portion **22** of the trim panel **14** and the vehicle body **12** in the uninflated position.

(19) As shown in FIG. **2**, the airbag **16** extends downwardly from the roof **30** along at least the portion of the body **12** to which the trim panel **14** is connected, e.g., the rear panel in the example shown in the Figures, in the inflated position. The airbag **16** may extend downwardly from the roof **30** along at least one of the doors **44** in the inflated position. In the example shown in the Figures, the airbag **16** extends downwardly along both doors **44** and three pillars in the inflated position. The airbag **16** is supported by the roof **30** in the uninflated position and in the inflated position, i.e., the weight of the airbag **16** is borne by the roof **30** in the uninflated position and in the inflated position. The airbag **16** may deform the headliner **32** as the airbag **16** inflates from the uninflated position to the inflated position, and the airbag **16** may be designed to deform under forces associated with the inflation of the airbag **16**.

(20) The airbag **16** may be fabric, e.g., a woven polymer yarn. The woven polymer yarn may be, for example, nylon 6, 6. Other examples of the woven polymer yarn include polyether ether ketone (PEEK), polyetherketoneketone (PEKK), polyester, etc. The woven polymer yarn may include a coating, such as silicone, neoprene, urethane, etc. For example, the coating may be polyorgano siloxane.

(21) The inflator **40** is in fluid communication with the airbag **16**. The inflator **40** expands an inflation chamber of the airbag **16** with inflation medium, such as a gas, to move the airbag **16** from the uninflated position to the inflated position. The inflator **40** may be supported by any suitable component. For example, the inflator **40** may be supported by the roof **30**. The inflator **40** may be, for example, a pyrotechnic inflator that ignites a chemical reaction to generate the inflation medium, a stored gas inflator that releases (e.g., by a pyrotechnic valve) stored gas as the inflation medium, or a hybrid. The inflator **40** may be, for example, at least partially in the inflation chamber to deliver inflation medium directly to the inflation chamber or may be connected to the inflation chamber through fill tubes, diffusers, etc.

(22) A trim panel assembly **60** includes the trim panel **14** and the elastomeric member **26**. The trim panel **14** conceals components of the vehicle **10** such as the vehicle body **12**, airbag **16**, etc., from view of an occupant in the occupant cabin **28**. The trim panel **14** includes a class-A surface, i.e., a finished surface exposed to view by a customer and free of unaesthetic blemishes and defects. The class-A surface faces the occupant cabin **28**. The trim panel **14** may be plastic. As an example, the trim panel **14** may be acrylonitrile butadiene styrene (ABS), polypropylene, etc.
(23) The trim panel **14** is supported by the vehicle body **12**, i.e., the weight of the trim panel **14** is borne by the vehicle body **12**, e.g., the rear pillar **42** and/or roof **30** of the vehicle body **12**. The trim panel **14** may be directly connected to the vehicle body **12**. For example, the trim panel **14** may include connectors **46**, e.g., clips, fasteners, brackets, etc., that directly contact and engage the vehicle body **12**. In the example shown in the Figures, the trim panel **14** includes spring clips that directly contact and engage the vehicle body **12**. Specifically, the base portion **20** of the trim panel **14** is directly connected to the vehicle body **12** when the airbag **16** is in the uninflated position and in the inflated position. In other words, the base portion **20** of the trim panel **14** remains connected to the vehicle body **12** when the airbag **16** inflates to the inflated position. The distal portion **22** of the trim panel **14** may be directly connected to the vehicle body **12** or indirectly connected to the vehicle body **12** through the base portion **20** when the airbag **16** is in the uninflated position. In the example shown in the Figures, the distal portion **22** is free of connectors between the distal portion **22** and the vehicle body **12**. In other words, the distal portion **22** is connected to the vehicle body **12** through the base portion **20**. In other examples in which the distal portion **22** is directly connected to the vehicle body **12** when the airbag **16** is in the uninflated position, the connector between the distal portion **22** and the body **12** releases during inflation of the airbag **16** as the distal portion **22** rotates relative to the base portion **20** about the weakened area **24**. For example, the connector between the distal portion **22** and the body **12** may be designed (i.e., positioned, designed with a holding strength, etc.) to release during inflation of the airbag **16**. In the example shown in the Figures, the trim panel **14** extends from the headliner **32** to a lower trim panel **14** and conceals the rear pillar **42** between the headliner **32** and the lower trim panel **14**.
(24) The trim panel **14** includes a back side **18** and a front side **48**. The back side **18** and the front side **48** extend along the base portion **20** and the distal portion **22**. The weakened area **24** is on the back side **18**, as described further below.
(25) The back side **18** faces the vehicle body **12**. The back side **18** is designed to connect to the vehicle body **12**. Specifically, the back side **18** includes the connectors **46** and/or features to engage the connectors **46**.
(26) The front side **48** is opposite the back side **18**. In other words, the back side **18** faces in a direction and the front side **48** faces in an opposite direction. The front side **48** faces the occupant cabin **28** and is exposed to the occupant cabin **28**. The front side **48** defines a boundary of the occupant cabin **28**. The front side **48** includes the class-A surface. The class-A surface extends along the base portion **20** and the distal portion **22**. The class-A surface is uninterrupted on the front side **48** and extends uninterrupted across the base portion **20** and the distal portion **22**.
(27) As set forth above, the trim panel **14** includes the base portion **20**, the distal portion **22**, and the weakened portion between the base portion **20** and the distal portion **22**. As set forth above, the base portion **20** is directly connected to the vehicle body **12** in the uninflated position and in the inflated position. The distal portion **22** is positioned to be impacted by the airbag **16** when the airbag **16** inflates from the uninflated position to the inflated position. Upon inflation of the airbag **16**, the airbag **16** impacts the distal portion **22** and rotates the distal end relative to the base portion **20** about the weakened area **24**. In the example shown in the Figures, the airbag **16** is between the distal portion **22** and the rear pillar **42** in the uninflated position. The airbag **16** may abut the distal portion **22** in the uninflated position.
(28) The base portion **20**, the distal portion **22**, and the weakened area **24** are unitary, i.e., a single, uniform piece of material with no seams, joints, fasteners, or adhesives holding the trim panel **14**

together. The base portion **20**, the distal portion **22**, and the weakened area **24** are formed together simultaneously as a single continuous unit, e.g., by molding, machining from a unitary blank, forging, casting, etc. In contrast, non-unitary components are formed separately and subsequently assembled, e.g., by welding, bonding, etc.

(29) The weakened area **24** is between the base portion **20** and the distal portion **22**. In the example shown in the Figures, the weakened area **24** extends from the base portion **20** to the distal portion **22**. The weakened area **24** is designed to allow the distal portion **22** to bend relative to the base portion **20** from force of an airbag **16** inflating from an uninflated position to an inflated position. Specifically, the size, shape, and location of the weakened area **24** allows the weakened area **24** to deform when the airbag **16** impacts the distal portion **22** during inflation of the airbag **16**. In the example shown in the Figures, the weakened area **24** includes at least one indentation **50** on the back side **18** between the base portion **20** and the distal portion **22**. Due to the indentation **50**, the weakened area **24** has a thinner wall thickness than the adjacent base portion **20** and distal portion **22** such that, when the airbag **16** applies force to the distal portion **22** during inflation of the airbag **16**, the moment of force on the distal portion **22** causes deformation at the weakened area **24**.

(30) In the examples shown in the Figures, the trim panel **14** includes two indentations **50** and an intermediate portion **62** between the two indentations **50**. In such an example, one of the indentations **50** is between the base portion **20** and the intermediate portion **62** and the other of the indentations **50** is between the distal portion **22** and the intermediate portion **62**. In such an example, the trim panel **14** may bend at both indentations during inflation of the airbag **16**. In the example shown in the Figures, the airbag **16** abuts the intermediate portion **62** in the uninflated position.

(31) The weakened area **24** is on the back side **18**. For example, in the example shown in the Figures in which the weakened area **24** is the indentation **50**, the indentation **50** is concealed from the occupant cabin **28**. In other words, the indentation **50** is not visible from the occupant cabin **28**. In the example shown in the Figures, the indentation **50** is elongated along a straight line, i.e., the longest dimension of the indentation **50** is along a straight line so that the indentation **50** allows the distal portion **22** to rotate relative to the base portion **20** about the indentation **50**.

(32) The elastomeric member **26** is connected to the back side **18** at the base portion **20** and the distal portion **22**. The elastomeric member **26** is directly connected to the base portion **20**, and the distal portion **22** is movable with the distal portion **22** as the distal portion **22** rotates relative to the base portion **20** upon inflation of the airbag **16**. The elastomeric member **26** remains directly connected to the base portion **20** and the distal portion **22** during and after rotation of the distal portion **22** by the airbag **16**.

(33) The elastomeric member **26** is between the airbag **16** and the distal portion **22**. The airbag **16** abuts the elastomeric member **26** at the distal portion **22** during inflation of the airbag **16**. The airbag **16** may abut the elastomeric member **26** in the uninflated position. The elastomeric member **26** spaces the airbag **16** from the trim panel **14** during inflation of the airbag **16** to the inflated position. The airbag **16** may slide on the elastomeric member **26** when the airbag **16** inflates from the uninflated position to the inflated position.

(34) The elastomeric member **26** extends across the weakened area **24** from the base portion **20** to the distal portion **22** when the airbag **16** is uninflated and when the airbag **16** is inflated. In other words, the elastomeric member **26** remains connected to the base portion **20** and the distal portion **22** and extends across the weakened area **24** from the base portion **20** to the distal portion **22** during and after inflation of the airbag **16**. The elastomeric member **26** is designed (e.g., thickness, geometry, and material selection) to maintain the connection to the base portion **20** and the distal portion **22** in the even the distal portion **22** separates from the base portion **20** at the weakened area **24** during inflation of the airbag **16**.

(35) The elastomeric member **26** is flexible relative to the base portion **20** and the distal portion **22**. The elastomeric member **26** bends more easily than the base portion **20** and the distal portion **22**,

and the elastomeric member **26** bends relative to the base portion **20** and the distal portion **22** during inflation of the airbag **16**. The elastomeric member **26** may resiliently deform during inflation of the airbag **16** and, in some examples, deforms in the absence of plastic deformation. An elastomer is a polymer material that has rubber-like elasticity capable of recovering its original shape after being stretched. The elastomeric member **26** may be, for example, Santoprene®, synthetic rubber, etc.

(36) As set forth above, the elastomeric member **26** is connected to the back side **18** at the base portion **20** and the distal portion **22**. In the example shown in FIGS. **3-5**, the trim panel **14** is connected to the trim panel **14** with mechanical fasteners **52**. For example, in FIGS. **3-5**, the trim panel **14** has heat stakes **54** that connect the elastomeric member **26** to the back side **18**. In such examples, the heat stakes **54** are fixed to the back side **18** and extend through holes in the elastomeric member **26**. Each heat stake **54** may include a head at a distal end of the heat stake **54** to retain the elastomeric member **26** on the heat stake **54**. For example, during assembly, the heat stakes **54** may be inserted into the holes in the elastomeric member **26**, and the distal ends of the heat stakes **54** may be compressed with a heated tool to form the head of the heat stake **54**.

(37) As another example, as in the example in FIGS. **6-7**, the elastomeric member **26** may be bonded to the back side **18** at the base portion **20** and the distal portion **22**. In such examples, the elastomeric member **26** is joined to the back side **18** with adhesive, heating (e.g., during molding of the elastomeric member **26**), and/or pressure. In other words, the elastomeric member **26** is bonded to the back side **18** at an interface **56**. As one example, the elastomeric member **26** may be overmolded on the trim member. “Over-molded” is a structural description of the elastomeric member **26** and the interface **56** between the elastomeric member **26** and the trim panel **14**, not the process by which the elastomeric member **26** is made. In other words, the elastomeric member **26** and the interface **56** between the elastomeric member **26** and the trim panel **14** have the structure of an over-molded component. When over-molded, the elastomeric member **26** may be a single, uniform piece of material with no seams, joints, and may be fixed to the trim panel **14** without fasteners or adhesives holding the elastomeric member **26** and the trim panel **14** together. In such an example, the elastomeric member **26** has a shape that conforms to a mold, e.g., an injection mold, used to form the elastomeric as an over-molded component to the trim panel **14**. In other examples, the elastomeric member **26** is fixed to the trim panel **14** with fasteners, adhesive, etc. In some examples, the elastomeric member **26** may be connected to the back side **18** by both mechanical fastener **52** and bonding.

(38) The trim panel **14** may include ribs **58** on the back side **18**. The ribs **58** increase structural rigidity of the base portion **20** and the distal portion **22**. In some examples, such as in FIGS. **3-5**, the elastomeric member **26** may extend across multiple ribs **58**. In other examples, such as in FIGS. **6-7**, the elastomeric member **26** may be disposed between ribs **58**.

(39) The disclosure has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present disclosure are possible in light of the above teachings, and the disclosure may be practiced otherwise than as specifically described.

Claims

1. A vehicle comprising: a vehicle body; a trim panel supported by the vehicle body; an airbag between the trim panel and the vehicle body; the trim panel including a back side facing the vehicle body; the trim panel including a base portion and a distal portion; the trim panel including a weakened area between the base portion and the distal portion on the back side; and an elastomeric member connected to the back side at the base portion and the distal portion, the elastomeric member extending across the weakened area from the base portion to the distal portion.

2. The vehicle as set forth in claim 1, wherein the airbag abuts the elastomeric member at the distal

portion.
3. The vehicle as set forth in claim 1, wherein the base portion, the distal portion, and the weakened area are unitary.
4. The vehicle as set forth in claim 1, wherein the trim panel includes a front side opposite the back side, the front side including a class-A surface.
5. The vehicle as set forth in claim 4, wherein the class-A surface extends along the base portion and the distal portion.
6. The vehicle as set forth in claim 1, wherein the weakened area is an indentation on the back side between the base portion and the distal portion.
7. The vehicle as set forth in claim 6, wherein the indentation is elongated along a straight line.
8. The vehicle as set forth in claim 1, wherein the weakened area extends from the base portion to the distal portion.
9. The vehicle as set forth in claim 1, wherein the weakened area is designed to allow the distal portion to bend relative to the base portion from force of the airbag inflating from an uninflated position to an inflated position.
10. The vehicle as set forth in claim 9, wherein the distal portion is positioned to be impacted by the airbag when the airbag inflates from the uninflated position to the inflated position.
11. The vehicle as set forth in claim 1, wherein the elastomeric member is bonded to the back side of the trim panel.
12. The vehicle as set forth in claim 1, wherein the trim panel is plastic.
13. A vehicle interior trim panel assembly comprising: a trim panel including a base portion and a distal portion; the trim panel including a back side designed to connect to a vehicle body; the trim panel including a front side opposite the back side, the front side including a class-A surface extending along the base portion and the distal portion; the trim panel including a weakened area between the base portion and the distal portion on the back side, the weakened area being designed to allow the distal portion to bend relative to the base portion from force of an airbag inflating from an uninflated position to an inflated position; and an elastomeric member connected to the back side at the base portion and the distal portion, the elastomeric member extending across the weakened area from the base portion to the distal portion.
14. The vehicle as set forth in claim 13, wherein the base portion, the distal portion, and the weakened area are unitary.
15. The vehicle as set forth in claim 13, wherein the weakened area is an indentation on the back side between the base portion and the distal portion.
16. The vehicle as set forth in claim 15, wherein the indentation is elongated along a straight line.
17. The vehicle as set forth in claim 15, wherein the weakened area extends from the base portion to the distal portion.
18. The vehicle as set forth in claim 13, wherein the elastomeric member is bonded to the back side of the trim panel.