(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
02 January 2020 (02.01.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/006290 A1

(51) International Patent Classification:
B60R 21/20 (2011.01) *B29L 31/30* (2006.01)
B29C 65/06 (2006.01) *B60K 37/00* (2006.01)
B29C 65/08 (2006.01) *B60R 21/205* (2011.01)

(21) International Application Number:
PCT/US2019/039590

(22) International Filing Date:
27 June 2019 (27.06.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/691,584 28 June 2018 (28.06.2018) US

(71) Applicant: **SHANGHAI YANFENG JINQIAO AUTOMOTIVE TRIM SYSTEMS CO. LTD.** [US/US]; Yanfeng Global Automotive Interior Systems Co. Ltd, c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US).

(72) Inventors: **STROEBE, Jennifer A.**; c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US). **FOX, Bart W.**; c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US). **PHILLIPS, Michael E.**; c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US). **GLYNN, Dale Todd**; c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US). **ZIMMER, Michael G.**; c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US). **DOMINE, Mike**; c/o Law Department, 41935 West 12 Mile Road, Novi, Michigan 48377 (US).

(74) Agent: **AMIN, Himanshu S.** et al.; Amin, Turocy & Watson, LLP, 200 Park Avenue, Suite 300, Beachwood, Ohio 44122 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) Title: VEHICLE TRIM COMPONENT

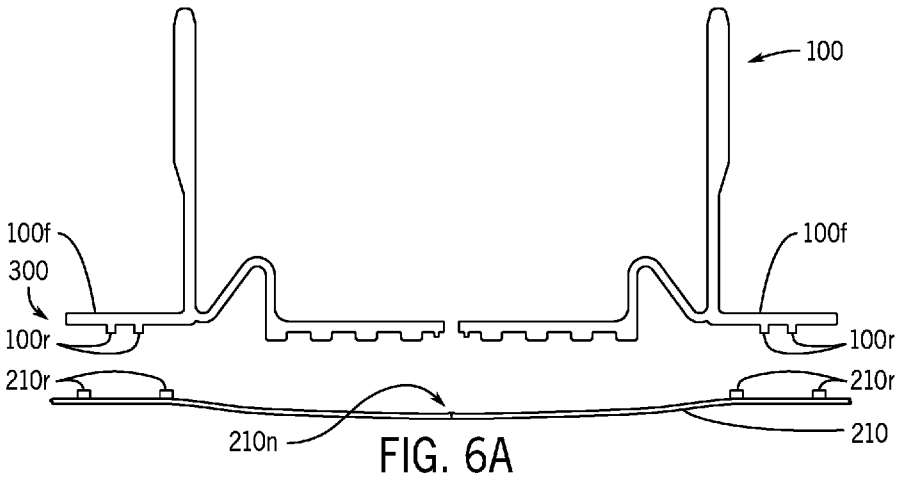

FIG. 6A

(57) Abstract: A component for a vehicle interior is disclosed. The component may comprise a structural substrate, an airbag chute and a structure coupling the chute and structural substrate. The structure may comprise a rib injection molded onto the structural substrate; the structure may be bonded to the structural substrate. The chute may be welded to the structure and/or the structural substrate. The structural substrate may comprise a panel comprised of fibers; the structure may be comprised of resin. The structure may comprise an interface bonding the chute and structural substrate; the interface may comprise a molded feature/resin feature/mounting area on the structural substrate; a structure/material/rib injection molded on the structural substrate; a bond; an attachment; a composite or resin material; a material comprising fibers; polypropylene with fibers. The component may comprise a trim component; an instrument panel; a trim panel.

WO 2020/006290 A1

[Continued on next page]

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

PATENT APPLICATION

VEHICLE TRIM COMPONENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to and incorporates by reference in full the following patent application: U.S. Provisional Patent Application No. 62/691,584 titled "VEHICLE TRIM COMPONENT" filed June 28, 2018.

FIELD

[0002] The present invention relates to a vehicle trim component.

BACKGROUND

[0003] It is known to provide a trim component for a vehicle interior provided as an instrument panel, door panel and various other components. It is known to form the trim component with fibers by a compression forming process.

[0004] It would be advantageous to provide an improved trim component for a vehicle interior. It would also be advantageous to provide an improved trim component formed from a panel with a structure configured to secure an airbag chute to the panel during deployment of an airbag.

SUMMARY

[0005] The present invention relates to a component for a vehicle interior configured to support an airbag module providing an airbag configured to be deployed through an opening into the vehicle interior. The component may comprise a structural substrate and an airbag chute; and a structure between the structural substrate and the airbag chute; the structure may be configured to couple the airbag chute to the structural substrate. The structure may be configured to couple the airbag chute to the structural substrate during deployment of the airbag; the structure may comprise a rib injection molded onto the structural substrate; the structure may be bonded to the structural substrate. The airbag chute may be welded to the structure; the airbag chute may be welded to the structure and the structural substrate. The structural substrate may comprise a panel comprised at least partially of fibers; the structure may be comprised of resin. The structural substrate may comprise a first material; the airbag chute may comprise a second material; the structure may comprise a third material; the third material may be different than the first material and the second material. The first material may comprise a composite comprising fibers; the second material may comprise thermoplastic polyolefin; the third material may comprise a resin. The structural substrate may comprise a fiber panel; the airbag chute may comprise a thermoplastic polyolefin; the structure may comprise polypropylene. The structure may comprise polypropylene filled with structural fibers. The airbag chute may be welded to the structural substrate; the airbag chute may be welded to the structure. The structure may comprise a composite comprising fibers; the fibers may be configured to reinforce an interface between the airbag chute and the structural substrate. The airbag chute may comprise at least one flange; the structure may be positioned between the structural substrate and the at least one flange of the airbag chute. The airbag chute may comprise a first flange and a second flange; the first flange may comprise a rib; the second flange may comprise a rib; the structure may comprise the rib of the first flange; the rib of the second flange, a rib injection molded onto the structural substrate adjacent the rib of the first flange; and a rib injection molded onto the structural substrate adjacent the rib of the second flange. The rib injection molded onto the structural substrate adjacent the rib of the first flange may comprise a set of ribs surrounding the rib of the first flange. The rib of the first flange may comprise a height; the rib injection molded onto the structural substrate adjacent the rib of the first flange may comprise a height; the height of the rib of the first flange may be generally the same as the height of the rib injection molded onto the structural substrate adjacent the rib of the first flange. The structure may comprise an

interface configured to bond the airbag chute to the structural substrate. The component may comprise at least one of (a) a trim component; (b) an instrument panel; (c) a trim panel.

[0006] The present invention relates to a component for a vehicle interior configured to provide a module with an airbag configured to be deployed through an opening into the vehicle interior comprising a structural substrate, an airbag chute and an interface configured to couple the structural substrate and the airbag chute; the interface may comprise a feature on the structural substrate. The substrate may comprise a compression-formed component formed from a fiber panel. The interface may comprise (a) a bond of the feature to the structural substrate and (b) coupling the airbag chute to the feature. The bond may comprise injection molding of the feature to the structural substrate. The interface may comprise a bond comprising at least one of a weld and/or an adhesive. The interface may comprise a bond configured to attach the feature to the surface of the structural substrate. The interface may comprise (a) a bond between the feature on the structural substrate and a feature of the airbag chute; and (b) a bond to a surface of the structural substrate. The interface may comprise at least one molded feature. The interface may comprise a structure; the structure of the interface may comprise at least one of (a) a composite material; (b) a resin material; (c) a material comprising fibers; (d) polypropylene with fibers; (e) a material molded onto the structural substrate. The component may comprise a composite structure comprising the structural substrate and the airbag chute; the airbag module may be configured to deploy the airbag through an opening in the composite structure. The interface may comprise the feature and a mounting area on the structural substrate. The interface may comprise the feature on the structural substrate and a feature of the airbag chute. The interface may comprise a bond configured to attach the feature of the airbag chute to the structural substrate; the feature of the airbag chute may comprise at least one flange. The interface may comprise a bond to a surface of the structural substrate. The interface may comprise at least one of (a) a molded feature on the structural substrate; (b) a resin feature on the structural substrate; (c) a mounting area on the structural substrate; (d) a structure injection molded on the structural substrate; (e) a rib; (f) a set of ribs; (g) a rib injection molded onto the structural substrate; (h) a flange on airbag chute; (i) a weld; (j) an ultrasonic weld; (k) a bond; (l) an attachment; (m) a composite material; (n) a resin material; (o) a material comprising fibers; (p) polypropylene with fibers; (q) a material molded onto the structural substrate. The component may comprise at least one of (a) a trim component; (b) an instrument panel; (c) a trim panel.

[0007] The present invention relates to a component for a vehicle interior configured to support an airbag module providing an airbag for deployment through an opening into the

vehicle interior prepared using a mold by a process comprising the steps of: (a) providing a fiber panel; (b) compressing the fiber panel in the mold; (c) forming a feature on the structural substrate; and (d) joining an airbag chute to the structural substrate. The feature may be configured to couple the airbag chute to the structural substrate. The step of forming a feature on the structural substrate may comprise forming a structure for joining the airbag chute to the structural substrate. The feature may comprise an injection-molded structure. The step of joining an airbag chute to the structural substrate may comprise welding the airbag chute to the structure. The step of joining an airbag chute to the structural substrate may comprise welding the airbag chute to the structural substrate. The step of compressing the fiber panel in the mold may comprise compressing the fiber panel into a structural substrate having a shape. The process may comprise the step of forming a composite structure comprising a cover on the structural substrate.

[0008] The present invention relates to a method of manufacturing a vehicle component configured to support an airbag module providing an airbag for deployment from the airbag module through an opening into the vehicle interior comprising the steps of: (a) providing a fiber panel; (b) compressing the fiber panel in a mold to form a structural substrate; (c) molding a structure on the structural substrate; and (d) joining an airbag chute to the structure. The structure may be configured to couple the airbag chute to the structural substrate. The step of molding a structure on the structural substrate may comprise injecting resin into the mold. The step of joining an airbag chute to the structure may comprise welding the airbag chute to the structure. The step of joining an airbag chute to the structure may further comprise welding the airbag chute to the structural substrate.

[0009] The present invention relates to a trim component for a vehicle interior configured to support an airbag module providing an airbag configured to be deployed through an opening into the vehicle interior. The trim component may comprise a structural substrate providing a front side, a back side and at least one door established upon deployment of the airbag to facilitate deployment of the airbag from the airbag module through the opening, an airbag chute and a structure positioned between the structural substrate and the airbag chute. The structure may be configured to secure the airbag chute to the structural substrate. The structure may be configured to secure the airbag chute to the structural substrate during deployment of the airbag. The structure may comprise a rib injection molded onto the back side of the structural substrate. The structure may be bonded to the structural substrate. The structural substrate may comprise a panel comprised at least partially of fibers; the reinforcement may be comprised of resin. The structural substrate may comprise a fiber

panel; the airbag chute may comprise a thermoplastic polyolefin; the structure may comprise polypropylene. The structure may comprise polypropylene filled with structural fibers. The airbag chute may be welded to the structure. The airbag chute may be welded to the structural substrate. The structure may comprise a composite comprising fibers; the fibers may be configured to reinforce an interface between the airbag chute and the structural substrate. The airbag chute may comprise at least one flange; the structure may be positioned between the structural substrate and the at least one flange of the airbag chute.

[0010] The present invention relates to a trim component for a vehicle interior configured to support an airbag module providing an airbag for deployment through an opening into the vehicle interior prepared using a mold by a process comprising the steps of providing a fiber panel; disposing the fiber panel onto a first surface of the mold; compressing the fiber panel between the first surface and a second surface of the mold to form the fiber panel into a structural substrate having a shape corresponding to a first contour of the first surface and a second contour of the second surface; molding a structure on a side of the structural substrate; and joining an airbag chute to the structure. The structure may be configured to secure the airbag chute to the structural substrate. The structure may be configured to secure the airbag chute to the structural substrate during deployment of the airbag. Molding the structure on a side of the structural substrate may comprise injecting resin into the mold. Joining an airbag chute to the structure may comprise welding the airbag chute to the structure. Joining an airbag chute to the structure may comprise welding the airbag chute to the structural substrate.

[0011] The present invention relates to a method of manufacturing a vehicle trim component configured to support an airbag module providing an airbag for deployment from the airbag module through an opening into the vehicle interior comprising the steps of providing a fiber panel; disposing the fiber panel onto a first surface of a mold; compressing the fiber panel between the first surface and a second surface of the mold to form the fiber panel into a structural substrate having a shape corresponding to a first contour of the first surface and a second contour of the second surface; molding a structure on a side of the structural substrate; and joining an airbag chute to the structure. The structure may be configured to secure the airbag chute to the structural substrate. Molding a structure on a side of the structural substrate may comprise injecting resin into the mold. Joining an airbag chute to the structure may comprise welding the airbag chute to the structure. Joining an airbag chute to the structure may comprise welding the airbag chute to the structural substrate.

FIGURES

[0012] FIGURE 1A is a schematic perspective view of a vehicle according to an exemplary embodiment.

[0013] FIGURE 1B is a schematic perspective cut-away view of a vehicle showing a vehicle interior according to an exemplary embodiment.

[0014] FIGURE 1C is a schematic perspective view of a vehicle trim component shown as an instrument panel according to an exemplary embodiment.

[0015] FIGURES 1D through 1F are schematic perspective detail views of an airbag deployment according to an exemplary embodiment.

[0016] FIGURE 2A is a schematic perspective view of a vehicle trim component according to an exemplary embodiment.

[0017] FIGURE 2B is a schematic exploded perspective view of a vehicle trim component according to an exemplary embodiment.

[0018] FIGURE 2C is a schematic bottom perspective view of a structural substrate of a vehicle trim component according to an exemplary embodiment

[0019] FIGURE 2D is a schematic bottom perspective cut-away view of a structural substrate of a vehicle trim component according to an exemplary embodiment.

[0020] FIGURE 3A is a schematic exploded perspective view of a vehicle trim component according to an exemplary embodiment.

[0021] FIGURE 3B is a schematic partial perspective view of an airbag chute according to an exemplary embodiment.

[0022] FIGURE 3C is a schematic partial perspective view of a structural substrate of a vehicle interior component according to an exemplary embodiment.

[0023] FIGURES 4A through 4G are schematic perspective views of a process to form a structural substrate of a vehicle trim component according to an exemplary embodiment.

[0024] FIGURES 5A through 5D are schematic partial section views of a process to form a vehicle trim component according to an exemplary embodiment.

[0025] FIGURES 6A through 6C are schematic partial section views of a process to form a vehicle trim component according to an exemplary embodiment.

[0026] FIGURES 7A through 7B are schematic partial section views of a process to form a vehicle trim component according to an exemplary embodiment.

[0027] FIGURES 8A through 8B are schematic partial section views of a process to form a vehicle trim component according to an exemplary embodiment.

[0028] FIGURE 9A is a schematic section view of a vehicle trim component according to an exemplary embodiment.

[0029] FIGURE 9B is a schematic cut-away section view of a vehicle trim component according to an exemplary embodiment.

[0030] FIGURES 9C through 9D are schematic cut-away section views of a deployment of an airbag through a vehicle trim component according to an exemplary embodiment.

[0031] FIGURE 10A is a schematic flow diagram of a method for forming a vehicle interior component according to an exemplary embodiment.

[0032] FIGURE 10B is a schematic flow diagram of a method for forming a vehicle interior component according to an exemplary embodiment.

[0033] FIGURES 11A and 11B are schematic flow diagrams of a method for forming a vehicle interior component according to an exemplary embodiment.

DESCRIPTION

[0034] Referring to FIGURES 1A and 1B, a vehicle V is shown including an interior I with an instrument panel IP, doors D and a floor console FC. According to an exemplary embodiment, interior components of vehicle V such as instrument panel IP and doors D may include trim panels comprised of fiber and plastic. According to an exemplary embodiment, instrument panel IP and doors D may provide visible surfaces in the vehicle interior of vehicle V. According to an exemplary embodiment, instrument panel IP and/or doors D may provide at least one airbag behind the visible surfaces; instrument panel IP and/or doors D may provide a weakened area to aid the airbag in breaking through the trim panel during airbag deployment. See FIGURES 1D-1F.

[0035] According to an exemplary embodiment as shown schematically in FIGURES 1C-1F, a component for a vehicle interior (such as a trim panel, instrument panel, etc.) may be configured to provide/support a module with an airbag configured to be deployed through an opening into the vehicle interior. See also FIGURES 3A and 9A-9D. As shown schematically in FIGURES 1C-1F, instrument panel IP may provide a weakened shape/zone shown as a recess R to facilitate an airbag AB deployment through an airbag door ABD. According to an exemplary embodiment, the weakened shape/zone may comprise at least one of a recess or a score line behind the visible surface of instrument panel IP. The weakened shape/zone may comprise an "H" shape pattern. According to an exemplary embodiment, the weakened shape/zone may comprise a "U" shape pattern, a "bow tie" shape pattern, or any pattern suitable for airbag deployment.

[0036] As shown schematically according to an exemplary embodiment in FIGURES 2A-2D, the component 1000 may comprise a structural substrate 210 and an airbag chute 100 and a structure/interface between the structural substrate and the airbag chute configured to couple the airbag chute to the structural substrate (e.g. features shown as a rib 210r injection molded onto the structural substrate, features 100r on the airbag chute, etc.). See also FIGURES 3A-3C.

[0037] As shown schematically according to an exemplary embodiment in FIGURES 2A-2B, 3A and 6A-6C, the airbag chute 100 may be welded to form a bond/interface at the structure to bond to the structural substrate 210 and/or the airbag chute may be welded to form a bond/interface at the structure and the structural substrate 210. See e.g. FIGURES 6B-6C (showing bond/interface established between airbag chute 100 and structural substrate 210).

[0038] As shown schematically according to an exemplary embodiment in FIGURES 1C-1F, 2A-2D and 3A-3C, the component (e.g. trim/instrument panel IP) may comprise a structural

substrate and a structure coupled to the structural substrate and configured to facilitate deployment of the airbag (shown as an airbag chute 100); and an interface may be provided to couple the structural substrate and the airbag chute (e.g. structure configured to facilitate deployment of the airbag); the interface may comprise a feature on the structural substrate and/or a feature on the structure configured to facilitate deployment of the airbag. See e.g. FIGURES 5A-5D, 6A-6C, 7A-7B and 8A-8B. As indicated schematically according to an exemplary embodiment, the interface may comprise a bond configured to attach the structure configured to facilitate deployment of the airbag to the structural substrate; the bond of the interface may comprise a weld (e.g. ultrasonic weld, etc.). See e.g. FIGURES 6A-6C, 7A-7B and 8A-8B. As indicated schematically according to an exemplary embodiment, the interface may comprise a bond to a surface of the structural substrate; the interface may comprise a feature on the structural substrate and a feature on the structure configured to facilitate deployment of the airbag; the interface may comprise (a) a bond between the feature the structural substrate and the feature on the structure configured to facilitate deployment of the airbag; and (b) a bond to a surface of the structural substrate. See e.g. FIGURES 6A-6C, 7A-7B, 8A-8B and 9A-9D. As indicated schematically according to an exemplary embodiment, the bond may comprise at least one of a weld and/or an adhesive; the interface may comprise at least one molded feature and/or a mounting area on the structural substrate. See e.g. FIGURES 6C, 7B, 8B and 9B.

[0039] As shown schematically according to an exemplary embodiment in FIGURES 7A-7B and 8A-8B, the airbag chute 100x may comprise members such as a flange and/or set of flanges 100f (e.g. providing a feature such as a rib); the structure/features shown as ribs 210r may be positioned between the structural substrate 210/210x and the members/flange 100f of the airbag chute 210. As shown schematically according to an exemplary embodiment, a member/flange may comprise a rib; a rib injection may be molded onto the structural substrate; the rib arrangement may comprise an interface configured to bond the airbag chute to the structural substrate. See FIGURES 3A-3C, 7A-7B and 8A-8B (bond at interface established between feature shown as flange 100f of airbag chute 100x and features 210r shown as ribs of structural substrate 210/210x).

[0040] As shown schematically according to an exemplary embodiment in FIGURES 4A-4G and 5A-5D, the structural substrate 210 may comprise a panel comprised at least partially of fibers; the structure for the interface shown as features 210r may be comprised of resin. See also FIGURES 3C and 9A-9D. According to an exemplary embodiment indicated schematically, the structural substrate may comprise a fiber panel and/or a material

comprising fibers; the airbag chute may comprise a plastic/resin material such as thermoplastic polyolefin; the structure/interface may comprise a resin material such as polypropylene (which may also comprise fibers such as structural fibers).

[0041] As shown schematically according to an exemplary embodiment in FIGURES 4A-4G and 5A-5D, the structural substrate 210 may comprise a fiber panel 202t/202u; the structural substrate may comprise a compression formed component formed from the fiber panel 202t. As shown schematically according to an exemplary embodiment in FIGURES 9A-9D, the component 1000 may comprise a composite structure (e.g. to provide a trim component/panel shown as instrument panel IP with cover/surface) comprising the structural substrate 210 (e.g. with features such as ribs 210r and/or border 210b) and interface/bond to the airbag chute 100 (e.g. the structure configured to facilitate deployment of the airbag). See also FIGURES 1D-1F and 3A (structure configured to facilitate deployment of the airbag may comprise an airbag chute configured to facilitate deployment of the airbag from the airbag module). As shown schematically according to an exemplary embodiment in FIGURES 6C, 7B, 8B and 9B, the interface may comprise at least one of a bond (e.g. attachment, weld, ultrasonic weld, etc.) of the airbag chute 100/100x to the structural substrate 210/210x. As shown schematically according to an exemplary embodiment in FIGURES 7A-7B and 8A-8B, the interface may comprise a feature 100f on the airbag chute 100; the interface may comprise a feature 210r molded onto the structural substrate. As indicated schematically according to an exemplary embodiment, the interface may comprise a structure; the structure may comprise an interface configured to bond the airbag chute to the structural substrate. See e.g. FIGURES 3A-3C. As indicated schematically according to an exemplary embodiment, the structure of the interface may comprise at least one of (a) a composite material; (b) a resin material; (c) a material comprising fibers; (d) polypropylene with fibers. As shown schematically according to an exemplary embodiment in FIGURES 9A-9D, the component may comprise a composite structure comprising the structural substrate and the structure configured to facilitate deployment of the airbag; the structure configured to facilitate deployment of the airbag may comprise an airbag chute; the airbag module may be configured to deploy the airbag through an opening in the composite structure; the interface may comprise a feature of the airbag chute; the feature may comprise at least one flange; the interface may be between the structural substrate and the at least one flange of the airbag chute. See e.g. FIGURES 1D-1F.

[0042] According to an exemplary embodiment as indicated schematically in FIGURES 1D-1F, 2A-2D, 3A-3C, 4A-4G, 5A-5D, 6A-6C, 7A-7B, 8A-8B and 9A-9D, the component for a

vehicle interior configured to provide a module with an airbag configured to be deployed through an opening into the vehicle interior comprising a structural substrate an airbag chute and an interface configured to couple the structural substrate and the airbag chute; the interface may comprise a feature on the structural substrate. The substrate may comprise a compression-formed component formed from a fiber panel; the interface may comprise (a) a bond of the feature to the structural substrate and (b) coupling the airbag chute to the feature. See e.g. FIGURES 4A-4G, 6C, 7B and 8B. The bond may comprise injection molding of the feature to the structural substrate. See e.g. FIGURES 5A-5D. As indicated schematically in FIGURES 6C, 7B and 8B, the interface may comprise a bond comprising at least one of a weld and/or an adhesive; the interface may comprise a bond configured to attach the feature to the surface of the structural substrate; the interface may comprise (a) a bond between the feature the structural substrate and a feature of the airbag chute; and (b) a bond to a surface of the structural substrate; the interface may comprise at least one molded feature; the interface may comprise a structure; the structure of the interface may comprise at least one of (a) a composite material; (b) a resin material; (c) a material comprising fibers; (d) polypropylene with fibers; (e) a material molded onto the structural substrate. As indicated schematically in FIGURES 9A-9B, the component may comprise a composite structure comprising the structural substrate and the airbag chute; the airbag module may be configured to deploy the airbag through an opening in the composite structure. As indicated schematically according to an exemplary embodiment, the interface may comprise the feature and a mounting area on the structural substrate; the interface may comprise the feature on the structural substrate and a feature of the airbag chute; the interface may comprise a bond configured to attach the feature of the airbag chute to the structural substrate; the feature of the airbag chute may comprise at least one flange; the interface may comprise a bond to a surface of the structural substrate. See e.g. FIGURES 4A-4G, 6C, 7B and 8B.

[0043] As shown schematically according to an exemplary embodiment, the interface may comprise at least one of (a) a molded feature on the structural substrate; (b) a resin feature on the structural substrate; (c) a mounting area on the structural substrate; (d) a structure injection molded on the structural substrate; (e) a rib; (f) a set of ribs; (g) a rib injection molded onto the structural substrate; (h) a flange on airbag chute; (i) a weld; (j) an ultrasonic weld; (k) a bond; (l) an attachment; (m) a composite material; (n) a resin material; (o) a material comprising fibers; (p) polypropylene with fibers; (q) a material molded onto the structural substrate. See e.g. FIGURES 3A-3C, 5A-5D, 6A-6C, 7A-7B, 8A-8B and 9B.

[0044] As shown schematically according to an exemplary embodiment in FIGURES 1B and 9A, the component may comprise at least one of (a) a trim component; (b) an instrument panel; (c) a trim panel.

[0045] According to an exemplary embodiment as indicated schematically in FIGURES 1D-1F, 2A-2D, 3A-3C, 4A-4G, 5A-5D, 6A-6C, 7A-7B, 8A-8B and 9A-9D, a component 1000 for a vehicle interior configured to support an airbag module providing an airbag configured to be deployed through an opening into the vehicle interior may comprise a structural substrate 210, an airbag chute 100/100x and a structure 300 between the structural substrate 210 and the airbag chute 100/100x; the structure 300 may be configured to couple the airbag chute 100/100x to the structural substrate 210. The structure 300 may be configured to couple the airbag chute 100/100x to the structural substrate 210 during deployment of the airbag. The structure 300 may comprise a rib 210r injection molded onto the structural substrate 210. The structure 300 may be bonded to the structural substrate 210. The airbag chute 100/100x may be welded to the structure 300. The airbag chute 100/100x may be welded to the structure 300 and the structural substrate 210. The structural substrate 210 may comprise a panel comprised at least partially of fibers; the structure 300 may be comprised of resin. The structural substrate 210 may comprise a first material; the airbag chute 100/100x may comprise a second material; the structure 300 may comprise a third material; the third material may be different than the first material and the second material. The first material may comprise a composite comprising fibers; the second material may comprise thermoplastic polyolefin; the third material may comprise a resin. The structural substrate 210 may comprise a fiber panel; the airbag chute 100/100x may comprise a thermoplastic polyolefin; the structure 300 may comprise polypropylene. The structure 300 may comprise polypropylene filled with structural fibers. The airbag chute 100/100x may be welded to the structural substrate 210; the airbag chute 100/100x may be welded to the structure 300. The structure 300 may comprise a composite comprising fibers; the fibers may be configured to reinforce an interface between the airbag chute 100/100x and the structural substrate 210. The airbag chute 100/100x may comprise at least one flange 100f; the structure 300 may be positioned between the structural substrate 210 and the at least one flange 100f of the airbag chute 100/100x. The airbag chute 100/100x may comprise a first flange and a second flange; the first flange may comprise a rib 100r; the second flange may comprise a rib 100r; the structure 300 may comprise the rib 100r of the first flange; the rib 100r of the second flange, a rib 210r injection molded onto the structural substrate 210 adjacent the rib 100r of the first flange; and a rib 210r injection molded onto the structural substrate 210 adjacent the rib 100r

of the second flange. The rib 210r injection molded onto the structural substrate 210 adjacent the rib 100r of the first flange may comprise a set of ribs 210r surrounding the rib 100r of the first flange. The rib 100r of the first flange may comprise a height; the rib 210r injection molded onto the structural substrate 210 adjacent the rib 100r of the first flange may comprise a height; the height of the rib 100r of the first flange may be generally the same as the height of the rib 210r injection molded onto the structural substrate 210 adjacent the rib 100r of the first flange. The structure 300 may comprise an interface configured to bond the airbag chute 100/100x to the structural substrate 210. The component 1000 may comprise at least one of (a) a trim component; (b) an instrument panel; (c) a trim panel.

[0046] According to an exemplary embodiment as shown schematically in FIGURES 10A-10B and 11A-11B, the component for a vehicle interior configured to support an airbag module providing an airbag for deployment through an opening into the vehicle interior may be manufactured/produced by a process comprising the steps of: (a) providing a fiber panel; (b) compressing the fiber panel in the mold; (c) forming a feature on the structural substrate; and (d) joining an airbag chute to the structural substrate. See also FIGURES 1B-1C, 2A-2 and 9A-9D. As shown schematically according to an exemplary embodiment in FIGURES 3A-3C, 5A-5D, 6A-6C, 7A-7B, 8A-8B and 9A-9B, the feature may be configured to couple the airbag chute to the structural substrate; the step of forming a feature on the structural substrate may comprise forming a structure for joining the airbag chute to the structural substrate; the feature may comprise an injection-molded structure. See e.g. FIGURES 5A-5D. As indicated schematically according to an exemplary embodiment, the step of joining an airbag chute may comprise welding the airbag chute to the structure; the step of joining an airbag chute may comprise welding the airbag chute to the structural substrate. See e.g. FIGURES 6C, 7B and 8B. As shown schematically according to an exemplary embodiment in FIGURES 4A-4E, the step of compressing the fiber panel in the mold may comprise compressing the fiber panel into a structural substrate having a shape. See also FIGURES 10A-10B and 11A-11B. As shown indicated schematically according to an exemplary embodiment in FIGURES 10A-10B and 11A, the process may comprise the step of forming a composite structure for the component 1000 comprising a cover C on the structural substrate 210. See e.g. FIGURES 1C and 9A.

Exemplary Embodiment – Method of Manufacture

[0047] According to an exemplary embodiment as shown schematically in FIGURE 8A, a method of manufacturing a vehicle trim component 1000 may comprise the steps of

providing a substrate layer (e.g. fiber mat, etc.) as a base for a pre-form substrate, forming the pre-form substrate (e.g. consolidating, compressing, merging/fusing, heating/melting, shaping, cutting/sizing, etc.), pre-treating/heating the pre-form substrate, forming the structural substrate (e.g. compressing/molding the pre-form substrate), joining a rib to the structural substrate, joining an airbag chute to the rib/structural substrate, applying a cover to the structural substrate and finishing/providing a panel assembly (with the cover on the structure/substrate).

[0048] According to an exemplary embodiment as shown schematically in FIGURE 8B, a method of manufacturing a vehicle trim component 1000 may comprise the steps of providing a substrate layer (e.g. fiber mat, etc.) as a base for a pre-form substrate, forming the pre-form substrate (e.g. consolidating, compressing, merging/fusing, heating/melting, shaping, cutting/sizing, etc.), pre-treating/heating the pre-form substrate, forming the structural substrate (e.g. compressing/molding the pre-form substrate) in a mold, injection molding a rib onto the structural substrate in the mold, removing the structural substrate with the rib from the mold, applying a cover to the structural substrate with the chute and finishing/providing a panel assembly (with the cover on the structure/substrate).

[0049] According to an exemplary embodiment as shown schematically in FIGURES 9A and 9B, a method of manufacturing a vehicle trim component 1000 may comprise the steps of provide fiber mat, forming a pre-form substrate, heating the pre-form substrate, forming a structural substrate in a mold, injection molding a rib onto the structural substrate in the mold, removing the structural substrate with the rib from the mold, welding an airbag chute to the rib and the structural substrate, applying a cover to the structural substrate with the chute and finishing/providing a panel assembly (with the cover on the structure/substrate).

Exemplary Embodiment

[0050] According to an exemplary embodiment as shown schematically in FIGURE 4A, a fiber mat 202u may comprise a combination of fibers (e.g. natural and/or synthetic fibers) and thermoplastic resin (e.g. polypropylene (PP), acrylonitrile butadiene styrene (ABS), polycarbonate (PC), etc.). According to an exemplary embodiment as shown schematically in FIGURE 4B, fiber mat 202u may be trimmed into a fiber mat 202t having a thickness. According to an exemplary embodiment, fiber mat 202t may be heated to induce the thermoplastic resin to liquefy. According to an exemplary embodiment as shown schematically in FIGURE 4C, heated fiber mat 202t may be partially compressed into a fiber panel 202 having a thickness less than the thickness of fiber mat 202t. According to an exemplary embodiment as shown schematically in FIGURE 4D, fiber panel 202 may be heated in an oven OV. As shown schematically in FIGURE 4E, heated fiber panel 202 may be transferred into a mold having a mold top MT and mold bottom MB. According to an exemplary embodiment as shown schematically in FIGURE 4F, a component shown as an instrument panel substrate 200 may be produced by a process of compression forming heated fiber panel 202 into a structural substrate 210 and injection molding resin onto compression formed heated fiber panel 202.

[0051] According to an exemplary embodiment, instrument panel substrate 200 may provide a plastic rib on a back side of structural substrate 210 to improve structural integrity and rigidity of structural substrate 210. Structural substrate 210 may be configured to support an airbag chute 100 and an airbag module comprising an airbag. As shown schematically in FIGURE 7A, structural substrate 210 may comprise a border 220b to provide reinforcement and/or dimensional accuracy for structural substrate 210. According to an exemplary embodiment, a plastic rib may be placed at any location on structural substrate 210 (e.g. along an edge of structural substrate 210, in the middle of structural substrate 210, etc.). According to an exemplary embodiment, multiple plastic ribs may be placed at various different locations on structural substrate 210. According to an exemplary embodiment, a plastic rib may improve structural integrity of instrument panel substrate 200. According to an exemplary embodiment, instrument panel substrate 200 may be able to maintain structural integrity during an airbag deployment; the position/placement of a plastic rib may be intended to create a strength differential between different areas of instrument panel substrate 200; energy needed for an airbag to break through a vehicle interior component 1000 may be directed to a recess 210r of structural substrate 210; a plastic rib may prevent or minimize ripping or tearing of structural substrate 210 at any location other than at recess 210r during

an airbag deployment. A plastic rib forming a honeycomb shaped pattern may improve structural integrity and rigidity. According to an exemplary embodiment, a plastic rib may be formed in any configuration according to a specific application (e.g. ancillary features for attaching air vents, speakers or infotainment system, etc.). According to an exemplary embodiment as shown schematically in FIGURE 2B, a trim component 1000 for a vehicle interior may comprise airbag chute 100 and instrument panel substrate 200.

[0052] According to an exemplary embodiment as shown schematically in FIGURES 7A-7D, a trim component 1000 for a vehicle interior may be configured to support an airbag module providing an airbag AB configured to be deployed through an opening into the vehicle interior. Trim component 1000 may comprise a structural substrate 210 providing a front side, a back side and at least one door established upon deployment of the airbag to facilitate deployment of the airbag from the airbag module through the opening, an airbag chute 100 and a structure 300 positioned between structural substrate 210 and airbag chute 100. Structure 300 may be configured to secure airbag chute 100 to structural substrate 210. Structure 300 may be configured to secure airbag chute 100 to structural substrate 210 during deployment of airbag AB. Structure 300 may comprise a rib injection molded onto the back side of structural substrate 210. Structure 300 may be bonded to structural substrate 210. Structural substrate 210 may comprise a panel comprised at least partially of fibers; structure 300 may be comprised of resin. Structural substrate 210 may comprise a fiber panel; airbag chute 100 may comprise a thermoplastic polyolefin; structure 300 may comprise polypropylene. Structure 300 may comprise polypropylene filled with structural fibers. Airbag chute 100 may be welded to structure 300. Airbag chute 100 may be welded to structural substrate 210. Structure 300 may comprise a composite comprising fibers; the fibers may be configured to reinforce an interface between airbag chute 100 and structural substrate 210. Airbag chute 100 may comprise at least one flange 100f; structure 300 may be positioned between structural substrate 210 and the at least one flange 100f of airbag chute 100.

[0053] According to an exemplary embodiment as shown schematically in FIGURES 2A-2D, 4A-4G, and 7A-7D, a trim component 1000 for a vehicle interior configured to support an airbag module providing an airbag AB for deployment through an opening into the vehicle interior may be prepared using a mold M by a process comprising the steps of providing a fiber panel 202; disposing fiber panel 202 onto a first surface of mold M; compressing fiber panel 202 between the first surface and a second surface of mold M to form fiber panel 202 into a structural substrate 210 having a shape corresponding to a first contour of the first

surface and a second contour of the second surface; molding a structure 300 on a side of structural substrate 210; and joining an airbag chute 100 to structure 300. Structure 300 may be configured to secure airbag chute 100 to structural substrate 210. Structure 300 may be configured to secure airbag chute 100 to structural substrate 210 during deployment of airbag AB. Molding structure 300 on a side of structural substrate 210 may comprise injecting resin into mold M. Joining airbag chute 100 to structure 300 may comprise welding airbag chute 100 to structure 300. Joining airbag chute 100 to structure 300 may comprise welding airbag chute 100 to structural substrate 210.

[0054] According to an exemplary embodiment as shown schematically in FIGURES 2A-2D, 4A-4G and 7A-7D, a method of manufacturing a vehicle trim component 1000 configured to support an airbag module providing an airbag AB for deployment from the airbag module through an opening into the vehicle interior may comprise the steps of providing a fiber panel 202; disposing fiber panel 202 onto a first surface of a mold M; compressing fiber panel 202 between the first surface and a second surface of mold M to form fiber panel 202 into a structural substrate 210 having a shape corresponding to a first contour of the first surface and a second contour of the second surface; molding a structure 300 on a side of structural substrate 210; and joining an airbag chute 100 to structure 300. Structure 300 may be configured to secure airbag chute 100 to structural substrate 210. Molding a structure 300 on a side of structural substrate 210 may comprise injecting resin into mold M. Joining airbag chute 100 to structure 300 may comprise welding airbag chute 100 to structure 300. Joining airbag chute 100 to structure 300 may comprise welding airbag chute 100 to structural substrate 210.

Related Patent Documents – Incorporation by Reference

[0055] The present application incorporates by reference (a) U.S. Patent Application No. 13/595,741 titled "SYSTEM AND METHOD FOR MANUFACTURING A VEHICLE TRIM COMPONENT VIA CONCURRENT COMPRESSION FORMING AND INJECTION MOLDING" filed August 27, 2012 (now U.S. Patent No. 8,939,745); (b) U.S. Patent Application No. 13/846,529 titled "SYSTEM AND METHOD FOR MANUFACTURING A VEHICLE TRIM COMPONENT VIA CONCURRENT COMPRESSION FORMING AND INJECTION MOLDING" filed on March 18, 2013 (now U.S. Patent No. 9,149,961); (c) U.S. Patent Application No. 14/808,938 titled "VEHICLE TRIM COMPONENT" filed July 24, 2015 (now U.S. Patent No. 10,118,325).

* * *

[0056] It is important to note that the present inventions (e.g. inventive concepts, etc.) have been described in the specification and/or illustrated in the FIGURES of the present patent document according to exemplary embodiments; the embodiments of the present inventions are presented by way of example only and are not intended as a limitation on the scope of the present inventions. The construction and/or arrangement of the elements of the inventive concepts embodied in the present inventions as described in the specification and/or illustrated in the FIGURES is illustrative only. Although exemplary embodiments of the present inventions have been described in detail in the present patent document, a person of ordinary skill in the art will readily appreciate that equivalents, modifications, variations, etc. of the subject matter of the exemplary embodiments and alternative embodiments are possible and contemplated as being within the scope of the present inventions; all such subject matter (e.g. modifications, variations, embodiments, combinations, equivalents, etc.) is intended to be included within the scope of the present inventions. It should also be noted that various/other modifications, variations, substitutions, equivalents, changes, omissions, etc. may be made in the configuration and/or arrangement of the exemplary embodiments (e.g. in concept, design, structure, apparatus, form, assembly, construction, means, function, system, process/method, steps, sequence of process/method steps, operation, operating conditions, performance, materials, composition, combination, etc.) without departing from the scope of the present inventions; all such subject matter (e.g. modifications, variations, embodiments, combinations, equivalents, etc.) is intended to be included within the scope of the present inventions. The scope of the present inventions is not intended to be limited to the subject matter (e.g. details, structure, functions, materials, acts, steps, sequence, system, result, etc.) described in the specification and/or illustrated in the FIGURES of the present patent document. It is contemplated that the claims of the present patent document will be construed properly to cover the complete scope of the subject matter of the present inventions (e.g. including any and all such modifications, variations, embodiments, combinations, equivalents, etc.); it is to be understood that the terminology used in the present patent document is for the purpose of providing a description of the subject matter of the exemplary embodiments rather than as a limitation on the scope of the present inventions.

[0057] It is also important to note that according to exemplary embodiments the present inventions may comprise conventional technology (e.g. as implemented and/or integrated in exemplary embodiments, modifications, variations, combinations, equivalents, etc.) or may

comprise any other applicable technology (present and/or future) with suitability and/or capability to perform the functions and processes/operations described in the specification and/or illustrated in the FIGURES. All such technology (e.g. as implemented in embodiments, modifications, variations, combinations, equivalents, etc.) is considered to be within the scope of the present inventions of the present patent document.

CLAIMS

What is claimed is:

1. A component for a vehicle interior configured to support an airbag module providing an airbag configured to be deployed into the vehicle interior comprising:

a structural substrate;

an airbag chute; and

a structure between the structural substrate and the airbag chute;

wherein the structure is configured to couple the airbag chute to the structural substrate.

2. The component of Claim 1 wherein the structure is configured to couple the airbag chute to the structural substrate during deployment of the airbag.

3. The component of Claim 1 wherein the structure comprises a rib injection molded onto the structural substrate.

4. The component of Claim 1 wherein the structure is bonded to the structural substrate.

5. The component of Claim 4 wherein the airbag chute is welded to the structure.

6. The component of Claim 4 wherein the airbag chute is welded to the structure and the structural substrate.

7. The component of Claim 1 wherein the structural substrate comprises a panel comprised at least partially of fibers; wherein the structure is comprised of resin.

8. The component of Claim 1 wherein the structural substrate comprises a first material; wherein the airbag chute comprises a second material; wherein the structure comprises a third material; wherein the third material is different than the first material and the second material.

9. The component of Claim 8 wherein the first material comprises a composite comprising fibers; wherein the second material comprises thermoplastic polyolefin; wherein the third material comprises a resin.

10. The component of Claim 1 wherein the structural substrate comprises a fiber panel; wherein the airbag chute comprises a thermoplastic polyolefin; wherein the structure comprises polypropylene.

11. The component of Claim 10 wherein the structure comprises polypropylene filled with structural fibers.

12. The component of Claim 1 wherein the airbag chute is welded to the structural substrate; wherein the airbag chute is welded to the structure.

13. The component of Claim 1 wherein the structure comprises a composite comprising fibers; wherein the fibers are configured to reinforce an interface between the airbag chute and the structural substrate.

14. The component of Claim 1 wherein the airbag chute comprises at least one flange; wherein the structure is positioned between the structural substrate and the at least one flange of the airbag chute.

15. The component of Claim 1 wherein the airbag chute comprises a first flange and a second flange; wherein the first flange comprises a rib; wherein the second flange comprises a rib; wherein the structure comprises the rib of the first flange; the rib of the second flange, a rib injection molded onto the structural substrate adjacent the rib of the first flange; and a rib injection molded onto the structural substrate adjacent the rib of the second flange.

16. The component of Claim 15 wherein the rib injection molded onto the structural substrate adjacent the rib of the first flange comprises a set of ribs surrounding the rib of the first flange.

17. The component of Claim 15 wherein the rib of the first flange comprises a height; wherein the rib injection molded onto the structural substrate adjacent the rib of the first flange comprises a height; wherein the height of the rib of the first flange is generally the same as the height of the rib injection molded onto the structural substrate adjacent the rib of the first flange.

18. The component of Claim 1 wherein the structure comprises an interface configured to bond the airbag chute to the structural substrate.

19. The component of Claim 1 comprising at least one of (a) a trim component; (b) an instrument panel; (c) a trim panel.

20. A component for a vehicle interior configured to provide a module with an airbag configured to be deployed through an opening into the vehicle interior comprising:

a structural substrate;

an airbag chute; and

an interface configured to couple the structural substrate and the airbag chute;

wherein the interface comprises a feature on the structural substrate.

21. The component of Claim 20 wherein the structural substrate comprises a compression-formed component formed from a fiber panel.

22. The component of Claim 20 wherein the interface comprises (a) a bond of the feature to the structural substrate and (b) coupling the airbag chute to the feature.

23. The component of Claim 22 wherein the bond comprises injection molding of the feature to the structural substrate.

24. The component of Claim 20 wherein the interface comprises a bond comprising at least one of a weld and/or an adhesive.

25. The component of Claim 20 wherein the interface comprises a bond configured to attach the feature to the surface of the structural substrate.

26. The component of Claim 20 wherein the interface comprises (a) a bond between the feature the structural substrate and a feature of the airbag chute; and (b) a bond to a surface of the structural substrate.

27. The component of Claim 20 wherein the interface comprises at least one molded feature.

28. The component of Claim 20 wherein the interface comprises a structure.

29. The component of Claim 28 wherein the structure of the interface comprises at least one of (a) a composite material; (b) a resin material; (c) a material comprising fibers; (d) polypropylene with fibers; (e) a material molded onto the structural substrate.

30. The component of Claim 20 further comprising a composite structure comprising the structural substrate and the airbag chute.

31. The component of Claim 30 wherein the airbag module is configured to deploy the airbag through an opening in the composite structure.

32. The component of Claim 20 wherein the interface comprises the feature and a mounting area on the structural substrate.

33. The component of Claim 20 wherein the interface comprises the feature on the structural substrate and a feature of the airbag chute.

34. The component of Claim 33 wherein the interface comprises a bond configured to attach the feature of the airbag chute to the structural substrate.

35. The component of Claim 33 wherein the feature of the airbag chute comprises at least one rib on at least one flange of the airbag chute.

36. The component of Claim 20 wherein the interface comprises a bond to a surface of the structural substrate.

37. The component of Claim 20 wherein the interface comprises at least one of (a) a molded feature on the structural substrate; (b) a resin feature on the structural substrate; (c) a mounting area on the structural substrate; (d) a structure injection molded on the structural substrate; (e) a rib; (f) a set of ribs; (g) a rib injection molded onto the structural substrate; (h) a flange on airbag chute; (i) a weld; (j) an ultrasonic weld; (k) a bond; (l) an attachment; (m) a composite material; (n) a resin material; (o) a material comprising fibers; (p) polypropylene with fibers; (q) a material molded onto the structural substrate.

38. A component for a vehicle interior configured to support an airbag module providing an airbag for deployment through an opening into the vehicle interior prepared using a mold by a process comprising the steps of:

(a) providing a fiber panel;

(b) compressing the fiber panel in the mold;

(c) forming a feature on the structural substrate; and

(d) joining an airbag chute to the structural substrate;

wherein the feature is configured to couple the airbag chute to the structural substrate.

39. The component of Claim 38 wherein the step of forming a feature on the structural substrate comprises forming a structure for joining the airbag chute to the structural substrate.

40. The component of Claim 39 wherein the feature comprises an injection-molded structure.

41. The component of Claim 39 wherein the step of joining an airbag chute to the structural substrate comprises welding the airbag chute to the structure.

42. The component of Claim 41 wherein the step of joining an airbag chute to the structural substrate comprises welding the airbag chute to the structural substrate.

43. The component of Claim 38 wherein the step of compressing the fiber panel in the mold comprises compressing the fiber panel into a structural substrate having a shape.

44. The component of Claim 38 further comprising the step of forming a composite structure comprising a cover on the structural substrate.

45. A method of manufacturing a vehicle component configured to support an airbag module providing an airbag for deployment from the airbag module through an opening into the vehicle interior comprising the steps of:

(a) providing a fiber panel;

(b) compressing the fiber panel in a mold to form a structural substrate;

(c) molding a structure on the structural substrate; and

(d) joining an airbag chute to the structure;

wherein the structure is configured to couple the airbag chute to the structural substrate.

46. The method of Claim 45 wherein the step of molding a structure on the structural substrate comprises injecting resin into the mold.

47. The method of Claim 45 wherein the step of joining an airbag chute to the structure comprises welding the airbag chute to the structure.

48. The method of Claim 47 wherein the step of joining an airbag chute to the structure further comprises welding the airbag chute to the structural substrate.

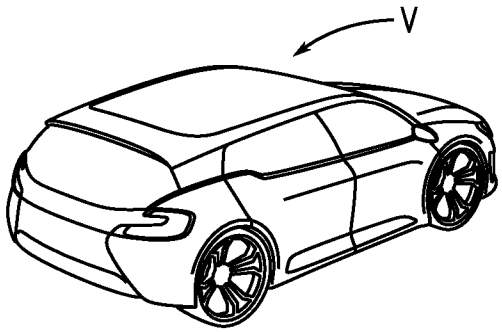

FIG. 1A

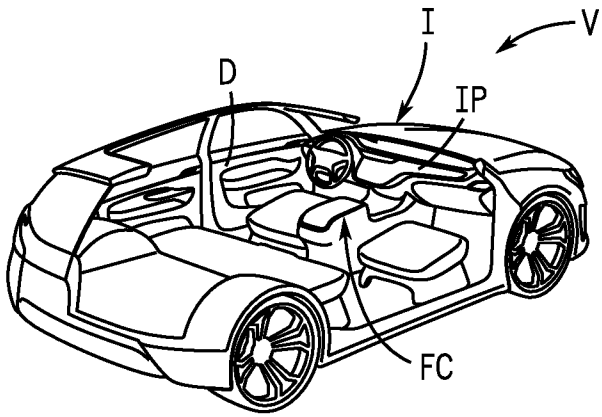

FIG. 1B

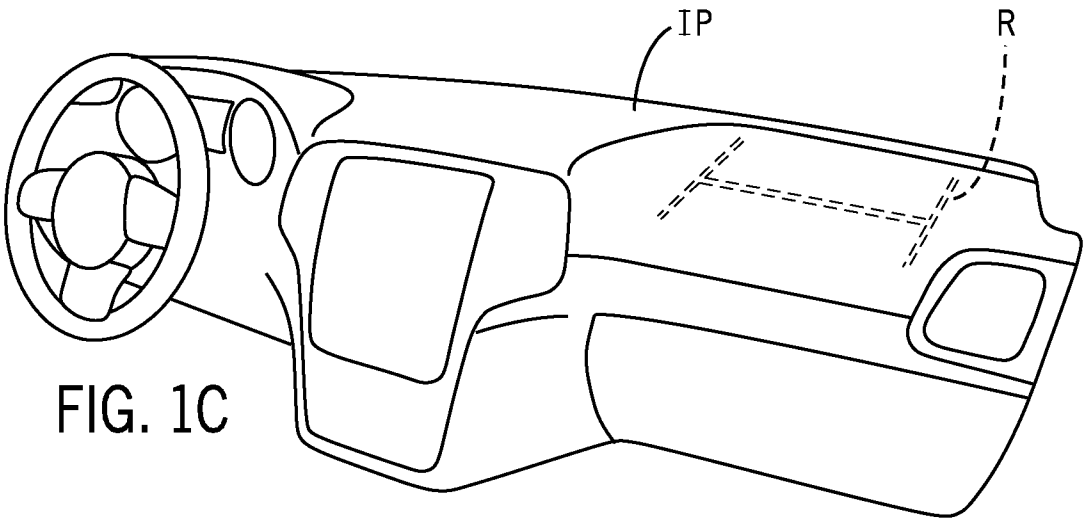

FIG. 1C

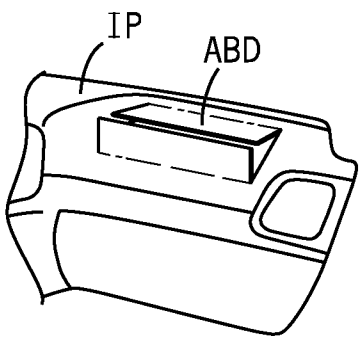

FIG. 1D

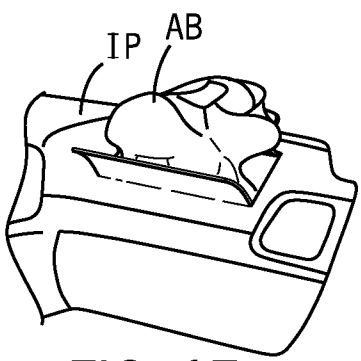

FIG. 1E

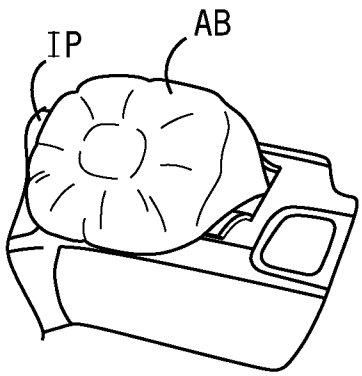

FIG. 1F

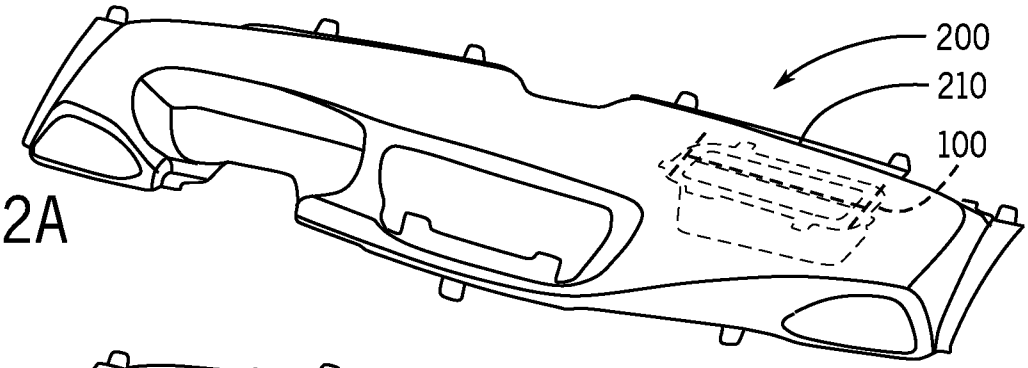

FIG. 2A

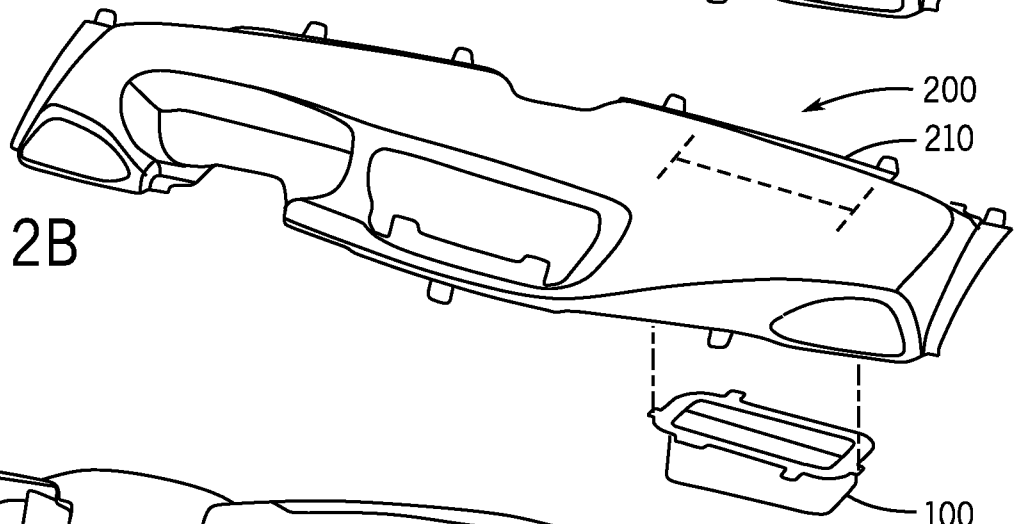

FIG. 2B

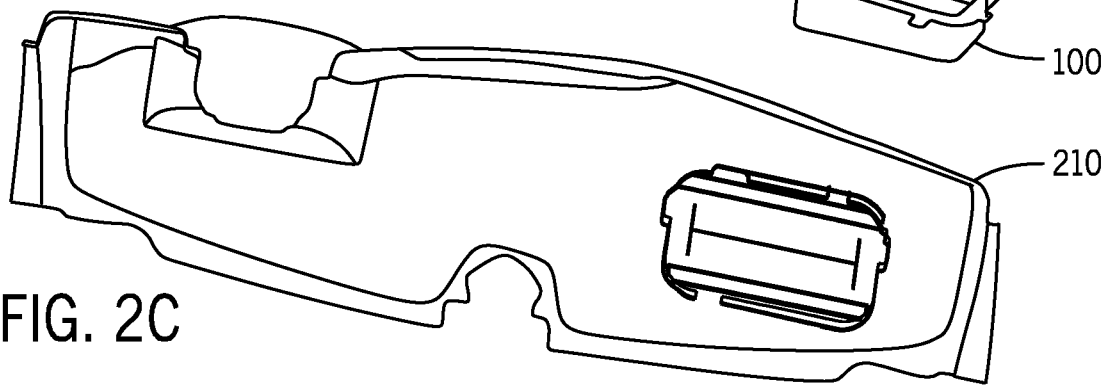

FIG. 2C

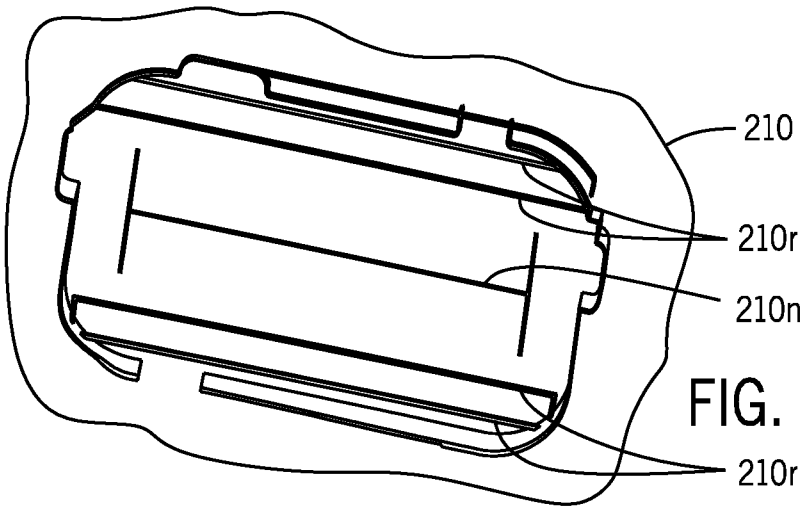

FIG. 2D

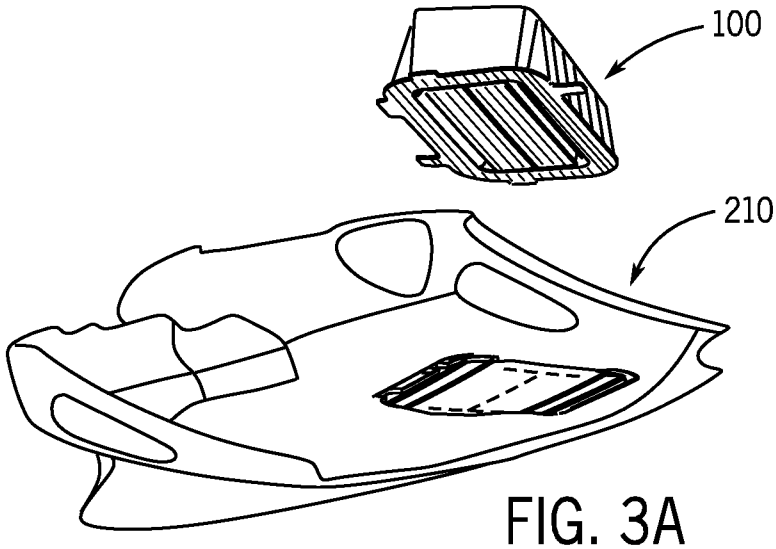

FIG. 3A

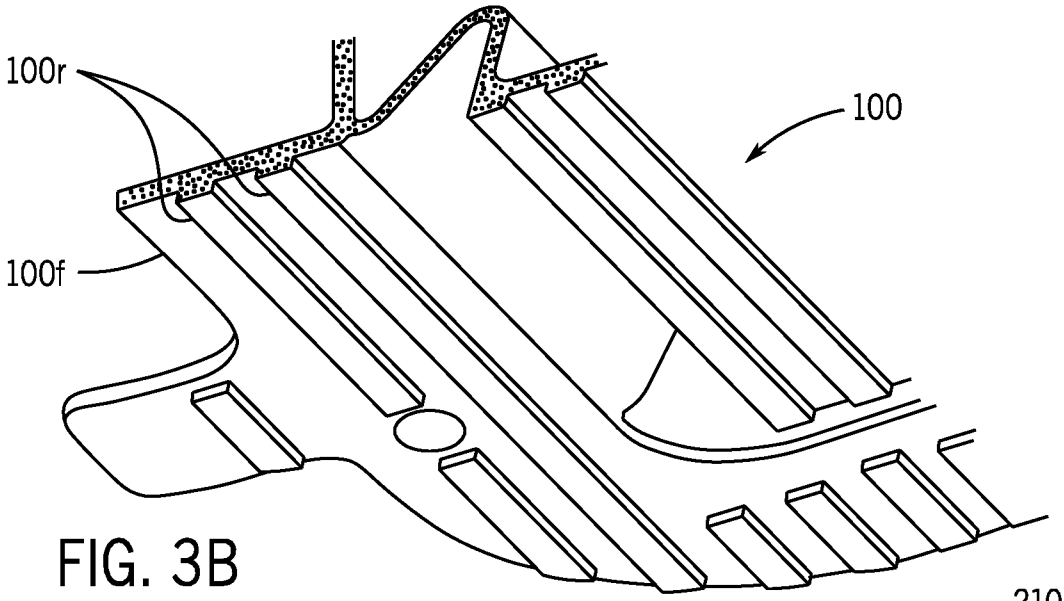

FIG. 3B

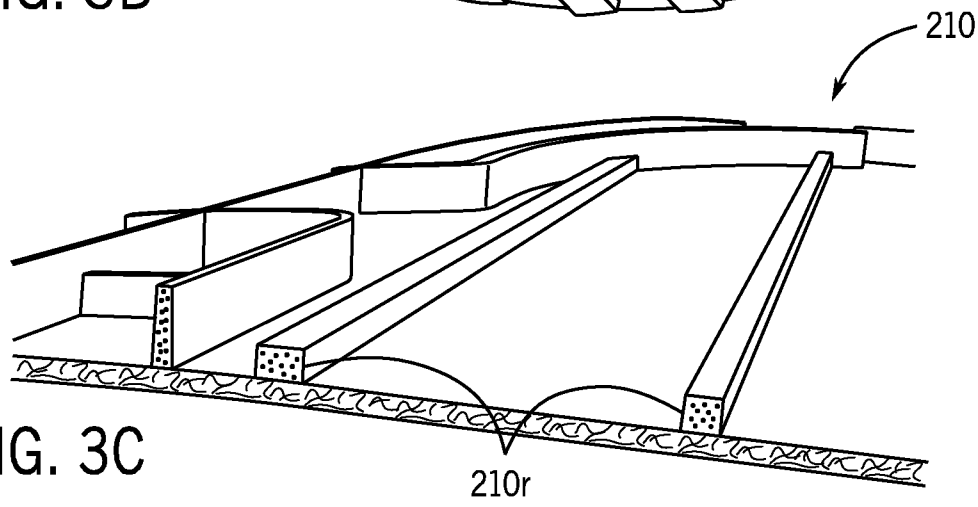

FIG. 3C

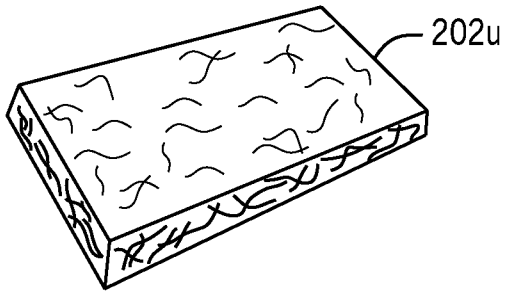

FIG. 4A

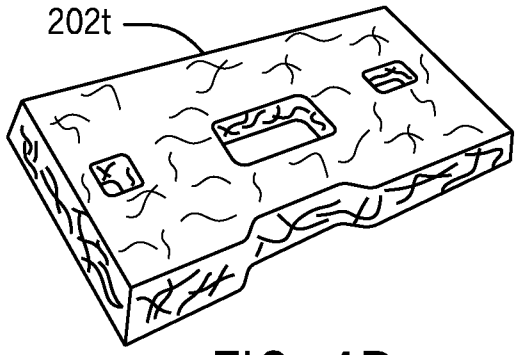

FIG. 4B

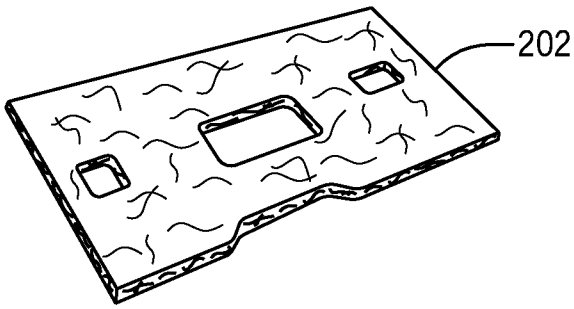

FIG. 4C

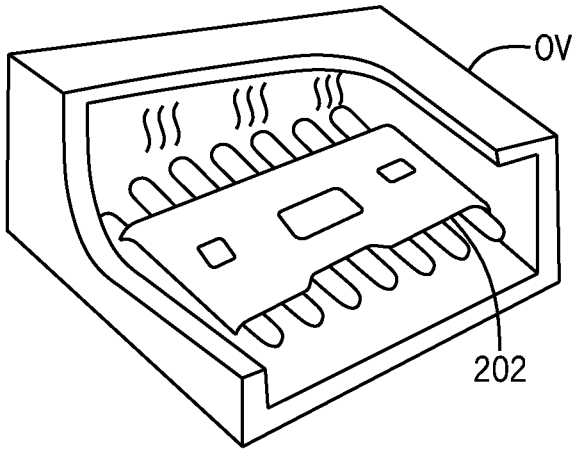

FIG. 4D

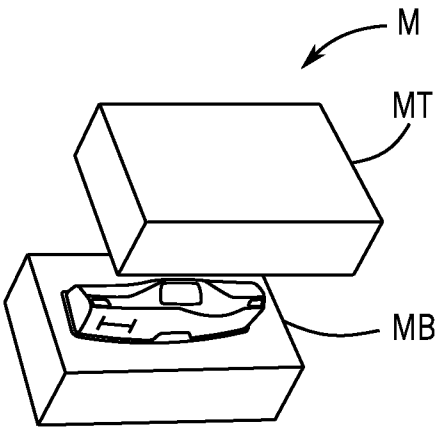

FIG. 4E

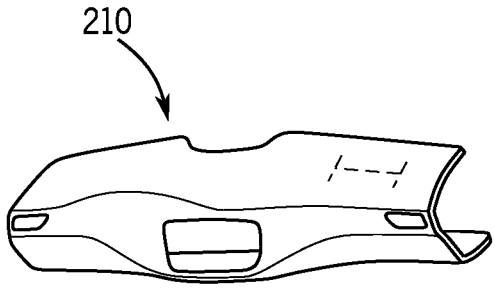

FIG. 4F

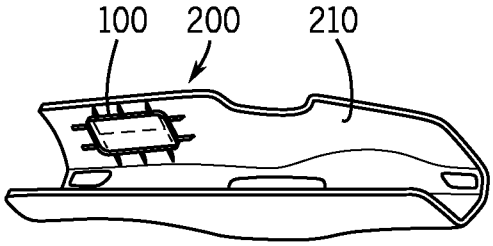

FIG. 4G

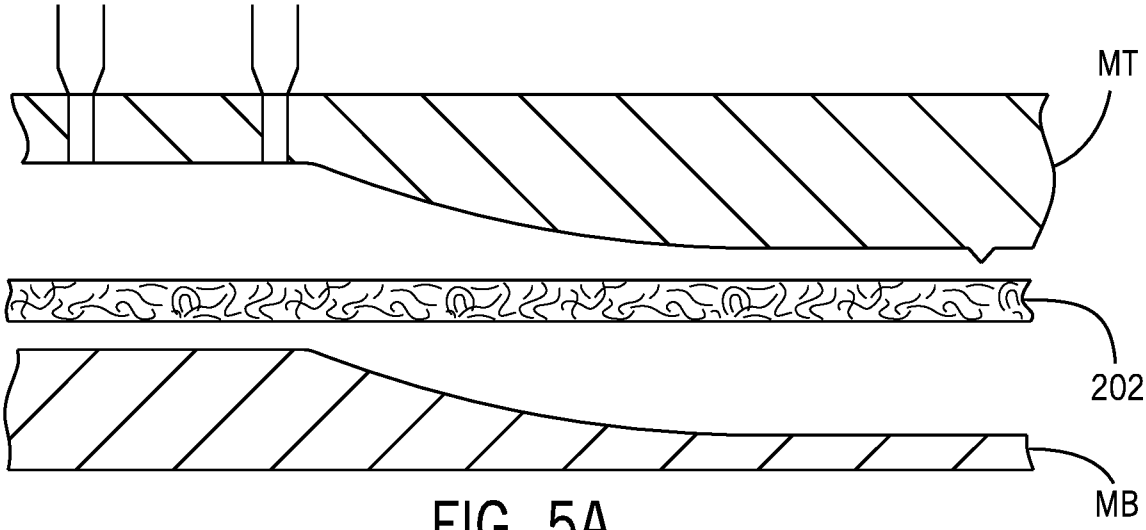

FIG. 5A

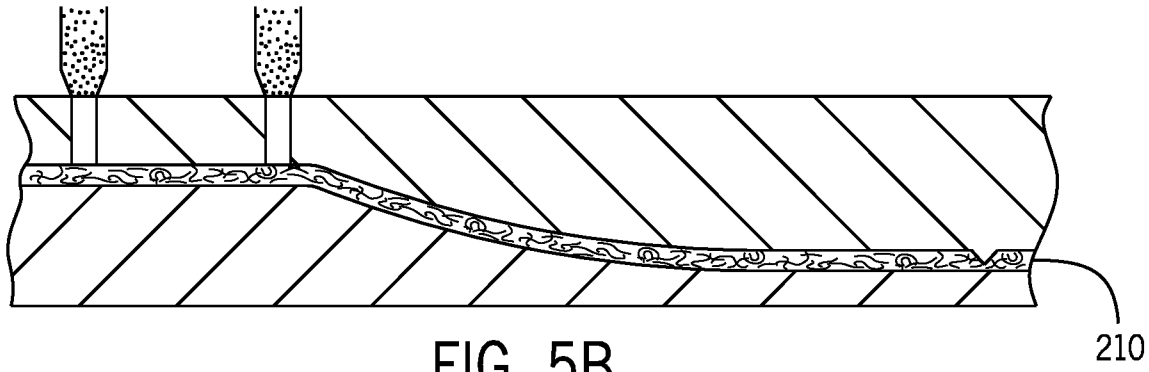

FIG. 5B

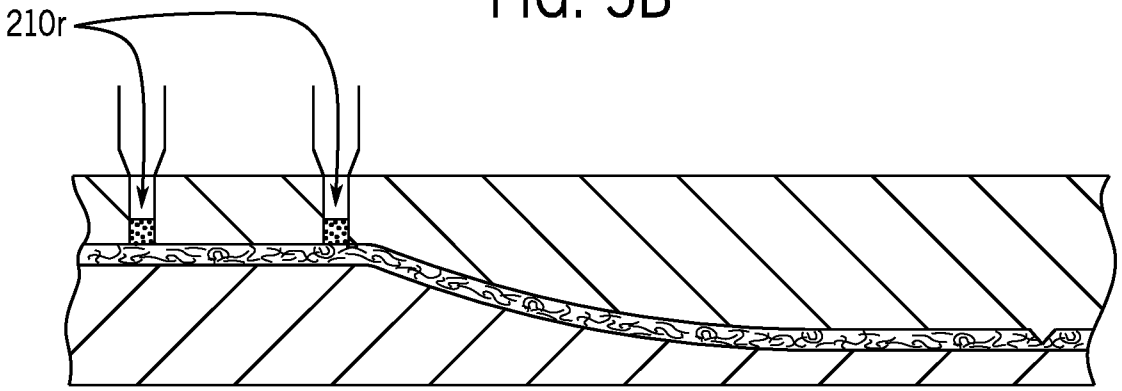

FIG. 5C

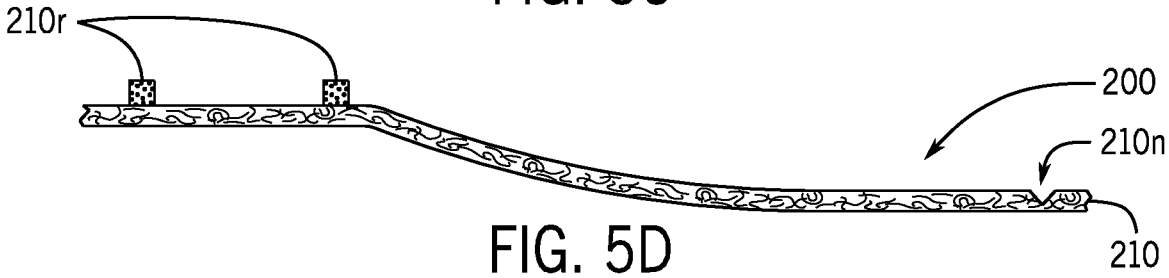

FIG. 5D

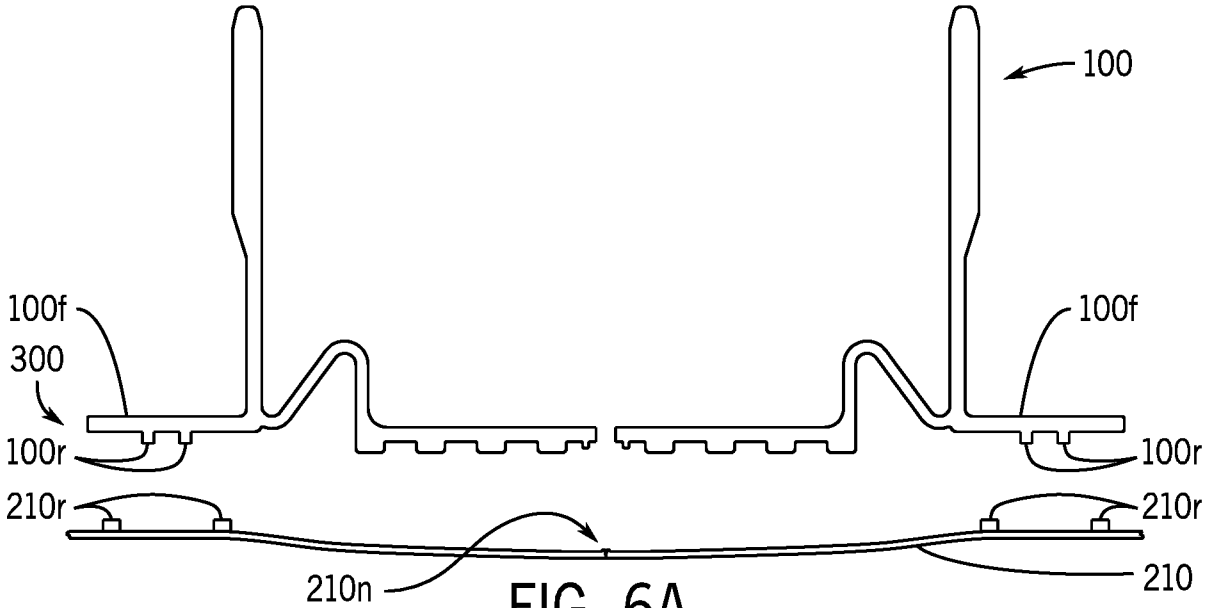

FIG. 6A

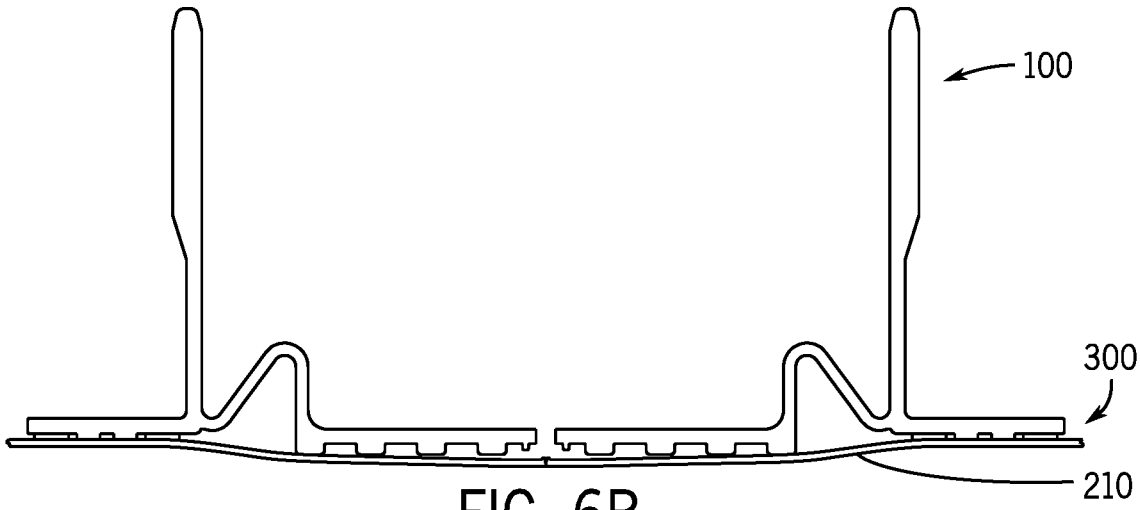

FIG. 6B

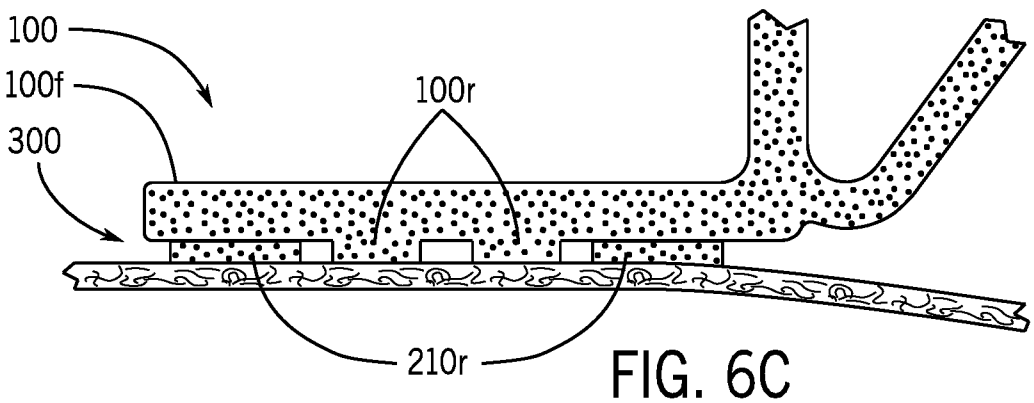

FIG. 6C

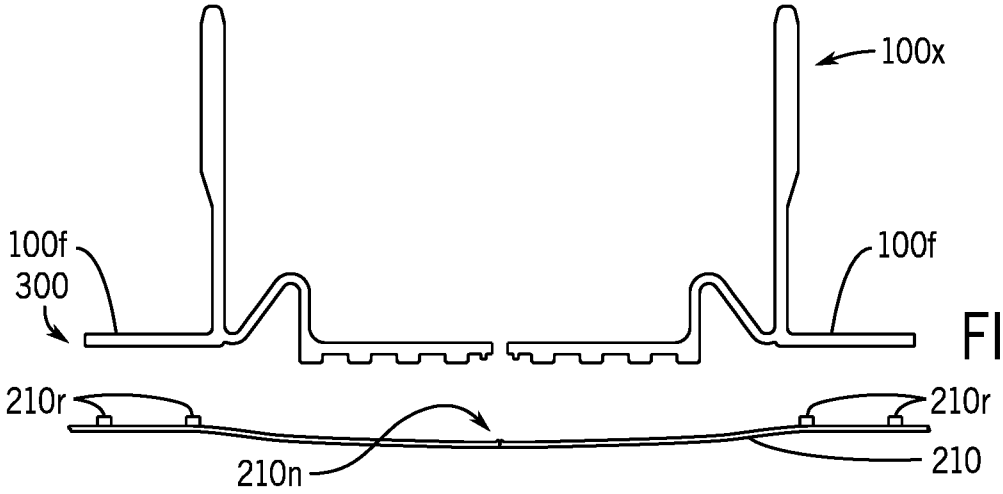

FIG. 7A

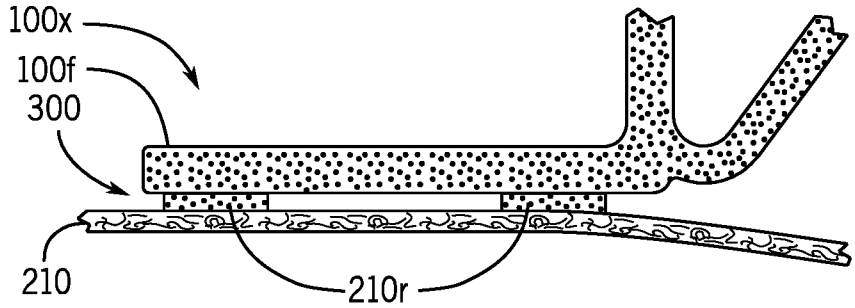

FIG. 7B

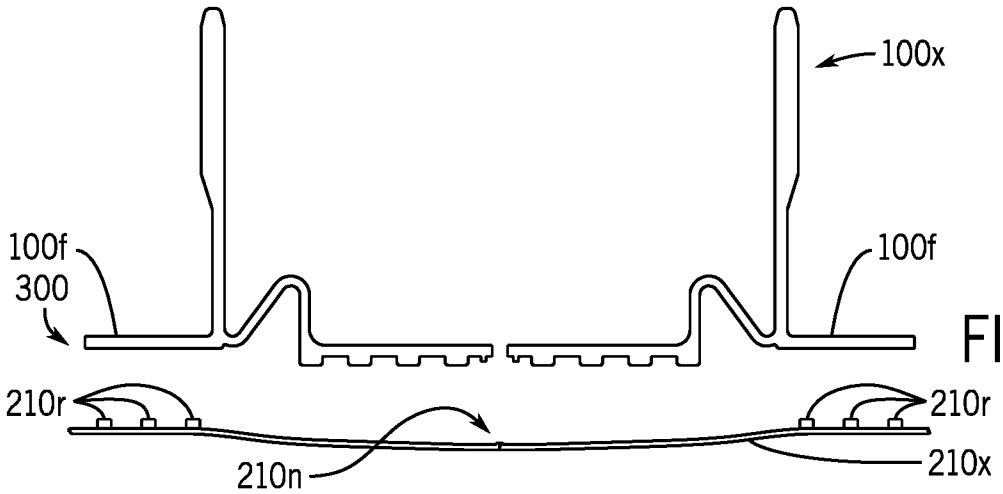

FIG. 8A

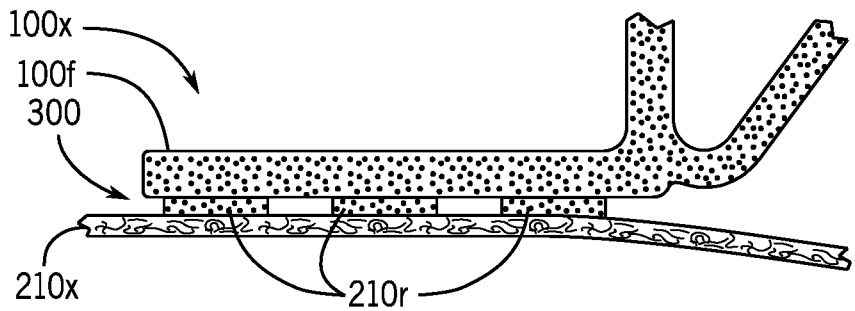

FIG. 8B

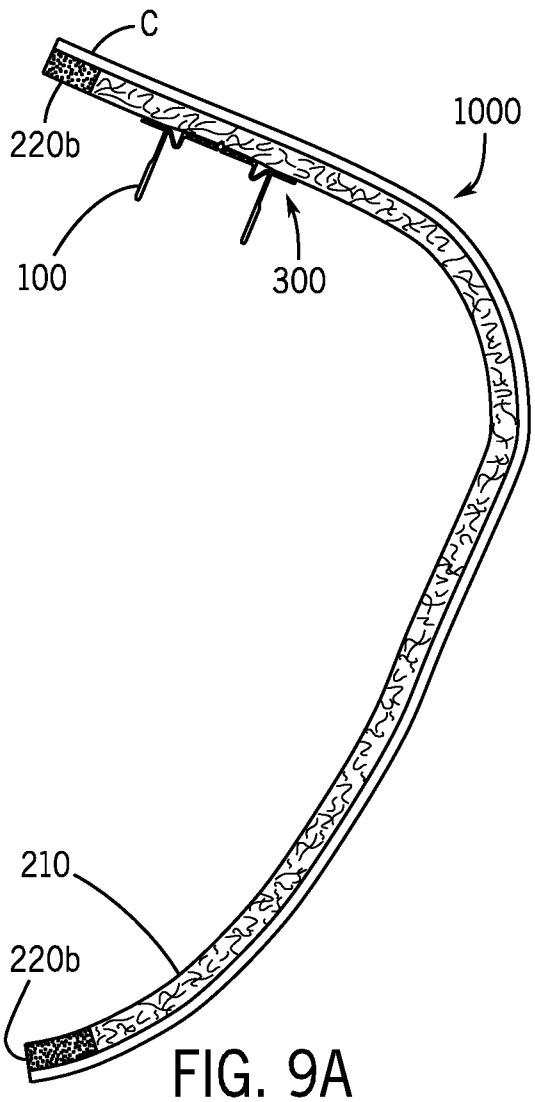

FIG. 9A

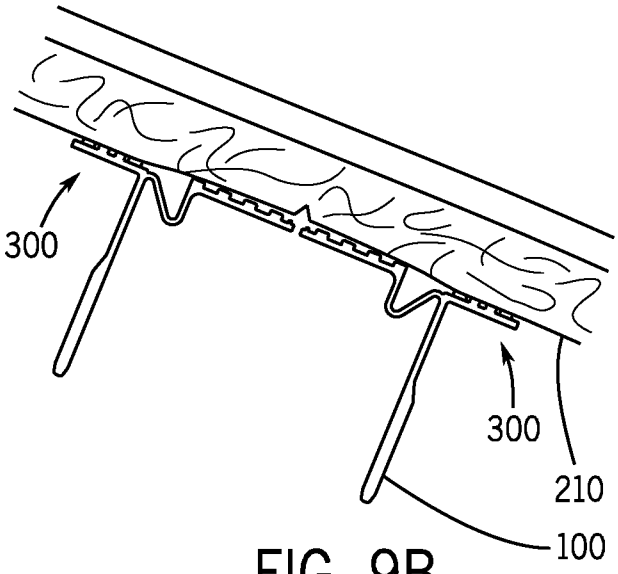

FIG. 9B

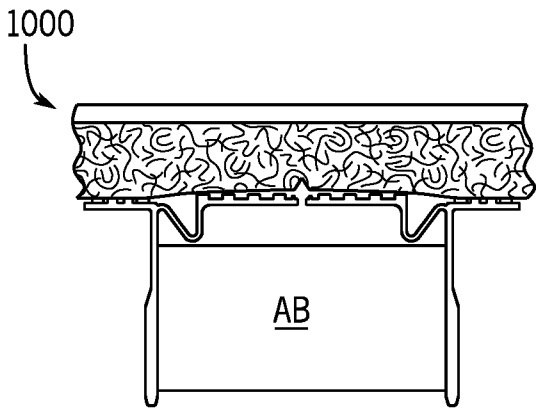

FIG. 9C

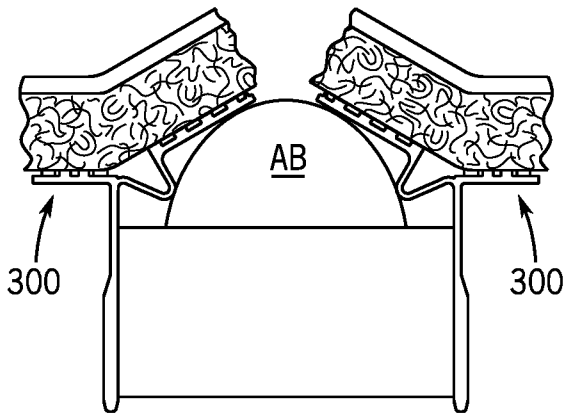

FIG. 9D

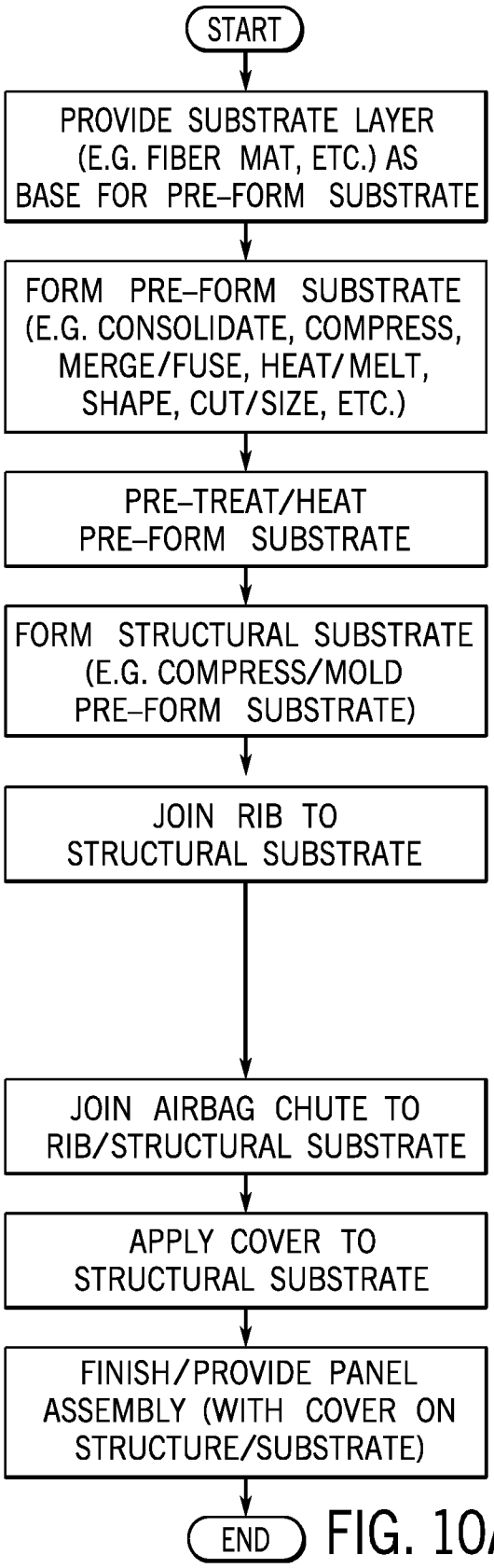

FIG. 10A

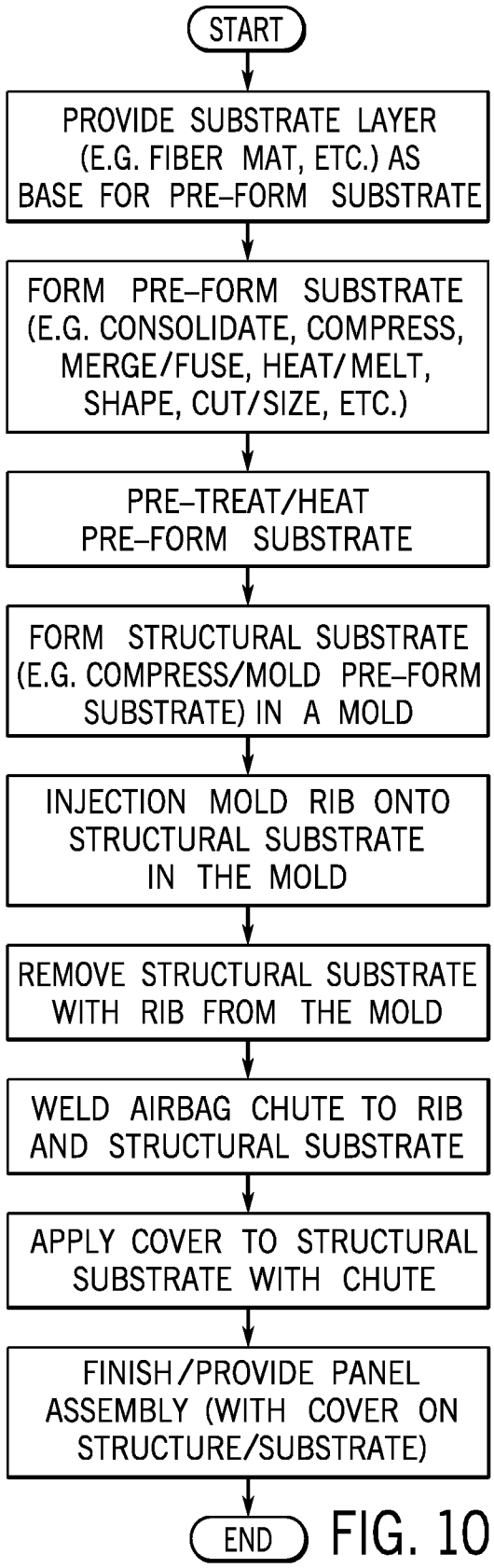

FIG. 10B

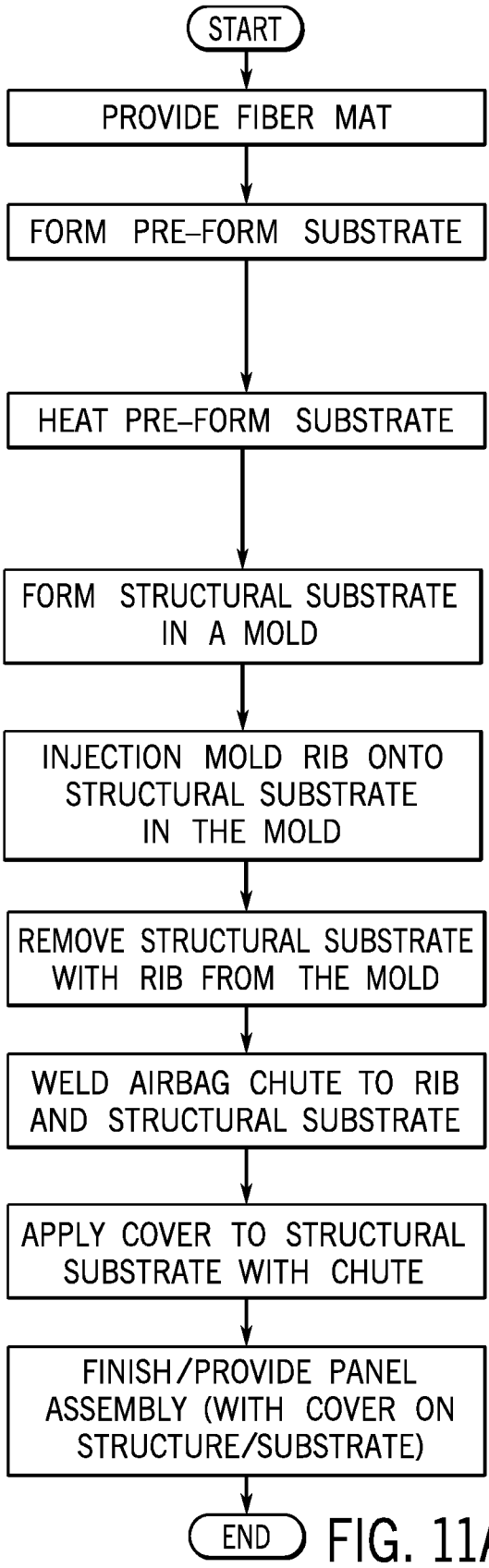

FIG. 11A

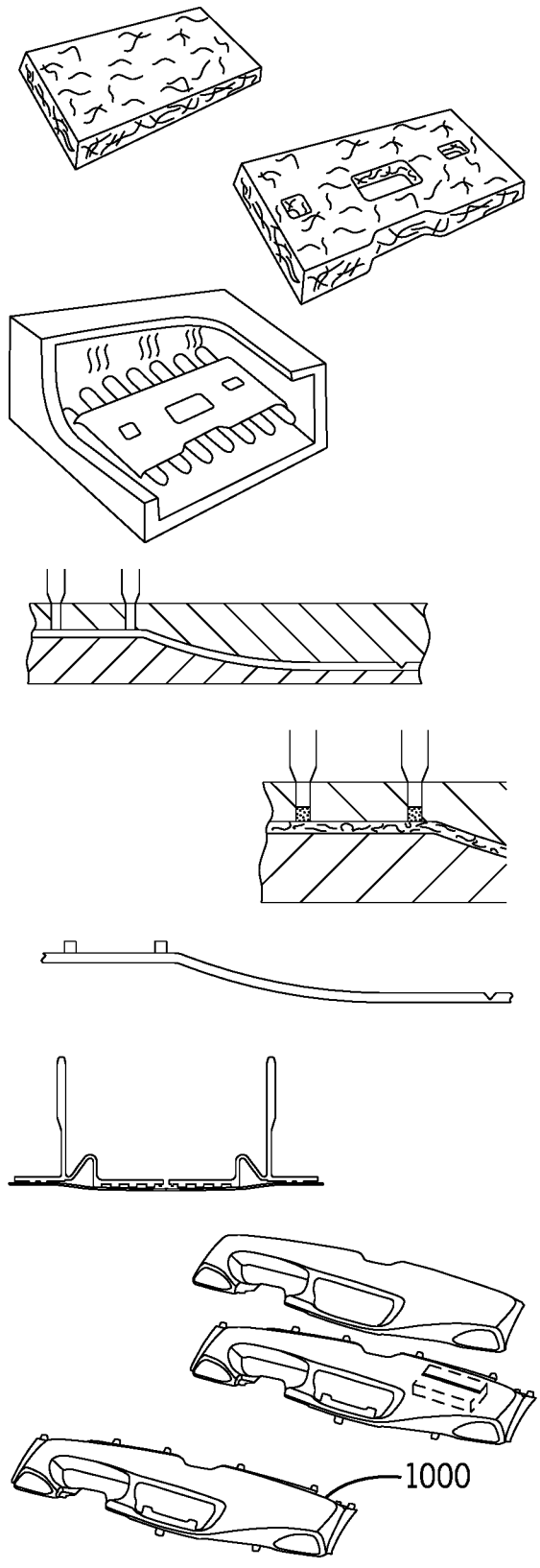

FIG. 11B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/039590

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B60R 21/20; B29C 65/06; B29C 65/08; B29L 31/30; B60K 37/00; B60R 21/205 (2019.01)

CPC - B60R 21/20; B29C 65/0618; B29L 2031/3038; B60K 37/00; B60R 21/205; B60R 21/215 (2019.08)

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)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 280/727; 280/728.1; 280/728.2; 280/728.3; 280/732 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2004-9708 A (INOUE MTP KK) 13 August 2008 (13.08.2008) see machine translation	1-6, 12, 14-16, 18-20, 24, 25, 27-37
---		---
Y		7, 13, 21, 38-48
Y	WO 2018/005197 A1 (SHANGHAI YANFENG JINQIAO AUTOMOTIVE TRIM SYSTEMS CO. LTD) 04 January 2018 (04.01.2018) entire document	7, 13, 21, 38-48
A	US 2018/0001856 A1 (CALSONIC KANSEI CORPORATION) 04 January 2018 (04.01.2018) entire document	1-48
A	US 9,010,800 B1 (HUNTER) 21 April 2015 (21.04.2015) entire document	1-48
A	US 2008/0048419 A1 (KONG) 28 February 2008 (28.02.2008) entire document	1-48

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 August 2019	19 SEP 2019

Name and mailing address of the ISA/US	Authorized officer
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774