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48446 (US). **THOMAS, Matthew** [US/US]; 770 North Fairground Road, Imlay City, MI 48444 (US).

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(74) Agent: **CHAPPLE, Scott**; Dobrusin & Thennish PC, 29 W. Lawrence St., Suite 210, Pontiac, MI 48342 (US).

(71) Applicant (for all designated States except US): **L & L PRODUCTS, INC.** [US/US]; 160 McLean Drive, Romero, MI 48065 (US).

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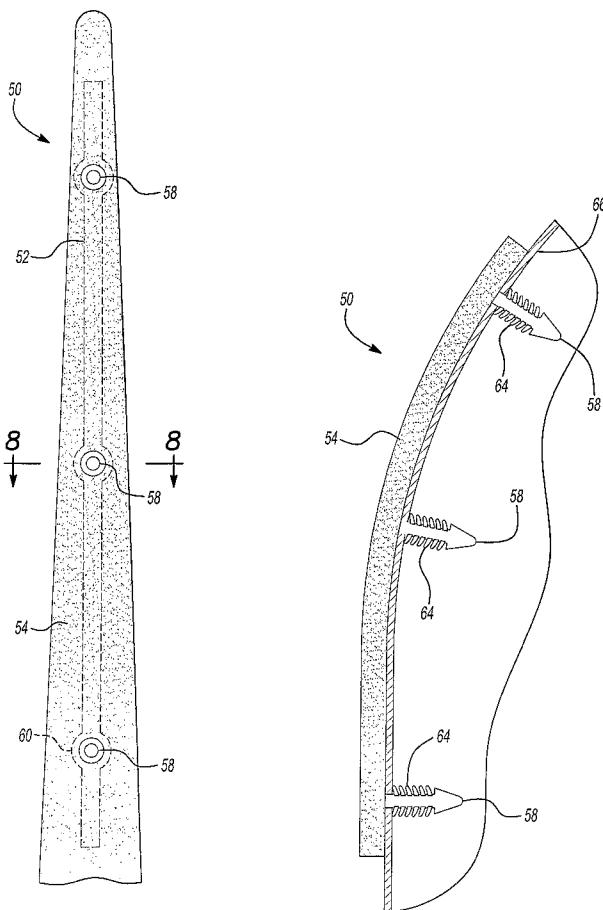
(72) Inventors; and

(75) Inventors/Applicants (for US only): **GRAY, Todd** [US/US]; 6465 Basswood Drive, Troy, MI 48098 (US). **COON, Thomas, L.** [US/US]; 3284 Merwin, Lapeer, MI

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[Continued on next page]

(54) Title: REINFORCEMENTS, BAFFLES AND SEALS WITH MALLEABLE CARRIERS



(57) Abstract: There is disclosed a process of forming reinforcements, baffles and seals having malleable carriers (10). The process typically includes application of an activatable material (38) to a malleable carrier (10) and contouring of the activatable material (38) the malleable carrier (10) or both.

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REINFORCEMENTS, BAFFLES AND SEALS WITH MALLEABLE CARRIERS

5

CLAIM OF PRIORITY

This application claims the benefit of the filing date of U.S. Provisional Application No. 60/705,561 filed August 4, 2005 and U.S. Application Serial No. To Be Assigned (Attorney Docket No. 1001-218), filed August 1, 2006, both of which are hereby incorporated by reference for all purposes.

10

FIELD OF THE INVENTION

The present invention relates generally to a member for providing sealing, baffling, reinforcement or a combination thereof to an article of manufacture such as an automotive vehicle.

15

BACKGROUND OF THE INVENTION

For many years, industry and particularly the transportation industry has been concerned with designing members for providing baffling, sealing, 20 structural reinforcement or the like to articles of manufacture such as automotive vehicles. As an example, United States Patent Nos. 5,755,486; 4,901,500; and 4,751,249 describe prior art devices. Generally, the members include carriers with activatable material disposed thereon. Design of such members can involve a variety of factors, which may be adverse to each 25 other. For example, it is generally desirable for such members to be relatively inexpensive. However, the cost of materials and processing for such members can drive costs up, particularly in situations where it is desirable for the members to be shaped to include one or more contours. Thus, the present invention provide a member for reinforcement, baffling or sealing that 30 effectively copes with competing design factors or provides other advantages, which will become apparent from the following description.

SUMMARY OF THE INVENTION

The present invention is directed to a process that provides sealing, 35 baffling, reinforcement or a combination thereof to a structure of an article of manufacture such as an automotive vehicle. According to the process, a

malleable carrier member is provided and an activatable material is associated with the malleable carrier thereby forming the member. Preferably, the volume of activatable material is at least 500% of the volume of the malleable carrier. The malleable carrier, the activatable material or 5 both are also shaped according to the process and the shaping step typically includes at least one or a combination of the following: 1) shaping the malleable carrier to a predetermined configuration and molding the activatable material onto the malleable carrier; 2) molding the activatable material upon the malleable carrier for forming the member and applying the 10 member to a structure of an article in a manner that includes shaping the malleable carrier and the activatable material; or 3) disposing the activatable material upon the carrier and bending at least a portion of the carrier to attach the carrier and the activatable material to a structure.

15

BRIEF DESCRIPTION OF THE DRAWINGS

The features and inventive aspects of the present invention will become more apparent upon reading the following detailed description, claims, and drawings, of which the following is a brief description:

Fig. 1 is a front view of an exemplary carrier material according to an 20 aspect of the present invention.

Fig. 2 is a front view of an exemplary carrier material according to another aspect of the present invention.

Fig. 3 is a front view of an exemplary carrier material according to another aspect of the present invention

25 Fig. 4 is a sectional view of an exemplary member according to an aspect of the present invention.

Fig. 5 is a perspective view of an exemplary member according to an aspect of the present invention.

Fig. 6 is a sectional view of an exemplary structure according to an 30 aspect of the present invention.

Fig. 7 is a front view of an exemplary member according to an aspect of the present invention.

Fig. 8 is a sectional view of the exemplary member of Fig. 7.

Fig. 8A is a side view of the member of Figs. 7 and 8 being applied to a substrate.

Fig. 9 is a front view of an exemplary member according to an aspect of the present invention.

5 Fig. 10 is side view of the exemplary member of Fig. 9.

Fig. 11 is a side view of the exemplary member of Fig. 9 and 10 applied to an exemplary structure of an automotive vehicle.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

10 The present invention is predicated upon the provision of a member suitable for providing sealing, baffling, reinforcement or a combination thereof to one or more structures of an article of manufacture and a process for forming the member and applying the member to the one or more structures of the article of manufacture. Together, the one or more structures and the 15 member form a system or assembly that is generally desirable for the article of manufacture because of the functional attributes (e.g., noise reduction, sealing, strength, combinations thereof or the like) provided by the member. It is contemplated that the member may be employed in conjunction with a variety of structures of various articles of manufacture such as boats, trains, 20 buildings, appliances, homes, furniture or the like. It has been found, however, that the member is particularly suitable for application to structures or assemblies of transportation vehicles such as automotive vehicles. Generally, it is contemplated that the member may be applied to various 25 structures of an automotive vehicle such as components of a body, a frame, an engine, a hood, a trunk, a bumper, combinations thereof or the like of an automotive vehicle.

The member typically includes one or more of the following:

- i) a malleable carrier;
- ii) an activatable material disposed upon the malleable carrier; and
- 30 iii) optionally, one or more fasteners connected to the carrier, the activatable material or both;

The process for forming the member typically include one or more of the following steps:

- 5 i) providing a malleable carrier;
- ii) associating an activatable material with the malleable carrier;
- iii) shaping of the activatable material, the malleable carrier material or both; and
- iv) optionally, connecting one or more fasteners to the activatable material, the carrier or both.

10 As used herein, the term malleable as it applies to a carrier generally means that the carrier has a degree of pliability that allows the carrier to be shaped or formed. A material that is malleable according to the present invention typically has a yield stress less than about 1000 MPa but may be greater, more typically less than about 700 MPa, more typically less than 15 about 500 MPa and even more typically less than about 350 MPa, but typically greater than about 10 MPa but may be less, more typically greater than about 70 MPa, even more typically greater than about 100 MPa and still more typically greater than about 250 MPa.

20 Suitable malleable carrier materials can include, without limitation, polymeric materials (e.g., elastomers, plastics or the like), metals, composite materials, fibrous materials, combinations thereof or the like. Materials including or composed substantially entirely of one or more metals are particularly suitable for use as carrier materials. Exemplary metals include, without limitation, aluminum, steel, iron, magnesium, zinc, lead, tin, titanium, 25 molybdenum, vanadium, zirconium, chromium, copper, tungsten, nickel, silver, gold, platinum, combinations thereof or the like.

30 Generally, a malleable carrier may be formed in a variety of configurations. In one embodiment, the carrier will be formed of one or more strips of malleable material. As used herein, a strip of material is any configuration of material having an extension length and a maximum diameter wherein the maximum diameter is substantially less than the extension length. For example, the maximum diameter should be less than 20%, more typically less than 10% and even more typically less than 2% and even more

typically less than 0.5% of the extension length. The extension length is a length of a strip when the strip is arranged in a substantially straight line and the maximum diameter is a maximum dimension of the strip substantially perpendicular to the length. Thus, for example, a coiled cylindrical wire could 5 be considered a strip if the wire is uncoiled, arranged in a substantially straight line and the maximum diameter of the wire is substantially less than the extension length. Exemplary strips includes wires, coils, straps, combinations thereof or the like.

Referring to Figs. 1-3, there are illustrated examples of suitable carrier 10 materials 10, 12 and 14 suitable for use in the present invention. Each of the materials includes a plurality (e.g., 2, 3, 4, 5 or more) of strips 18 intertwined (e.g., interwoven) with each other to form the materials 10, 12 and 14. In Fig. 1, the carrier material 10 includes a plurality of interwoven strips 18 (e.g., wires). The carrier material 12 of Fig. 2 includes a plurality of strips 18 (e.g., wires) 15 configured into a honeycomb arrangement. Moreover, the carrier material 14 of Fig. 3 includes a plurality of strips 18 (e.g., wires) arranged to form relatively large openings 20 and relatively small openings 22. Generally, wire mesh and particularly metal or plastic wire mesh products may be employed as carrier materials.

20 For forming a member according to the present invention, an activatable material is typically associated with (e.g., connected to, dispose upon, surrounding or the like) the carrier material. The carrier material may be formed into a carrier before or after the activated material is associated with the carrier material. For example, carrier material may be cut to form a 25 carrier of desired shape and the activatable material may be associated with the carrier thereafter. Alternatively, activatable material may be associated with the carrier material followed by cutting or otherwise forming the carrier material to for the carrier.

As used for the present invention, the term activatable material is 30 intended to mean a material that can be activated to cure (e.g., thermoset), expand (e.g., foam), soften, flow or a combination thereof upon exposure to a condition. Thus, it is contemplated for the present invention that an activatable material may be activated to perform only one of aforementioned

activities or any combination of the aforementioned activities unless otherwise stated.

A variety of activatable materials may be used for the member of the present invention. In one embodiment, the activated material may be formed 5 of a heat activated material and may flow, cure (e.g., thermoset), expand (e.g., foam) or a combination thereof upon exposure to heat. The activatable material may be generally dry to the touch and substantially non-tacky or may be tacky and, in either situation, may be shaped in any form of desired pattern, placement, or thickness, and may have substantially uniform 10 thickness or variable thickness. Exemplary expandable materials include L-7102 and L-7220 foams available through L&L Products, Inc. of Romeo, Michigan. Another exemplary expandable material is disclosed in U.S. patent application titled "Expandable Material", Serial No. 10/867,835, filed on June 15, 2004 and incorporated herein by reference for all purposes.

15 Though other heat-activated materials are possible, a preferred heat activated material is an expandable polymer or plastic, and preferably one that is foamable. Particularly preferred materials are foamable or sealing materials, which include or are based upon an EPDM, an elastomer an epoxy resin, an acrylate or an acetate combinations thereof or the like, which may 20 be structural, sealing, baffling, acoustic or a combination thereof. For example, and without limitation, the foam may be an epoxy-based material, including an ethylene copolymer or terpolymer that may possess an alpha-olefin. As a copolymer or terpolymer, the polymer is composed of two or 25 three different monomers, i.e., small molecules with high chemical reactivity that are capable of linking up with similar molecules.

A number of sealing, baffling or acoustic foams are known in the art and may be employed in the present invention. A typical foam includes a polymeric base material, such as an epoxy resin or ethylene-based polymer (e.g. EMA, EVA or the like) which, when compounded with appropriate 30 ingredients (typically a blowing and curing agent), expands and cures in a reliable and predictable manner upon the application of heat or the occurrence of a particular ambient condition. From a chemical standpoint for a thermally-activated material, the foam is usually initially processed as a flowable

thermoplastic and/or a thermosettable material. Typically, the material will cross-link (e.g. thermoset) upon curing, which makes the material incapable of further flow.

One advantage of the preferred foamable or activatable materials over 5 prior art materials is that the preferred materials can be processed in several ways. The preferred materials can be processed by injection molding, extrusion, compression molding or with a mini-applicator. This enables the formation and creation of part designs that exceed the capability of most prior art parts.

10 While preferred materials have been disclosed, other materials may be used as well, particularly materials that are heat-activated or otherwise activated by an ambient condition (e.g. moisture, pressure, time, chemical reaction or the like) and cure in a predictable and reliable manner under appropriate conditions for the selected application. Of course, the material 15 may also be formed of non-curable materials, non-expandable materials or otherwise. Thus, upon activation, the material may soften, cure and expand; soften and cure only; cure only; soften only; or may be non-activatable.

One example of an expandable material is the epoxy based resin 20 material disclosed in U.S. Patent No. 6,131,897, the teachings of which are incorporated herein by reference. Some other possible materials include, but are not limited to, polyolefin materials, copolymers and terpolymers with at least one monomer type an alpha-olefin, phenol/formaldehyde materials, phenoxy materials, and polyurethane materials with high glass transition 25 temperatures. See also, U.S. Patent Nos. 5,766,719; 5,755,486; 5,575,526; and 5,932,680, (incorporated by reference). Polyurethane materials including a blocked isocyanate may also be employed. In general, the desired characteristics of the material include high glass transition temperature (typically greater than 70 degrees Celsius), and adhesion durability properties. In this manner, the material does not generally interfere with the 30 materials systems employed by automobile manufacturers.

Other exemplary expandable materials can include combinations of two or more of the following: epoxy resin, polystyrene, styrene butadiene-styrene (SBS) block copolymer, butadiene acrylo-nitrile rubber, amorphous

silica, glass microspheres, azodicarbonamide, urea, dicyandiamide. Examples of such materials are sold under the tradename SIKAELASTOMER, SIKAREINFORCER and SIKABAFFLE and are commercially available from the Sika Corporation, Madison Heights, MI.

5 In applications where the material is a heat activated, thermally expanding material, an important consideration involved with the selection and formulation of the material comprising the foam is the temperature at which a material reaction or expansion, and possibly curing, will take place. Typically, the foam becomes reactive at higher processing temperatures, 10 such as those encountered in an automobile assembly plant, when the foam is processed along with the automobile components at elevated temperatures or at higher applied energy levels, e.g., during paint, primer or e-coat baking or curing steps. While temperatures encountered in an automobile assembly operation may be in the range of about 148.89° C to 204.44° C (about 300° F 15 to 400° F), body and paint shop applications are commonly about 93.33° C (about 200° F) or slightly higher. If needed, blowing agent activators can be incorporated into the composition to cause expansion at different temperatures outside the above ranges. Generally, suitable expandable foams have a volumetric range of expansion ranging from approximately 0 to 20 over 1000 percent (e.g., volumetric expansion of greater than 50%, 100%, 200% or 500% of the original unexpanded volume of the material).

The material or medium may be at least partially coated with an active polymer having damping characteristics or other heat activated polymer, (e.g., a formable hot melt adhesive based polymer or an expandable structural 25 foam, examples of which include olefinic polymers, vinyl polymers, thermoplastic rubber-containing polymers, epoxies, urethanes or the like) placed along the mold through the use of baffle technology; a die-cast application according to teachings that are well known in the art; pumpable application systems which could include the use of a baffle and bladder 30 system; and sprayable applications.

Formation

Generally, formation of the member of the present invention can be accomplished using multiple different techniques such as an extrusion, molding (e.g., compression molding, injection molding, blow molding or the like), machining, combinations thereof or the like. Such formation generally 5 includes associating one or more masses of activatable material with the carrier and/or carrier material. The activatable material can be connected or attached directly or indirectly to the carrier. Typically, however, the activatable material is disposed about (i.e., surrounds) a substantial portion of the carrier. In such an embodiment, it is typically desirable of the activatable 10 material to surround at least 30%, but possibly less, more typically at least 50% and even more typically at least 80% and still more typically at least 90 or even 100 percent of the carrier.

According to one preferred embodiment, the activatable material is injection molded about the carrier. In such embodiment, a carrier material is 15 formed (e.g., cut) to a desired shape and/or size for forming the carrier. The carrier is then placed in a mold of an injection molding machine and the mold is closed about the carrier. Activatable material is injected into the mold in a substantially fluid state and allowed to substantially surround and adhere to the carrier. Then the member including the carrier and the activatable 20 material are removed from the mold.

In Figs. 4 and 5, there is illustrated a member 30 that can be formed using injection molding. For forming the member 30, a carrier 32 is cut from carrier material into a rectangular shape. The carrier 32 is then placed in a mold of an injection molding machine and the mold is closed. If the carrier 32 25 does not include a bend 34 as shown in Fig. 5, once cut, the bend may be preformed prior to insertion of the carrier 32 in the mold or the bend 34 may be formed upon closing of the mold. Thereafter, activatable material 38 is injected into the mold about the carrier at an elevated temperature (e.g., a temperature that is typically greater than 30°, 40°, 60°, 80°, or even 100° C 30 but typically less than 220°, 170°, 120°, 100°, or even 70° C) that maintains the activatable material 38 in a relatively fluid state but does not substantially activate the material 38. The activatable material is then allowed to cool such that it adheres to the carrier 32 thereby forming the member 30.

According to one preferred embodiment, the activatable material is extruded or co-extruded about the carrier or carrier material. In such embodiment, a carrier material is preferably fed to an extrusion die along with 5 activatable material that is exiting an extruder thereby forming a composite extrudate. In this manner, activatable material can substantially surround the carrier material. Thereafter, the extrudate including the carrier material, the activatable material or both can be cut to a desired shape or configuration to form a member such as the member 30 shown in Fig. 5. Preferably, although 10 not required, the activatable material 38 is extruded at an elevated temperature (e.g., a temperature that is typically greater than 30°, 40°, 60°, 80°, or even 100° C but typically less than 220°, 170°, 120°, 100°, or even 70° C) that maintains the activatable material 38 in a relatively fluid or viscoelastic state but does not substantially activate the material 38. Then, upon cooling, 15 the activatable material can cool such that it adheres to the carrier 32 thereby forming the member 30.

Advantageously, formation of members using these techniques can provide the member with relatively complex or simple shapes and/or contours as needed or desired. Moreover, the carriers of the members assist the 20 members in maintaining these shapes and particularly assist the activatable material in maintaining its shape.

In any of the embodiments of the present invention, but particularly in situations where the carrier serves primarily to support the activatable material, it is preferable for the volume of the activatable material to be 25 substantially greater than the volume of the carrier. For example, the volume of the activatable material can be at least 200%, more typically at least 500% and even more typically at least 800% the volume of the carrier. As an exemplary calculation, 200% of a volume of 10 m³ is 20 m³.

It is additionally contemplated that a member according to the present 30 invention can include one or more fasteners such as adhesive, mechanical fasteners magnets or the like for assisting in assembly the member to a structure of an article of manufacture (e.g., an automotive vehicle). Such fasteners may be integrally formed (e.g., molded) of the same material as the

carrier, the activatable material or both. Alternatively, the one or more fasteners may be formed and separately attached to the member. As one example, a portion of the activatable material may be injection molded to extend outwardly from the member such that the portion may be interference fit into an opening of a structure of an article of manufacture. Alternatively, a portion of the carrier may extend outwardly from the member and be attachable in the same manner. As still another alternative, a separate fastener such as two-side tape, a magnet or a push-pin or other mechanical fastener may be attached to the member and then the fastener can be attached (e.g., adhered, magnetized or interference fit) to a structure of an article.

Application

A member according to the present invention may be applied to a variety of locations upon various structures a variety of articles of manufacture. Generally, a member in accordance with the present invention is quite suitable for application to a structure defining an internal cavity. In such a circumstance, the member can be placed within the cavity and the activatable material of the member can be activated, upon exposure to a condition such as heat (e.g., in an e-coat, primer or paint bake oven), to expand and/or adhere to walls of the structure defining the cavity for providing baffling, sealing or reinforcement to the structure.

The member of the present invention has been found particularly suitable for application to structures of automotive vehicles. As can be seen in Fig. 6, there is illustrated a structure 44 (e.g., a pillar) of an automotive vehicle wherein the structure 44 includes walls 46 defining an internal cavity 48. For exemplary purposes, the shape of the member 30 of Fig. 5 is such that it contours correspond to the shape of the cavity 48 of the structure 44 of Fig. 6. Thus, the member 30 can be placed in the cavity 48 with a relatively small clearance (e.g., less than 2.5 cm, more typically less than 1.0 cm and even more typically less than 0.4 cm and still more typically less than 0.2 cm) between the outer periphery of the member and that walls 46 defining the

cavity 48. Of course, the member may also be substantially smaller than the cavity.

After placement of the member 30 in the cavity 48, the activatable material is activated to expand (e.g., foam), cure (thermoset) and adhere to the walls 46 of the structure 44. If the member 30 is designed to provide baffling, sealing and/or noise reduction to the structure 44, the activatable material will typically expand to a volume that is at least 500%, although possibly less, more typically at least 800% and even more typically at least 1400% its original unexpanded volume such that the member and particularly the activated material (e.g., foam) substantially entirely span a cross-section of the cavity 48. If the member is designed for reinforcement, the activatable material will typically expand to a volume at least 5%, although possibly not at all, but typically less than 600%, more typically less than 400% and even more typically less than 250% its original unexpanded volume. Of course, the member could provide a combination of baffling, sealing and reinforcement to the structure such that it does any combination of the aforementioned. Moreover, the member could include two or more different activatable materials to assist in providing a combination of the aforementioned functional attributes.

20

Alternative Embodiments

Figs. 7 and 8 illustrate a different embodiment of a member 50 according to the present invention. It will be understood that the features of the member 50 of Figs. 7 and 8 can be employed in addition to or as alternatives to the previously described embodiments and the features of the previous embodiment can be employed with the member 50 of Figs. 7 and 8. The member 50 of Figs. 7 and 8 includes a malleable carrier 52, activatable material 54 disposed about and substantially surrounding the carrier 52 and, optionally, one or more fasteners 58.

30

The malleable carrier 52 can be provided as an elongated strip having a plurality of widened portions 60 with a plurality (e.g., 2, 3 or more) of openings 62 (e.g., through-holes) extending into and or through the carrier 52.

The carrier 52 can be formed of any of the materials discussed herein as suitable malleable carriers.

The fasteners 58 are illustrated as mechanical fasteners and more particularly push-pins. The fasteners 58 can be attached to (e.g., adhered to, 5 interferingly fit with) the carrier 52, the activatable material or both. In the embodiment shown, the fasteners 58 are interferingly fit to the carrier 52 by extending an elongated portion 64 of each of the fasteners 58 respectively through the openings 62 of the carrier.

The activatable material 54 can be any of the activatable materials 10 discussed herein and can be injection molded, extruded or otherwise shaped about and/or applied to the carrier 52. Preferably, although not required, the activatable material is shaped about the carrier 52 and at least a portion of the one or more fasteners 58 as in the illustrated embodiment.

The member 50 may be applied to a structure of an article of manufacture according to a variety of techniques. As one example, the fasteners 58 of the member 50 may be interference fit into openings (e.g., through holes) of a structure of an automotive vehicle (e.g., a pillar such as that illustrated in Fig. 6) such that the activatable material is located in a cavity of the structure. As an alternative, the fasteners 58 may be interference fit 20 into openings of a secondary carrier and the secondary carrier along with the member 50 may be placed in a cavity of a structure.

Advantageously, the malleable carrier 52 allows the member to be shaped (e.g., bent or curved) during application to accommodate contours of a structure or a secondary carrier thereby allowing the member to be more 25 easily attached thereto. As shown in Fig. 8A, the member 50 is applied to a contoured or curved substrate 66 (e.g., a structure or secondary carrier) and the member 50 is curved or contoured to accommodate the curved or contoured surface of the substrate 66. Preferably, after location within a cavity, the activatable material can be activated as previously described to 30 provide reinforcement, baffling or sealing to the structure.

Figs. 9 and 10 illustrate a different embodiment of a member 80 according to the present invention. It will be understood that the features of

the member 80 of Figs. 9 and 10 can be employed in addition to or as alternatives to the previously described embodiments and the features of the previous embodiment can be employed with the member 80 of Figs. 9 and 10. The member 80 of includes a malleable carrier 82, activatable material 5 84 disposed upon and or about the carrier 82 and, optionally, one or more fasteners 88, 90.

The malleable carrier 82 can be provided as a frame (shown as rectangular) formed of an elongated strip. The carrier 82 can be formed of any of the materials discussed herein as suitable malleable carriers.

10 The fasteners 88, 90 are illustrated as mechanical fasteners and more particularly as tabs, which are preferably bendable and are integrally formed of the same material as the carrier 82. As shown, a first fastener 88 extends from one side of the carrier 82 and a second fastener 90 extends from an opposite side of the carrier 82. The first fastener 88 is generally hook-shaped.

15 The activatable material 84 can be any of the activatable materials discussed herein and can be manually, automatically or otherwise applied to the carrier 82. If the activatable material 84 is tacky, it may be desirable to cover one or more surface of the material with release paper that can be removed from the material just prior to application of the member 80 to a structure. In the illustrated embodiment, the activatable material 84 has a shape (e.g., rectangular) corresponding generally to the shape of the carrier 82 and the material 84 is adhered to at least one surface 94 of the carrier 82.

20 The member 80 may be applied to a structure of an article of manufacture according to a variety of techniques. In Figs 11, the member is applied to a pillar structure 98 of a vehicle. As shown, the pillar structure 98 includes a first member 100 shown as a body side inner, a second member 102 shown as a body side reinforcement and a third member 104 shown as a body side outer. The member 80 is attached to the second member 102 of 25 the structure 98 by extending the first fastener 88 through an opening in the member 102 and hooking the first fastener 84 onto an edge of the second member 102. Thereafter, the second fastener 90 is bent around and hooked onto an edge at a distal end of the second member 102 by bending the 30

second fastener 90 about the edge for at least temporarily fastening the member 80 to the structure 98 and particularly the second member 102.

Preferably, after location within a cavity, the activatable material can be activated as previously described to provide reinforcement, baffling or sealing to the structure. In the particular embodiment illustrated, the member 80 is activated within a cavity 110 defined between the first member 100 and the third member 104 and the activatable material can be activated to, not only provide reinforcement (e.g., against buckling) to the structure 98, but also to provide a relatively strong reinforced connection between two reinforcements such as the second member 102 and a lower reinforcement 112 for the structure 98.

Unless stated otherwise, dimensions and geometries of the various structures depicted herein are not intended to be restrictive of the invention, and other dimensions or geometries are possible. Plural structural components can be provided by a single integrated structure. Alternatively, a single integrated structure might be divided into separate plural components. In addition, while a feature of the present invention may have been described in the context of only one of the illustrated embodiments, such feature may be combined with one or more other features of other embodiments, for any given application. It will also be appreciated from the above that the fabrication of the unique structures herein and the operation thereof also constitute methods in accordance with the present invention.

The preferred embodiment of the present invention has been disclosed. A person of ordinary skill in the art would realize however, that certain modifications would come within the teachings of this invention. Therefore, the following claims should be studied to determine the true scope and content of the invention.

CLAIMS

WHAT IS CLAIMED IS:

1. A process of forming and/or applying a member for sealing, 5 baffling or reinforcing a structure of an article of manufacture, the process comprising:
 - providing a malleable carrier;
 - associating an activatable material with the malleable carrier thereby forming the member wherein the volume of activatable material is at least 10 500% of the volume of the malleable carrier;
 - shaping the malleable carrier, the activatable material or both wherein the shaping step includes at least one of the following:
 - i. shaping the malleable carrier to a predetermined configuration and molding the activatable material onto the malleable carrier;
 - ii. molding the activatable material upon the malleable carrier for forming the member and applying the member to a structure of an article in a manner that includes shaping the malleable carrier and the activatable material; or
 - iii. disposing the activatable material upon the carrier and bending at least a portion of the carrier to attach the carrier and the activatable material to a structure.
- 25 2. A process as in claim 1 wherein the malleable carrier has a yield stress less than about 700 MPa and greater than about 100 MPa.
- 30 3. A process as in claim 1 or 2 wherein the activatable material is generally dry and substantially non-tacky.
4. A process as in claim 1, 2 or 3 wherein the malleable carrier is formed of metal.

5. A process as in claim 1, 2, 3 or 4 wherein the malleable carrier is formed of one or more strips.

6. A process as in claim 1, 2, 3, 4 or 5 wherein associating the 5 activatable material with the malleable carrier includes substantially surrounding the malleable carrier with the activatable material.

7. A process as in any of claims 1-6 wherein the malleable carrier is formed of a plurality of strips intertwined with each other.

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8. A process as in any of claims 1-7 wherein the malleable carrier is formed of a wire mesh.

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9. A process as in any of claims 1-6 wherein the malleable carrier is formed of a single strip.

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10. A process as in any of claims 1-5 wherein:

- i. the malleable carrier has a frame portion and a first tab and a second tab, the first tab in a hook shape;
- ii. shaping of the malleable carrier includes hooking the first tab about a first edge of a structure and bending the second tab about a second edge of the structure.

25

11. A process as in any of claims 1-6 attaching the member to a structure or secondary carrier wherein attaching of the member includes shaping of the member including the malleable carrier and the activatable material to accommodate one or more contours of the structure or secondary carrier.

30

12. A process as in claim 11 wherein shaping includes bending or curving of the member.

13. A process as in claim 11 or 12 wherein the malleable carrier is in the form of a singular elongated strip having a plurality of through-holes.

14. A process as in claim 11, 12 or 13 wherein the malleable carrier 5 includes a plurality of widened portion with one of the plurality of through-holes through each of the widened portions.

15. A process as in claim 13 or 14 further comprising:
extending a plurality of fasteners through the plurality of through-holes
10 wherein the attaching of the member includes attaching the fasteners to the structure or secondary carrier.

16. A process as in claim 15 wherein the activatable material is molded about at least a portion of the plurality of fasteners.

15

17. A method as in any of claims 1-16 wherein the activatable material is a heat activated thermosetting material that foams, expands and cure upon exposure to temperature in an e-coat or bake oven.

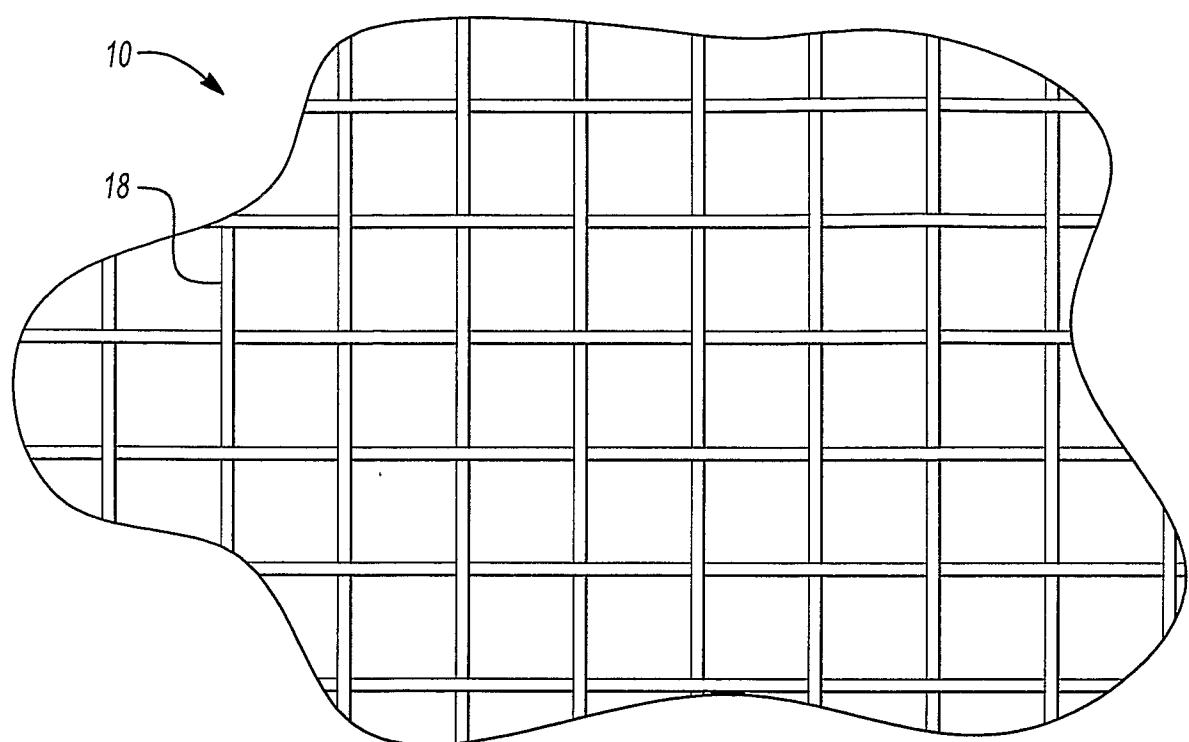


Fig-1

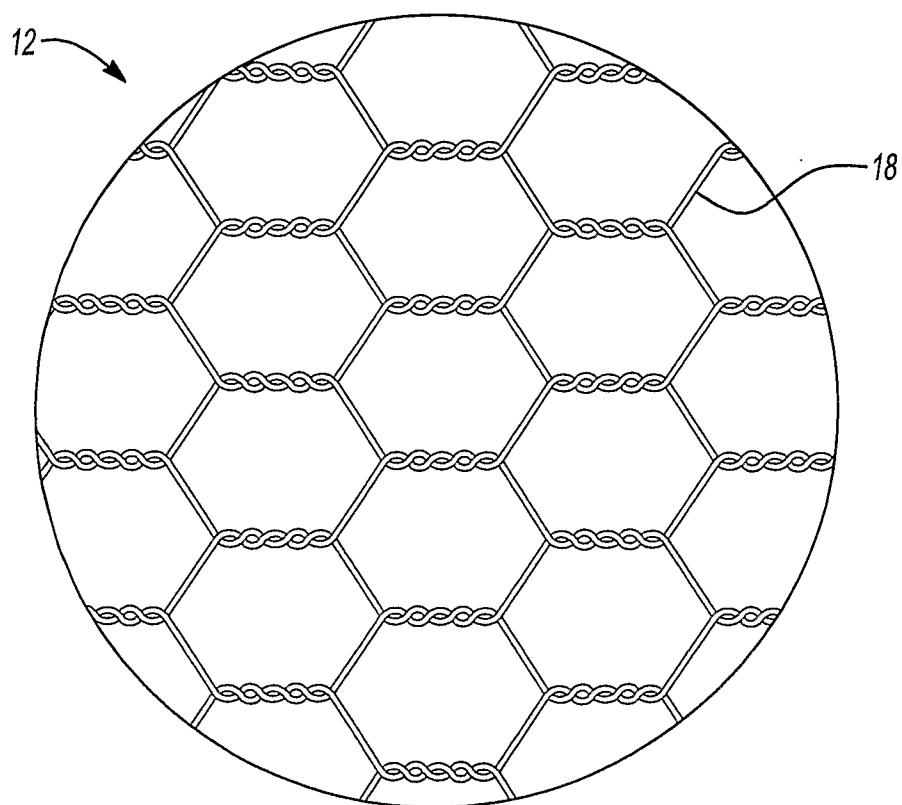


Fig-2

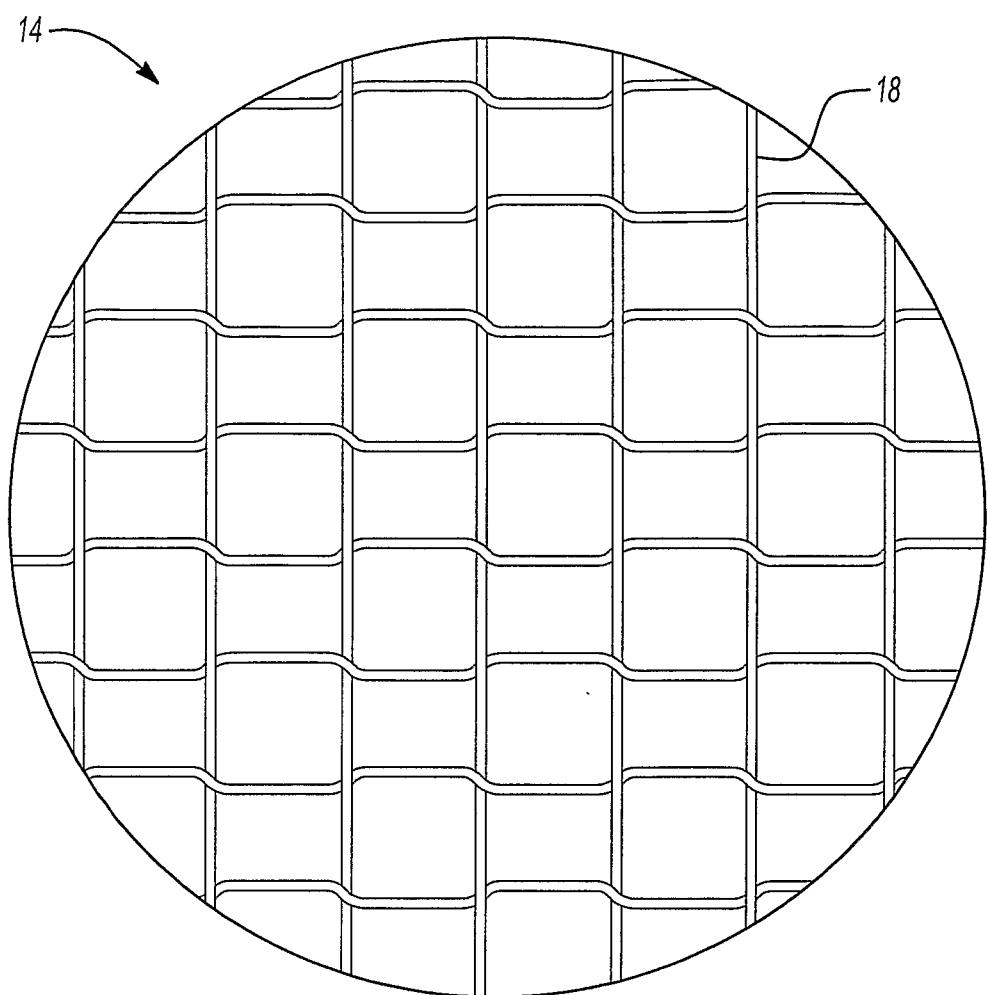


Fig-3

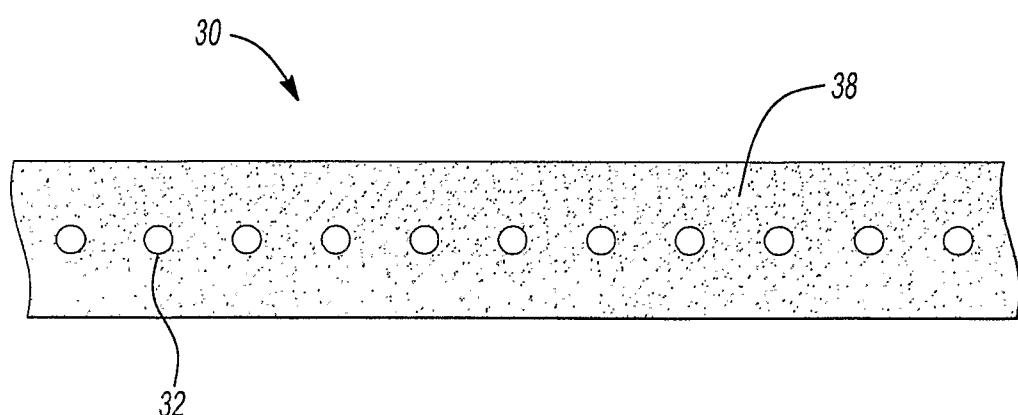


Fig-4

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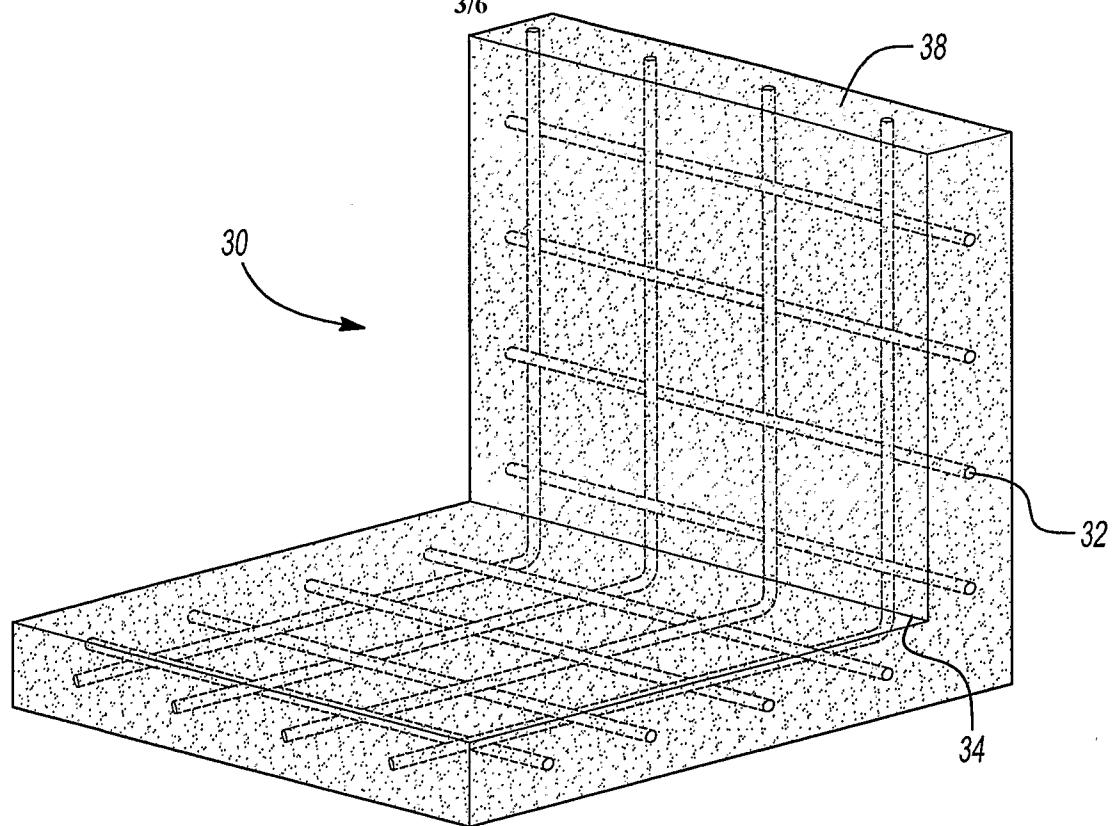


Fig-5

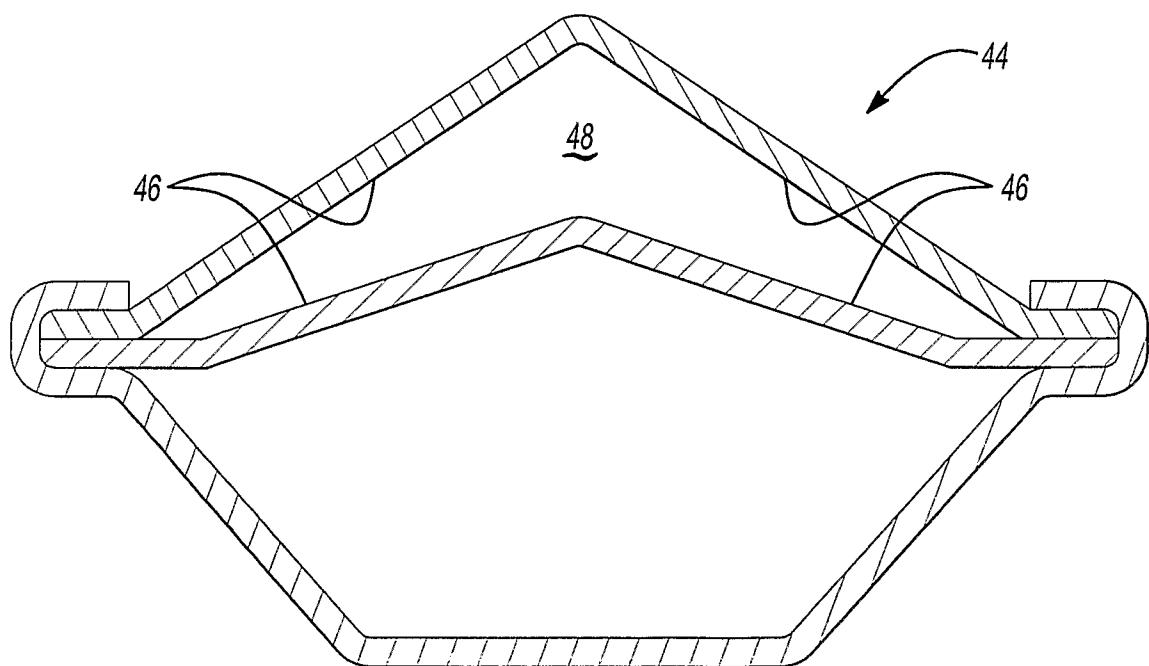


Fig-6

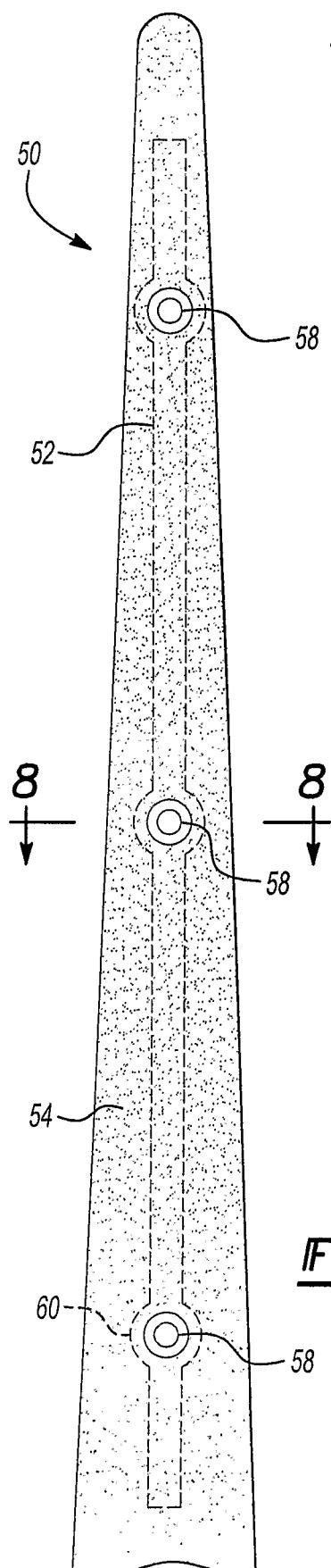


Fig-7

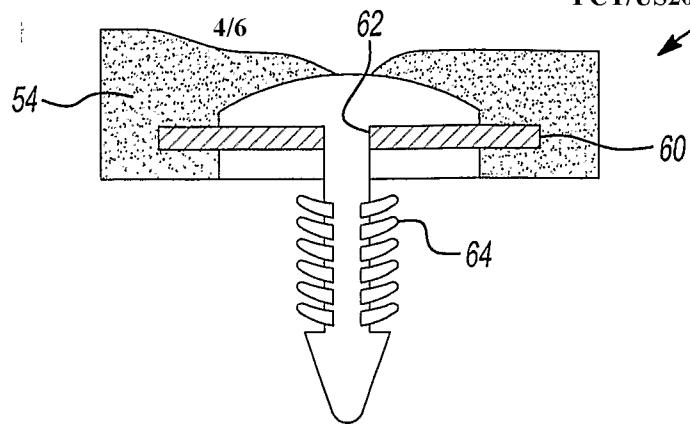


Fig-8

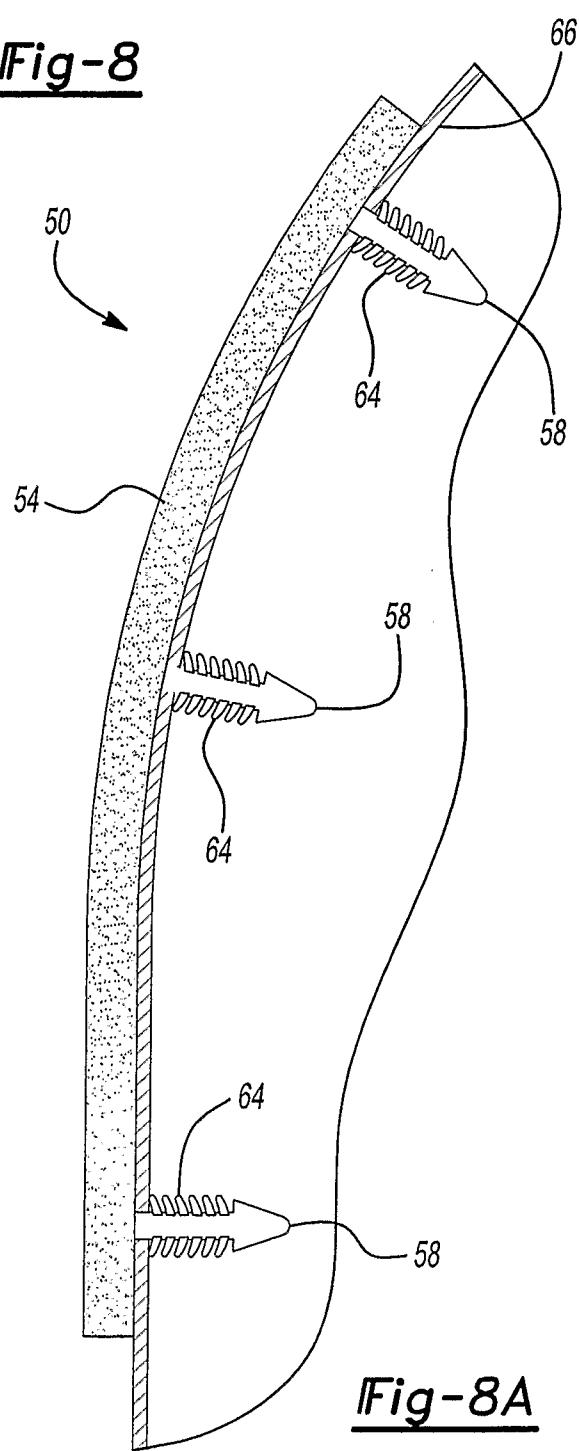


Fig-8A

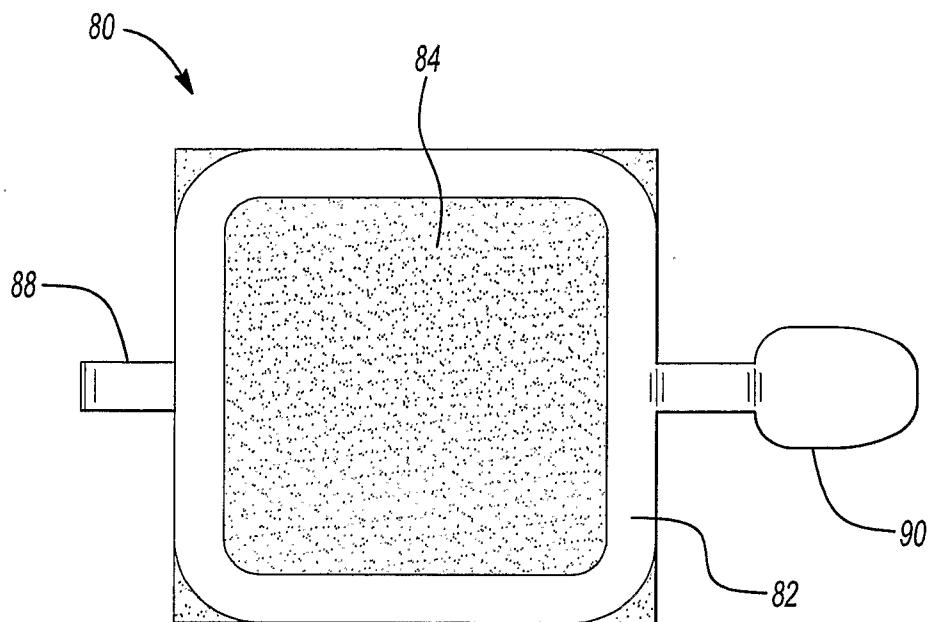


Fig-9

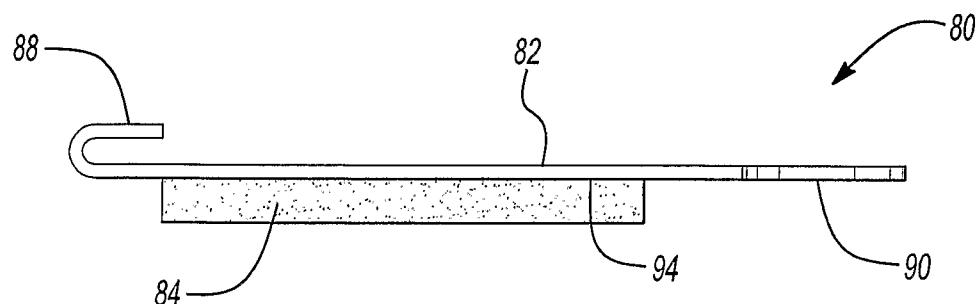


Fig-10

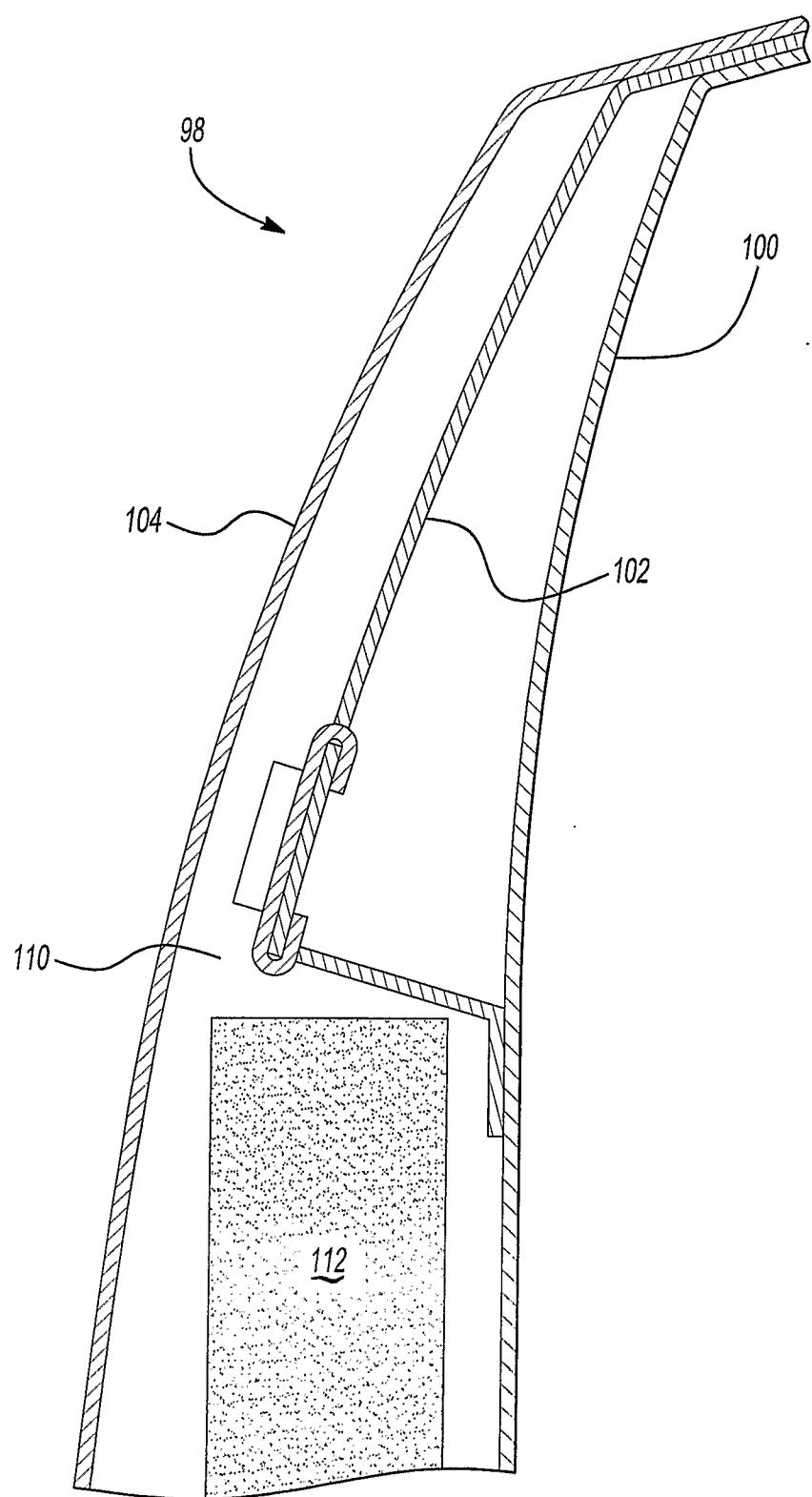


Fig-11

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/030480

A. CLASSIFICATION OF SUBJECT MATTER
INV. B29C44/12 B29C70/68
ADD. B29L31/30

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)
B62D B29C

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

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

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2005/002950 A2 (L & L PRODUCTS INC [US]; KASSA ABRAHAM [US]; HARTHCOCK MATTHEW [US]; A) 13 January 2005 (2005-01-13) claims 1,3,7,12	1,2,4-6, 9,11-17
Y	figures 1-3,9 page 3, line 6 - line 8 page 4, line 15 - page 5, line 7 page 6, line 1 - line 4 page 9, line 29 page 11, line 1 - line 10 page 12, line 10 - line 14 -----	3,5,7,8, 10
X	EP 0 893 332 A1 (HENKEL CORP [US]) 27 January 1999 (1999-01-27) claims 1,4,12,14,16	1,2,4,6, 11,12
Y	page 5, line 36 - line 38 -----	3
		-/-

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
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"&" document member of the same patent family

Date of the actual completion of the international search 7 December 2006	Date of mailing of the international search report 13/12/2006
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Jouannon, Fabien

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/030480

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/183317 A1 (CZAPLICKI MICHAEL J [US] ET AL) 2 October 2003 (2003-10-02)	1,2,4-6, 9,11,12, 17
Y	claim 1 figure 4 paragraphs [0015], [0016], [0018], [0027], [0029] -----	3,5,7,8, 10,13-16
P,X	WO 2005/077634 A2 (L & L PRODUCTS INC [US]; CARLSON DAVID [US]; KOSAL DAVID J [US]; LARSE) 25 August 2005 (2005-08-25)	1,2,4-6, 9,11,12, 17
P,Y	claims 1,4,8,10 figures 8,9 page 4, line 3 - line 16 page 9, line 14 - line 24 page 10, line 5 - line 11 page 18, line 23 - page 20, line 17 -----	3,5,7,8, 10,13-16
T	KIM J H ET AL: "Effects of Si and C additions on the thermal stability of directionally solidified TiAl-Nb alloys" INTERMETALLICS, ELSEVIER SCIENCE PUBLISHERS B.V, GB, vol. 13, no. 10, 2005, pages 1038-1047, XP004962792 ISSN: 0966-9795 figure 6 -----	2
A	HU D ET AL: "Phase transformations in some TiAl-based alloys" July 2002 (2002-07), INTERMETALLICS, ELSEVIER SCIENCE PUBLISHERS B.V, GB, PAGE(S) 701-715 , XP004369747 ISSN: 0966-9795 page 709 -----	2
Y	US 6 199 940 B1 (HOPTON GREGORY W [US] ET AL) 13 March 2001 (2001-03-13) column 1, line 55 - column 2, line 3 column 3, line 4 - line 28 column 4, line 65 - column 5, line 11 -----	3,10, 13-16
Y	US 5 506 025 A (OTTO DAVID J [US] ET AL) 9 April 1996 (1996-04-09) claim 1 column 4, line 34 - line 35 column 5, line 1 - line 4 -----	3,5,7,8
Y	EP 1 122 152 A2 (SIKA CORP [US]) 8 August 2001 (2001-08-08) paragraphs [0001], [0004], [0005], [0010], [0015], [0029] -----	3,10, 13-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/030480

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
WO 2005002950	A2	13-01-2005	CA EP	2530186 A1 1644238 A2		13-01-2005 12-04-2006
EP 0893332	A1	27-01-1999	AT AU BR CA DE DE DE ES FR GB IT JP NL NL PL TR US	214674 T 743431 B2 9802437 A 2242283 A1 29812841 U1 69804274 D1 69804274 T2 2174394 T3 2762894 A1 2327388 A T0980631 A1 11165355 A 1009643 C2 1009643 A1 327390 A1 9801351 A2 6233826 B1		15-04-2002 24-01-2002 14-03-2000 21-01-1999 08-10-1998 25-04-2002 24-10-2002 01-11-2002 06-11-1998 27-01-1999 20-01-2000 22-06-1999 13-04-1999 25-01-1999 01-02-1999 21-10-1999 22-05-2001
US 2003183317	A1	02-10-2003		NONE		
WO 2005077634	A2	25-08-2005	US	2005172486 A1		11-08-2005
US 6199940	B1	13-03-2001	AU CA EP JP MX WO	3452901 A 2382131 A1 1122153 A2 2003535237 T PA02007341 A 0154935 A1		07-08-2001 02-08-2001 08-08-2001 25-11-2003 28-01-2003 02-08-2001
US 5506025	A	09-04-1996		NONE		
EP 1122152	A2	08-08-2001	AU CA MX WO US	3453101 A 2398806 A1 PA02007373 A 0155523 A1 6305136 B1		07-08-2001 02-08-2001 12-02-2003 02-08-2001 23-10-2001