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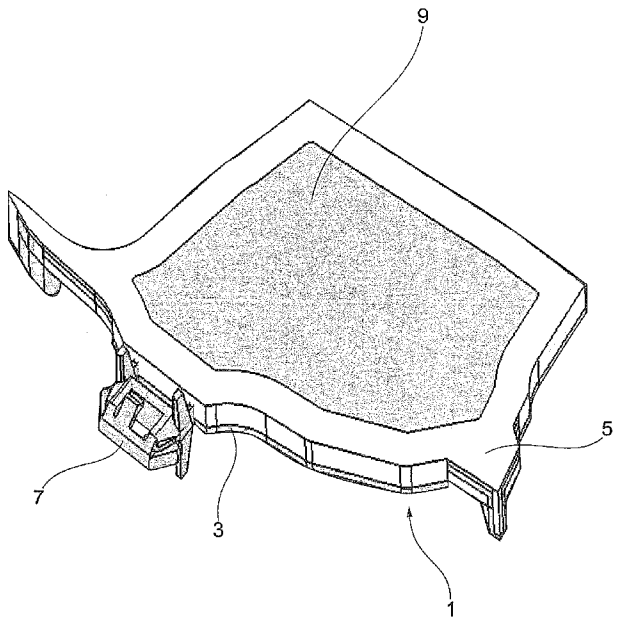

(57) Abstract: A fastenable member for use in a cavity of a structural member is disclosed. According to one embodiment of the invention, the fastenable member includes a carrier, an expandable material operably coupled with and supported by at least a portion of the carrier, an attachment member for securing the fastenable member to the structural member, and a connection member operably coupled with the carrier and the attachment member. The connection member is configured to allow the carrier to move at least horizontally and vertically with respect to the attachment member. The fastenable member is useful for sealing, baffling and/or structurally reinforcing hollow portions of vehicles and the like.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

FASTENABLE MEMBER

FIELD OF THE INVENTION

The present invention relates to a fastenable member that can be used for sealing, baffling, and/or structural reinforcement purposes in a vehicle body. More particularly, the present invention relates to a fastenable member that includes an expandable material and a relatively rigid carrier and that is mounted in a cavity of a vehicle body utilizing an attachment member. Upon activation, the expandable material foams to form a seal around the interior cavity wall.

BACKGROUND OF THE INVENTION

As shown in Fig. 5, a vehicle body typically includes a plurality of hollow structural members (such as pillars A, B, and C in Fig. 5) that form the passenger compartment, engine compartment, trunk, doorways, windows, and wheel wells thereof. Each hollow structural member typically includes one or more interconnected cavities, and these cavities can transmit undesirable noises and vibrations to the passenger compartment of the vehicle that are caused by the power train and road upon which the vehicle travels. One conventional way of reducing these undesirable noises and vibrations is to block the cavities of the vehicle with one or more fastenable members 90. Such fastenable members may also assist in reinforcing or stiffening the hollow structural member of the vehicle.

A typical fastenable member 90 employed for this purpose includes a carrier, an attachment member integrally formed with the carrier, and a thermally expandable expandable material formed on the carrier. The fastenable member 90 is typically configured so as to be similar in shape to, but somewhat smaller than, the vertical cross-section of the cavity in which it is to be placed. The attachment member 90 is typically configured so as to be inserted into an opening formed in one of the walls that define the cavity in order to fix the

fastenable member 90 to the wall. The fastenable member is typically positioned so that the plane of the carrier is substantially perpendicular to the longitudinal direction of the cavity. The expandable material will undergo heat-induced expansion when the vehicle body is conveyed through a baking oven that forms a part of the primer or paint curing step of the automobile manufacturing process. This heat-induced expansion of the expandable material will fill any peripheral space between the expandable material and the walls of the cavity, and thereby prevent undesirable noises and vibrations produced by the vehicle from being transmitted to the passenger compartment thereof.

Attachment members are available in a variety of configurations, and are typically designed so as to be quickly and easily inserted into an opening of a wall. One conventional type of attachment member is shown in Fig. 6. As shown in Fig. 6, an attachment member 100 is integrally formed on the periphery of a carrier 101, and includes an insertion member 102, two elastically deformable fingers 103 that project from the insertion member 102 (only one is shown in Fig. 6) and which each include an engagement portion 103a which laterally projects from the end thereof, and two retaining members 104 that are arranged on both sides of the insertion member 102. When the fastenable member is to be attached to a wall, the insertion member 102 will be inserted into an opening of the wall that is sized to substantially match the same. As the insertion member 102 is being inserted into the opening, the fingers 103 will be elastically deformed toward the insertion member 102 by the wall portions that form the opening. Then, the fingers 103 will spring back to their original configurations when the two retaining members 104 abut the wall, and thereby elastically engage with the wall via the engagement portions 103a. In this position, the two retaining members 104 will be in contact with one surface of the wall, and the two engagement portions 103a will be in contact with the opposite surface of the wall and/or the periphery of the opening, to thereby attach the attachment member 100 to the wall.

However, a major drawback to this type of conventional attachment member is that it may become dislodged from the opening in the wall by application of an external shock to the structural member to which it is attached. This type of external shock may occur, for example, when a structural member in which the fastenable member has been pre-installed is jostled or bumped during transport, or during the assembly of the structural members into a vehicle at a manufacturing facility. If a fastenable member becomes dislodged from an opening, or the attachment thereof with respect to the cavity becomes loosened, the heat-induced expansion of the fastenable member will occur in the wrong location of the cavity, and/or will not seal the cavity as intended. Either of these outcomes may allow undesirable noises and vibrations produced by the vehicle to be transmitted to the passenger compartment thereof and/or reduce the stiffening effect of the activated fastenable member, and thus have an adverse impact on the quality of the vehicle. In addition, it is usually difficult for workers to notice that a fastenable member has become dislodged or loosened because the cavity in which it is placed is typically hidden from view. Moreover, even if a worker notices that a fastenable member has become dislodged or loosened, it may be difficult or impossible for that worker to correct the problem because it is usually difficult or impossible to access a fastenable member after the structural member to which it is attached has been assembled.

The problem of conventional fastenable members becoming dislodged or loosened appears to be caused by a design flaw in the conventional fastenable member itself: a rigid and substantially inflexible connection between the attachment member and the carrier of the fastenable member. More particularly, when an external shock is applied to a conventional fastenable member via a structural member, force from that shock will be transmitted through the carrier directly to the attachment member because of the rigid and substantially inflexible connection therebetween. In addition, because there are typically only two elastically deformable fingers that act to secure the attachment member to the wall surface, the force that

is transmitted to the attachment member will often be sufficient to dislodge or loosen the attachment member from the wall, and cause the problems described above.

In view of the above, there exists a need for a fastenable member which overcomes the above mentioned problems in the prior art. This invention addresses this need in the prior art as well as other needs, which will become apparent to those skilled in the art from this disclosure.

SUMMARY OF THE INVENTION

A fastenable member for use in a cavity of a structural member is disclosed. According to one embodiment of the invention, the fastenable member includes a carrier, an expandable material operably coupled with and supported by at least a portion of the carrier, an attachment member for securing the fastenable member to the structural member, and a connection member operably coupled with the carrier and the attachment member. The connection member is configured to allow the carrier to move at least horizontally and vertically with respect to the attachment member.

These and other objects, features, aspects and advantages of the present invention will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the attached drawings which form a part of this original disclosure:

Fig. 1 is a perspective view of a fastenable member according to an embodiment of the present invention;

Fig. 2 is a fragmentary perspective view of a carrier, expandable material, and attachment member of a fastenable member according to an embodiment of the present invention;

Fig. 3 is a fragmentary perspective view of the fastenable member of Fig. 2, with the expandable material removed;

Fig. 4A is a fragmentary upper elevational view of the fastenable member shown in Fig. 2;

Fig. 4B is a fragmentary front elevational view of the fastenable member shown in Fig. 2;

Fig. 4C is a fragmentary cross-sectional view of the fastenable member shown in Fig. 2, taken along line A-A of Fig. 4A;

Fig. 4D is a fragmentary cross-sectional view of the fastenable member shown in Fig. 4C when attached to a structural member;

Fig. 5 is a perspective view of an automobile body having a plurality of conventional fastenable members disposed therein; and

FIG. 6 is a partial perspective view of a carrier and attachment member of a conventional fastenable member.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS OF THE INVENTION

A preferred embodiment of the present invention will now be explained with reference to the drawings. It will be apparent to those skilled in the art from this disclosure that the following description of this embodiment of the present invention is provided for illustration only, and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

Referring initially to Fig. 1, a fastenable member 1 includes a carrier 3, an expandable material 5 formed on the carrier 3, and an attachment member 7 integrally molded with the carrier 3. The carrier 3 includes a substantially flat and relatively rigid support plate 9 that is not covered by the expandable material 5. In addition, a structure that substantially surrounds

the perimeter of the support plate 9 is integrally molded therewith, and is configured to receive the expandable material 5 prior to thermal expansion.

Note that the overall shape of the fastenable member 1 is not particularly limited, but is typically configured so as to be similar in shape to, but somewhat smaller than, the vertical cross-section of a cavity in which it is to be placed. Note also that the fastenable member 1 need not include a support plate 9. For example, the fastenable member 1 may have a substantially rectilinear, curvilinear, or other similar shape. Furthermore, the structure on the support plate 9 that receives the expandable material 5 is not particularly limited and may, for example, be in the form of an "L" shaped shelf or flange, a "V", "U", or "C" shaped groove, brackets, clips or the like. The expandable material may also be secured to the support plate by means of holes around the perimeter of the carrier, wherein the expandable material extends into or through such holes, or by means of a rim around the perimeter of the support plate and generally perpendicular to the plane of the support plate, wherein the expandable material surrounds such rim. It will generally be preferred to employ a supporting structure that helps to direct the expandable material as it is expanding towards the interior surface of the cavity that is being sealed or reinforced. The expandable material may be disposed as discrete and separate portions around the periphery of the carrier or may be in the form of a circumscribing and continuous band.

In order to more clearly explain the present invention, and particularly the structure of the attachment member 7, a carrier 3 having a somewhat different structure than that shown in Fig. 1 will be used. As shown in Figs. 2-4, a support wall 9a that is orthogonal to the support plate 9 (not shown in Figs. 2, 3, and 4B), and a support flange 11 that is orthogonal to the support wall 9a, are integrally formed with the support plate 9. The support wall 9a and the support flange 11 extend around at least a portion of the perimeter of the support plate 9, and the expandable material 5 is molded and conformed to the peripheral surface of the support

wall 9a and the upper surface of the support flange 11 as shown in Fig. 2. Figs. 2-4 also shows that two portions 11a of the support flange 11 that are orthogonal thereto extend on both sides of the attachment member 7, and as shown in Fig. 2, the expandable material 5 is molded and conformed to the inner surfaces of the portions 11a.

The carrier 3 is preferably comprised of a moldable material which is sufficiently resistant to cracking and breakage during normal usage, and has a melting or softening point that is higher than both the activation temperature of the expandable material 5 and the bake temperature that the structural members containing the fastenable member 1 will be exposed to. Preferably, the moldable material is sufficiently resilient (non-brittle) and strong at ambient temperatures to withstand cracking or breaking while also being sufficiently heat resistant at elevated temperatures (e.g., the temperatures employed to foam the expandable material) to hold the expandable material in the desired position within the cavity of the structural member without significant warping, sagging or distortion. The material that comprises the carrier 3 is not particularly limited, and for example, may be any number of polymeric compositions that possess these qualities (e.g., polyesters, aromatic polyether, polyether ketones, and especially polyamides such as nylon 66). Polymeric compositions that are suitable for use as the carrier 3 would be well known to those of ordinary skill in the art and include both thermoplastic and thermoset materials, and thus will not be described in detail herein. The moldable materials can, in addition to the polymeric compositions, also comprise various additives and fillers, such as colorants and/or reinforcing fibers (e.g. glass fibers), depending on the desired physical characteristics. Preferably, the moldable material has a melting or softening point (ASTM D789) of at least 200 degrees C, more preferably at least 225 degrees C, or most preferably at least 250 degrees C and/or has a heat deflection temperature at 18.6 kg (ASTM D648) of at least 180 degrees C, more preferably at least 200 degrees C, or most preferably at least 220 degrees C and/or a tensile strength (ASTM D638;

50% R.H.) of at least 1000 kg/cm^2, more preferably at least 1200 kg/cm^2, most preferably at least 1400 kg/cm^2 and/or a flexural modulus (ASTM D790; 50% R.H.) of at least 50,000 kg/cm^2, more preferably at least 60,000 kg/cm^2, most preferably at least 70,000 kg/cm^2. Alternatively, the carrier or portions of the carrier may be fabricated from a metal such as steel or aluminum.

The expandable material 5 is a material that will foam and expand upon heating but that is typically solid (dimensionally stable) at room temperature (e.g., 15-30 degrees C). In some embodiments, the expandable material will be dry and non-tacky, but in other embodiments will be tacky. Upon activation, i.e., upon being subjected to a temperature of between about 100°C and 200°C (depending on the exact formulation of expandable material 5 that is used), the expandable material 5 will typically expand to several times its unactivated state. When used in an automobile body, for example, the expandable material 5 typically has an activation temperature lower than the temperature at which primer or paint is baked on the vehicle body during manufacture. The expandable material 5 will expand at least radially during activation in order to seal against the internal surfaces of the structural member to which the fastenable member 1 is attached, and thus prevent undesirable noises and vibrations produced by the vehicle from being transmitted to the passenger compartment. Note that the expandable material 5 is shown in the drawings in its initial, unactivated state. The expandable material may be formulated such that it comes into contact with, but does not adhere or bond to, the interior walls of the cavity when activated and expanded. Alternatively, the expandable material components may be selected such that in its expanded state it does adhere or bond to the interior cavity wall surfaces.

The expandable material 5 of the present invention is not particularly limited, and may comprise one or more expandable materials that are known to one of ordinary skill in the art, such as one or more thermoplastic polymers that contain a foaming agent. Thermosettable

resins (i.e., resins that undergo crosslinking or curing upon being heated, such as epoxy resins) and well as mixtures of thermoplastic polymers and thermosettable resins may also be utilized in the expandable material. Typically, the foaming agent used will be a latent foaming agent, i.e., a substance that forms a gas when heated to an elevated temperature but which is inactive at normal storage temperatures. Chemical foaming agents and/or physical foaming agents may be utilized, for example. The expandable material 5 may also include one or more other additives selected based upon the desired physical characteristics thereof. For example, additives such as tackifying resins, fillers, curing agents, adhesion promoters, and/or corrosion inhibitors may be added. The expandable material may be assembled with the carrier by any of the known methods for manufacturing fastenable members, including co-injection molding, side-by-side injection molding, overmolding and insert molding. Suitable expandable materials include, for example, certain of the products sold under the brand names TEROCORE and TEROPHON by Henkel Corporation, Madison Heights, Michigan.

As shown in Figs. 3-4, the attachment member 7 includes a generally hollow and rectangular insertion member 13, four elastically deformable fingers 15 and 17, two retaining members 19, and two projections 21. Two fingers 15 project from the top and bottom of the insertion member 13 (only one finger 15 shown in Figs. 1-3 and 4C), and each includes an engagement portion 15a which laterally projects from the end thereof. Two fingers 17 project from both lateral sides of the insertion member 13, and each includes an engagement portion 17a which laterally projects from the end thereof. The two retaining members 19 are arranged on both lateral sides of the insertion member 13, and vertically extend above and below the insertion member 13. The two projections 21 project out from the lateral sides of the insertion member 13. The attachment member 7 is typically formed from the same material as that of the carrier 3, but may be formed from a different material. In one embodiment, the

attachment member and carrier are integrally formed, e.g., molded simultaneously and in a single piece using a suitable moldable composition.

More particularly, the two fingers 15 are arranged on the insertion member 13 to project diagonally upward and downward in their non-deformed state, and the two fingers 17 are arranged on the insertion member 13 to project diagonally outward from the lateral sides of the insertion member 13. Each projection 21 is configured and arranged on the insertion member 13 so as to extend over each respective finger 17 when each respective finger 17 is elastically deformed toward the insertion member 13. The two retaining members 19 may be generally triangular in shape, with the base end of each generally triangular retaining member 19 facing toward each respective finger 17, and the tip of each generally triangular retaining member 19 pointing toward the carrier 3. The space between the base end of each retaining member 19 and the tip of each engagement portion 15a and 17a is substantially equal to the thickness of the wall to which the attachment member 7 is to be attached. In addition, the length of each retaining member 19 is configured to be longer than the diameter of the opening in which the attachment member 7 is to be inserted.

Note that the attachment member 7 is not limited to the structure described above, and may be modified in a variety of different ways. For example, the size, shape, number, and/or arrangement of the insertion member 13, the fingers 15 and 17, the retaining members 19, and/or the projections 21 can be modified as needed.

A flexible connection member 22 connects the attachment member 7 to the carrier 3. The connection member 22 comprises two arm members 23 and a base member 25. In one embodiment, the base member 25 is integrally molded to the carrier 3, is substantially rectangular in shape, has a length that is substantially the same as the distance between the two retaining members 19, a width that is approximately half that of the support flange 11, and a thickness that is substantially the same as that of the support wall 9a and the support

flange 11. The thickness of each arm member preferably is selected such that the connection member 22 is able to flex in the horizontal direction without breaking when subjected to moderate pressure (e.g., the forces likely to be encountered while installing the fastenable member and while handling the structural member with the fastenable member installed). Such thickness will depend upon the characteristics of the moldable material from which the carrier and connection member are constructed, among other factors, but may be readily determined by those skilled in the art. The arm members 23 are each integrally molded to one end of the base member 25 and to each retaining member 19, and have a thickness that is substantially the same as that of the support wall 9a and the support flange 11. The height of each arm member 23 at the point of connection with each end of the base member 25 is approximately equal to the thickness of the base member 25, and the height of each arm member 23 at the point of connection with each retaining member 19 is approximately half the height of the insertion member 13. Thus, each arm member 23 preferably is tapered from the point at which it connects with each retaining member 19 to the point at which it connects with each end of the base member 25, thereby making each arm member 23 somewhat triangular in shape. The height of each arm member 23 at the point at which it attaches to the base member 25 or directly to the carrier 3 or support wall 9a preferably is selected so that the connection member may be flexed in a vertical direction relative to the carrier without breaking or cracking when subjected to at least moderate force or shock. For example, the thickness and height of the arm member at the point at which the arm member is attached to the base member, carrier or support wall may be approximately equal (e.g., the thickness:height ratio may be from about 2:1 to about 1:2). In addition, as shown in Fig. 2, the arm members 23 preferably extend through the expandable material 5. In another embodiment (not shown), the arm members are attached directly to the carrier 3 or support wall 9a (i.e., rather than to a base member as illustrated in Fig. 3). In still another

embodiment, each arm member is attached to a separate base member (i.e., there are two base members). More than two arm members may be utilized if so desired.

When the fastenable member 1 is to be attached to a wall of a structural member, the insertion member 13 will be inserted into an opening of the wall that is sized to substantially match the insertion member. The shape of the opening is not particularly critical and may, for example, be square, circular, rectangular, polygonal, oval, or irregular, provided it is capable of receiving the insertion member. As the insertion member 13 is being inserted into the opening, the fingers 15 and 17 will be elastically deformed toward the insertion member 13 by the peripheral edges of the opening, and then each finger 15 and 17 will snap back to their original positions after they have passed through the opening. In this position, the two retaining members 19 will be in contact with one surface of the wall (or the periphery of the opening), and the engagement portions of the fingers 15 and 17 will be in contact with the opposite surface of the wall, and thereby rigidly attach the attachment member 7 to the wall. The configuration of the attachment member 7 when attached to a wall of a structural member is shown in Fig. 4D.

In preferred embodiments of the invention, a portion of expandable material is positioned near the opening in the structural member wall so that upon activation of the expandable material the expandable material expands to completely block the opening. The expanded material may extend through the opening and at least partially encase the attachment member, thereby helping to provide a secure, permanent fixing of the fastenable member within the cavity.

When the fastenable member 1 is configured as described above, the attachment member 7 will be capable of movement relative to the carrier 3 prior to activation of the expandable material 5. More specifically, because the connection member 22 has sufficient flexibility in both the horizontal direction (i.e., parallel to the plane of the support flange 11 or

support plate 9) and in the vertical direction (i.e., perpendicular to the plane of the support flange 11 or support plate 9), the attachment member 7 can move with respect to the carrier 3. In addition, as shown in Fig. 2, because the arm members 23 extend through the expandable material 5, the arm members 23 are capable of providing a cushioning effect against external shocks. Thus, when an external shock is applied to a structural member to which the fastenable member 1 is attached (prior to activation of the expandable material 5), the carrier 3 will move in the horizontal and/or vertical direction with respect to the attachment member 7, absorb some or all of the force of that shock, and thus the full force of that shock will not be transmitted to the attachment member 7. Because the fastenable member 1 of the present invention is capable of absorbing shock, the attachment of the fastenable member 1 to the structural member will become more secure, and the likelihood that the fastenable member 1 will become dislodged from the structural member during transport or the manufacturing process will be substantially reduced.

Note that the configuration and structure of the connection member 22 of the fastenable member 1 is not particularly limited, so long as the attachment member 1 is capable of at least horizontal and vertical movement with respect to the carrier 3.

Note also that the fastenable member 1 can be used in products having hollow structural members other than vehicles, including, without limitation, aircraft, domestic appliances, furniture, buildings, walls and partitions, and marine applications (boats).

Any terms of degree used herein, such as "substantially", "about" and "approximately", mean a reasonable amount of deviation of the modified term such that the end result is not significantly changed. These terms should be construed as including a deviation of at least ± 5% of the modified term if this deviation would not negate the meaning of the word it modifies.

While only selected embodiments have been chosen to illustrate the present invention, it will be apparent to those skilled in the art from this disclosure that various changes and modifications can be made herein without departing from the scope of the invention as defined in the appended claims. Furthermore, the foregoing description of the embodiments according to the present invention are provided for illustration only, and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A fastenable member for use in a cavity of a structural member, the fastenable member comprising:

a carrier;

an expandable material operably coupled with and supported by at least a portion of the carrier;

an attachment member for securing the fastenable member to the structural member; and

a connection member operably coupled with the carrier and the attachment member, and configured to allow the carrier to move with respect to the attachment member.

2. The fastenable member of claim 1, wherein the connection member is configured to allow the carrier to move at least horizontally and vertically with respect to the attachment member.

3. The fastenable member of claim 1, wherein the connection member comprises a base member integrally formed with the carrier, and two arm members integrally formed with the base member and the attachment member.

4. The fastenable member of claim 3, wherein said arm members extend through said expandable material.

5. The fastenable member of claim 3, wherein each arm member is tapered from the point at which said arm member connects with said attachment member to the point at which said arm member connects with said base member.

6. The fastenable member of claim 1, wherein the attachment member comprises a plurality of elastically deformable members that engage with the structural member when the fastenable member is secured thereto.

7. The fastenable member of claim 6, wherein the attachment member comprises four elastically deformable members.

8. The fastenable member of claim 7, wherein two elastically deformable members extend in a first direction and two elastically deformable members extend in a second direction that is substantially perpendicular to the first direction.

9. The fastenable member of claim 1, wherein the expandable material is comprised of at least one thermoplastic polymer and at least one latent foaming agent.

10. The fastenable member of claim 1, wherein the expandable material is disposed about a perimeter of the carrier.

11. A noise attenuated and/or reinforced structural member, comprising:

a structural member defining a cavity; and

a fastenable member positioned in the cavity, the fastenable member comprising:

a carrier;

an expanded material obtained by activation of an expandable material operably coupled with and supported by at least a portion of the carrier, said expanded material being sealed to said structural member;

an attachment member which secured the fastenable member to the structural member prior to activation of the expandable material; and

a connection member operably coupled with the carrier and the attachment member, and configured to allow the carrier to move with respect to the attachment member prior to activation of the expandable material.

12. The noise attenuated and/or reinforced structural member of claim 11, wherein the connection member is configured to allow the carrier to move at least horizontally and vertically with respect to the attachment member prior to activation of the expandable material.

13. The noise attenuated and/or reinforced structural member of claim 11, wherein the connection member comprises a base member integrally formed with the carrier, and two arm members integrally formed with the base member and the attachment member.

14. The noise attenuated and/or reinforced structural member of claim 13, wherein said arm members extend through said expanded material.

15. The noise attenuated and/or reinforced structural member of claim 13, wherein each arm member is tapered from the point at which said arm member connects with said attachment member to the point at which said arm member connects with said base member.

16. The noise attenuated and/or reinforced structural member of claim 11, wherein the attachment member comprises a plurality of elastically deformable members that engage with the structural member when the fastenable member is secured thereto.

17. The noise attenuated and/or reinforced structural member of claim 16, wherein the attachment member comprises four elastically deformable members.

18. The noise attenuated and/or reinforced structural member of claim 17, wherein two elastically deformable members extend in a first direction, and two elastically deformable members extend in a second direction that is substantially perpendicular to the first direction.

19. The noise attenuated and/or reinforced structural member of claim 11, wherein the expandable material is comprised of at least one thermoplastic polymer and at least one latent foaming agent.

20. The noise attenuated and/or reinforced structural member of claim 11, wherein the expanded material is disposed about a perimeter of the carrier and fills at least a portion of the space between said perimeter and the structural member.

21. A method of sealing, baffling and/or structurally reinforcing a structural member having a cavity, said method comprising securing the fastenable member of claim 1 to said structural member within said cavity and expanding said expandable material.

22. The method of claim 21, wherein said expandable material is comprised of at least one latent foaming agent and said expandable material is heated to a temperature effective to activate said at least one latent foaming agent.

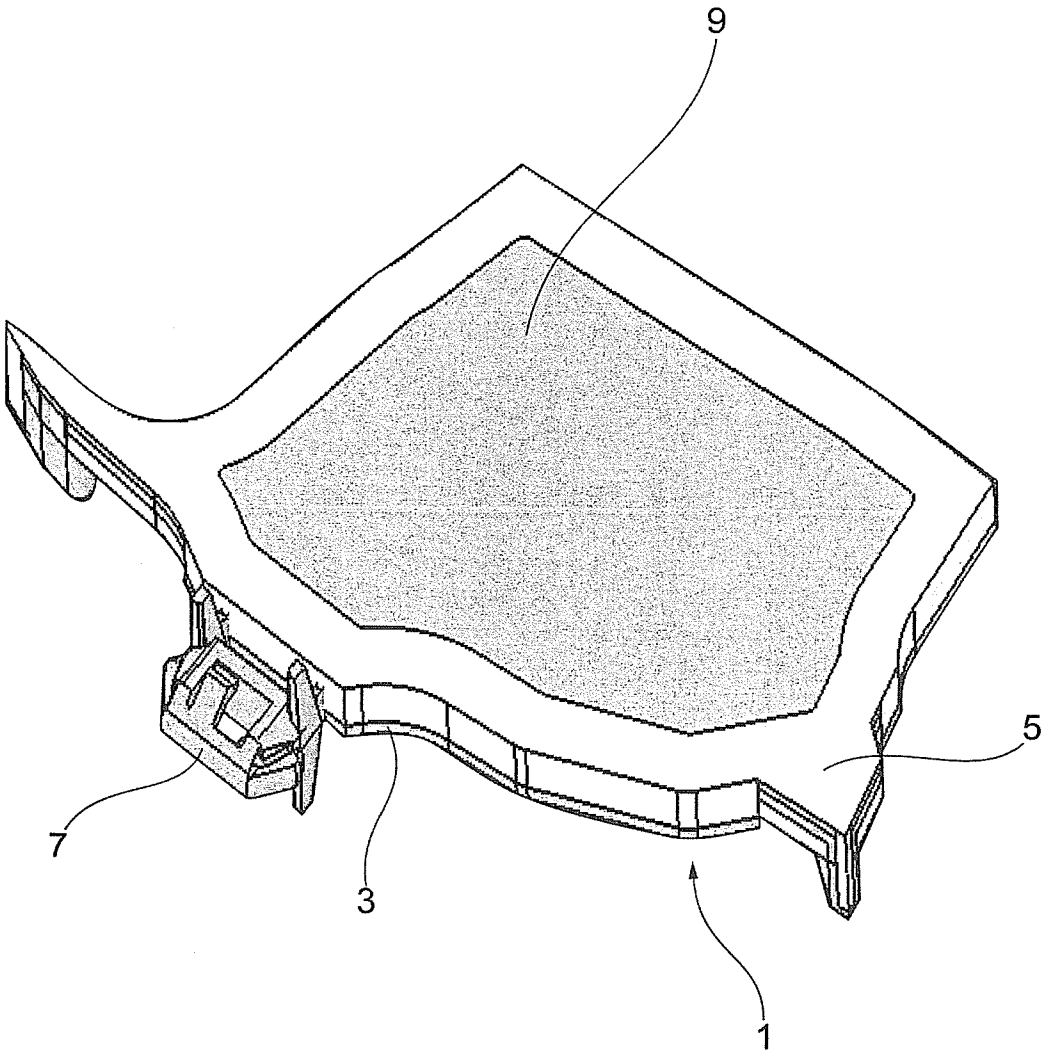

Fig. 1

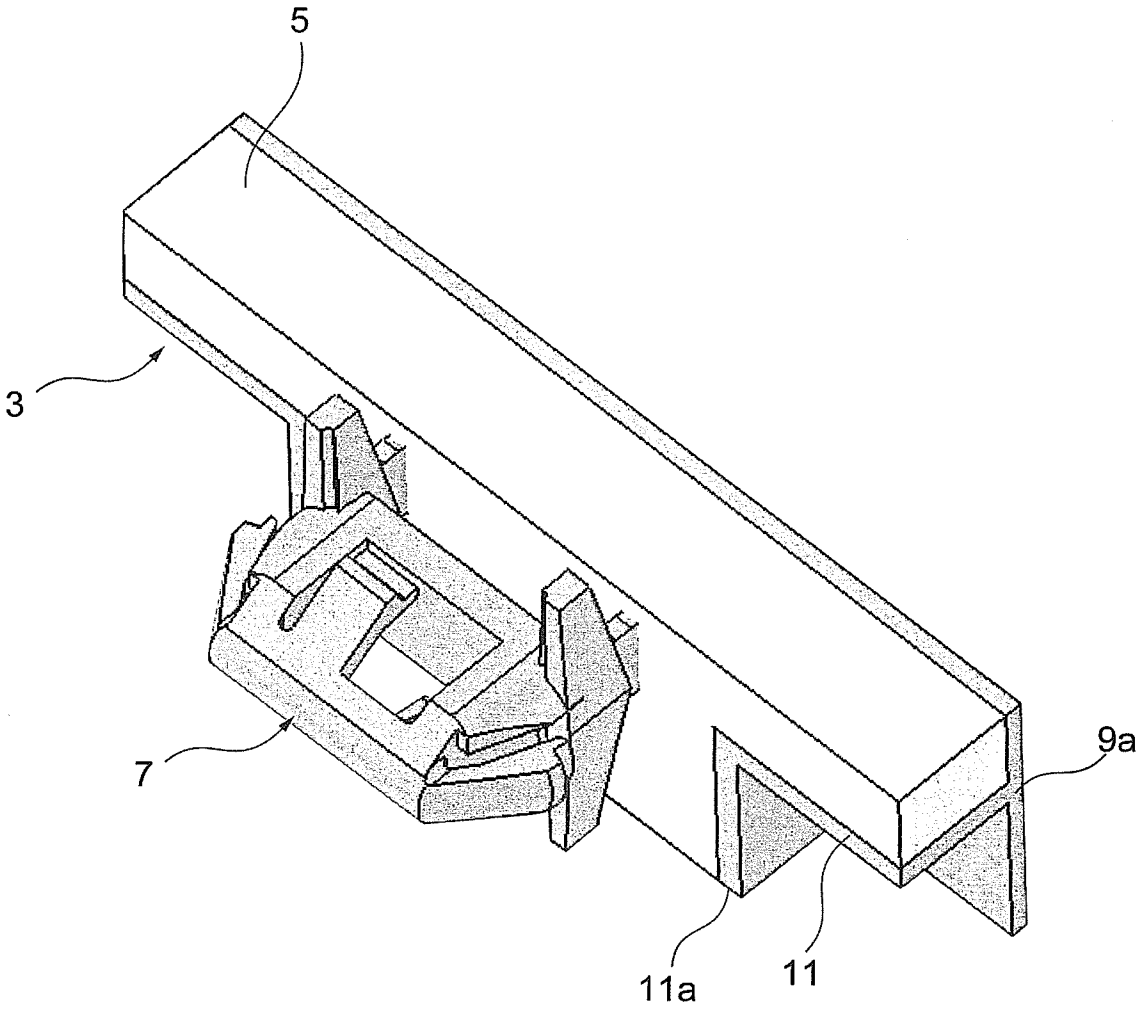

Fig. 2

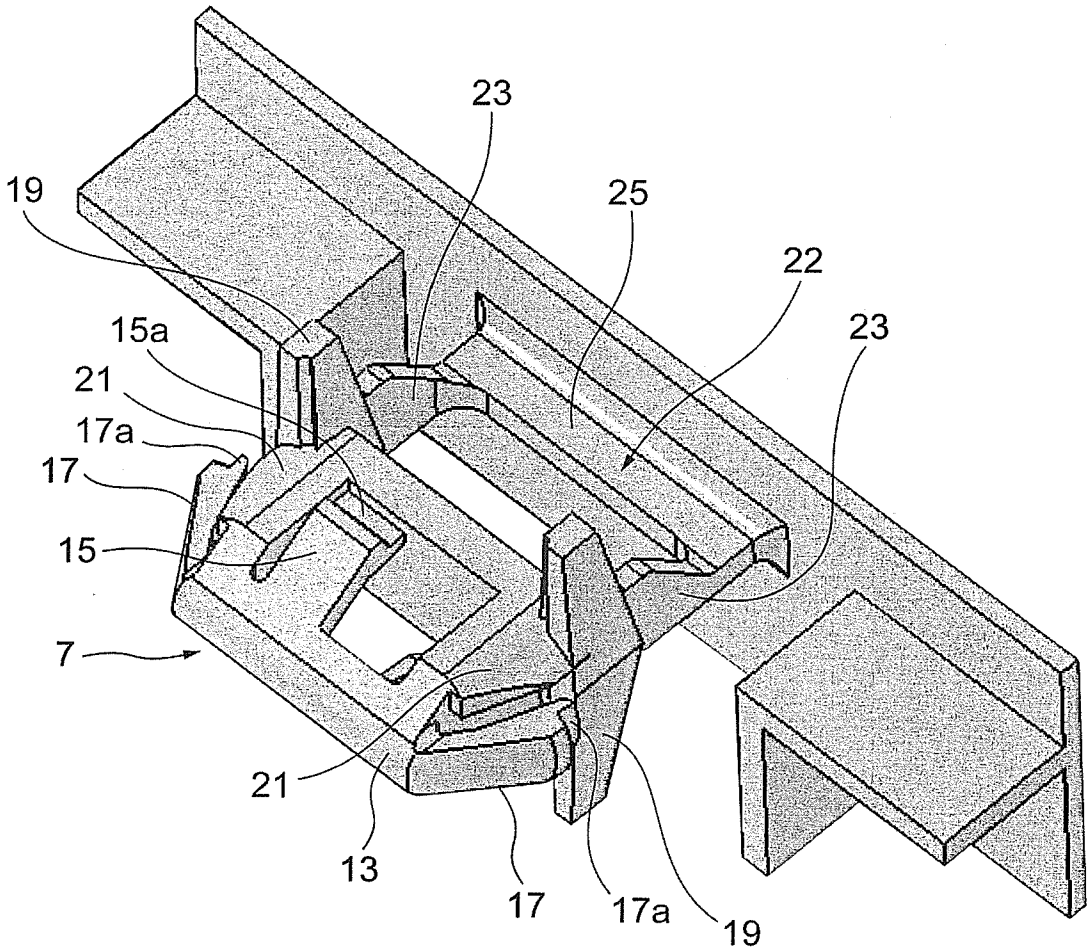

Fig. 3

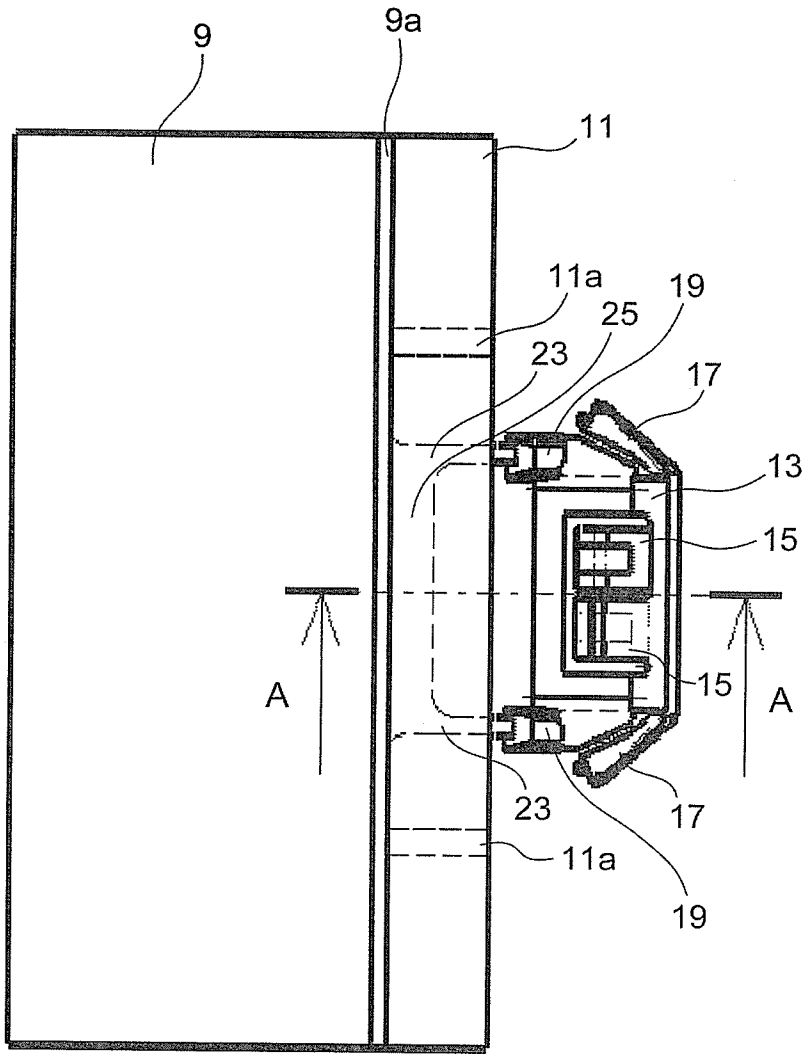

Fig. 4A

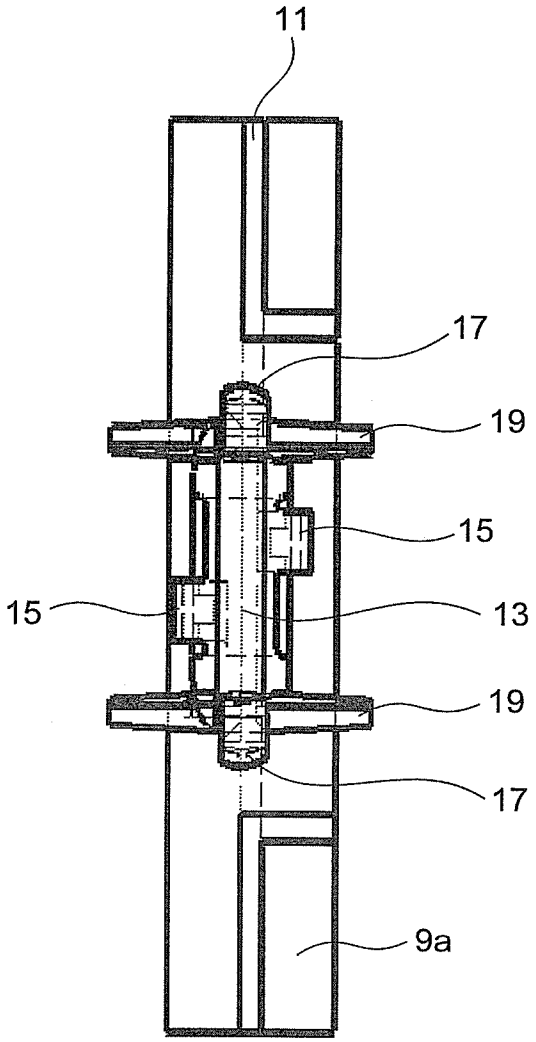

Fig. 4B

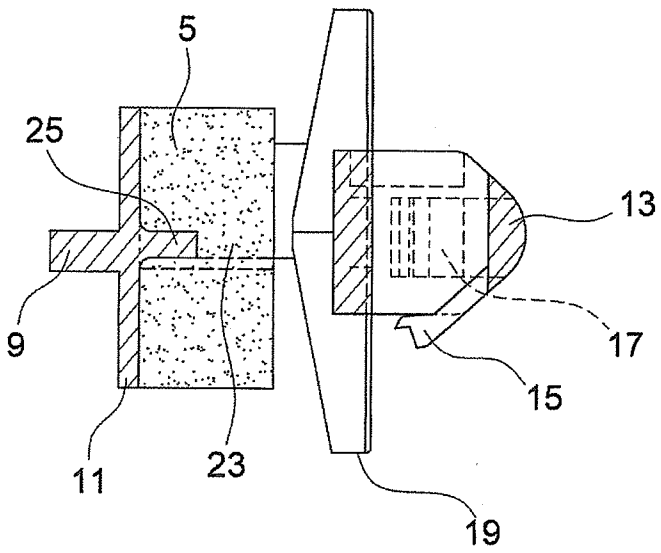

Fig. 4C

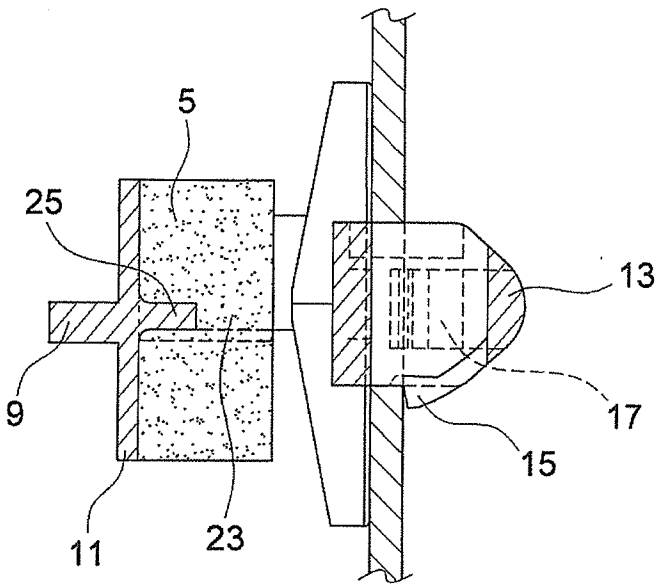

Fig. 4D

PRIOR ART

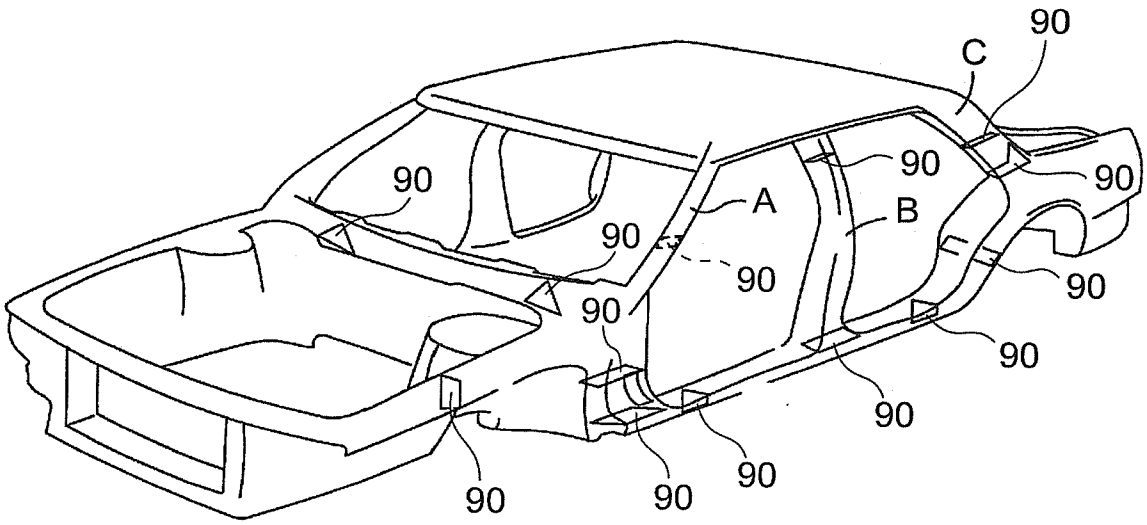

Fig. 5

PRIOR ART

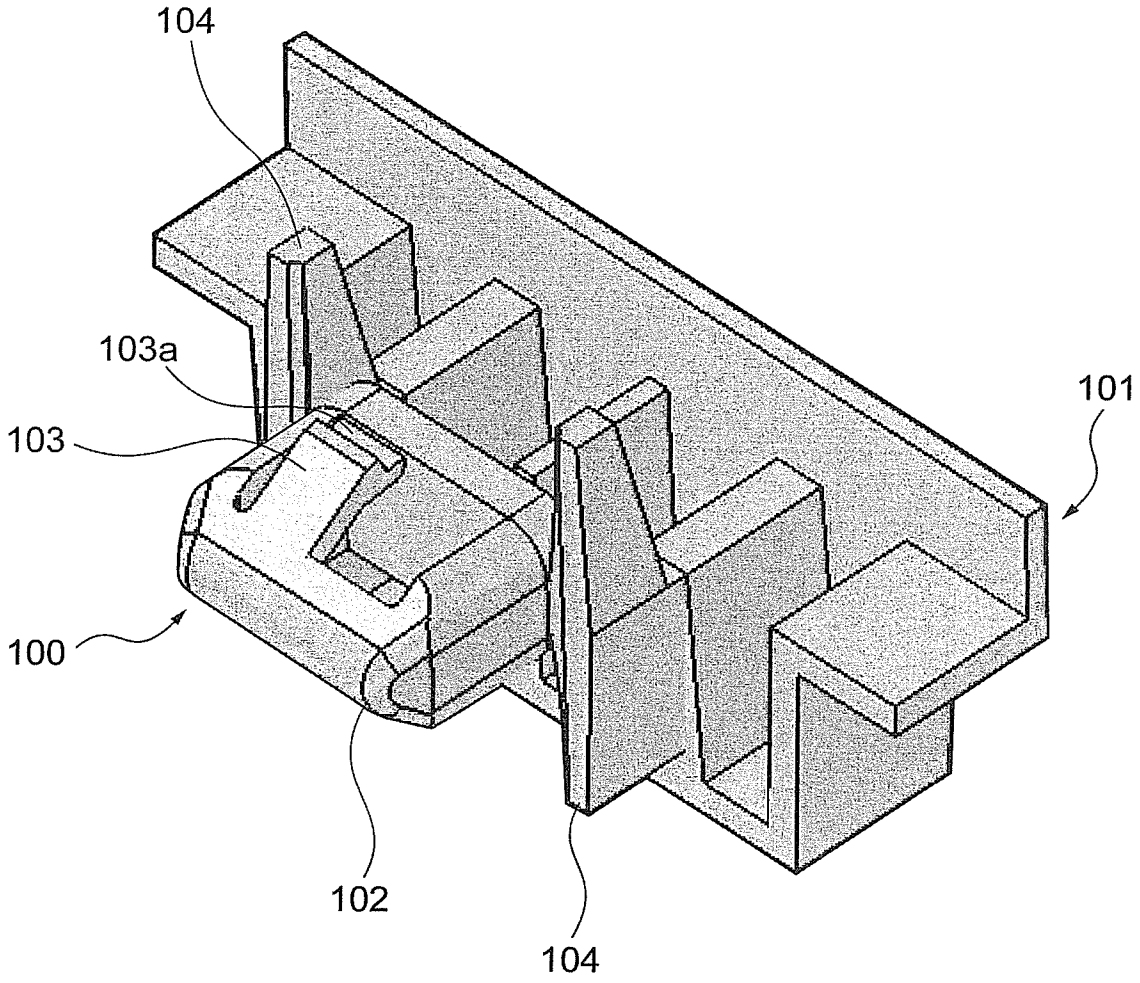

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/063018

A. CLASSIFICATION OF SUBJECT MATTER

B62D 25/00(2006.01)i, B62D 24/00(2006.01)i

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)

IPC 8 : B62D 25, B60R 13/08

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

Korean Utility Models and applications for Utility Models since 1975
Japanese Utility Models and applications for Utility Models since 1975

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

eKIPASS (KIPO internal) & "Keywords: pillar, hollow, noise, sound, foamable, expandable, support"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2005-319844 A (NITTO DENKO CORP.) 17 November 2005 See page 3, line 23 - page 4, line 25.	1-3, 5-13, 15-22 4, 14
Y	US 20040201258 A1 (DANIERE, PIERRE et al.) 14 October 2004 See column 2, line 47 - column 3, line 59.	1-22
Y	JP 11-254571 A (NEOEX LAB INC.) 21 September 1999 See column 1, line 40 - column 2, line 12 & column 3, line 34 - column 5, line 47.	1-22
A	US 5806915 A (TAKABATAKE, YOSHIHIRO) 15 September 1998 See column 4, line 1 - column 5, line 4.	1-22
A	US 5642914 A (TAKABATAKE, YOSHIHIRO) 01 July 1997 See column 3, line 50 - column 5, line 28.	1-22
Y	KR 10-2003-000517 A (HYUNDAI MOTOR COMPANY) 06 January 2003 See page 2, line 46 - page 3, line 19.	1-22

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 JULY 2007 (31.07.2007)	**31 JULY 2007 (31.07.2007)**

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2007/063018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005-319844 A	17.11.2005	None	
US 20040201258 A1	14.10.2004	BR 200110639 A	18.03.2003
		CA 2410621 AA	06.12.2001
		CA 2410621 C	05.12.2006
		DE 60119096 C0	01.06.2006
		DE 60119096 T2	19.10.2006
		EP 1289800 A1	12.03.2003
		EP 1289800 B1	26.04.2006
		JP 2003-534968 T2	25.11.2003
		PL 358890 A1	23.08.2004
		WO 01/92063 A1	06.12.2001
JP 11-254571 A	21.09.1999	JP 3373424 B2	04.02.2003
US 5806915 A	15.09.1998	DE 69600357 C0	23.07.1998
		DE 69600357 T2	17.12.1998
		EP 730999 A1	11.09.1996
		EP 730999 B1	17.06.1998
		JP 08-276448 A	22.10.1996
US 5642914 A	01.07.1997	JP 08-258047 A	08.10.1996
		JP 08-282396 A	29.10.1996
		JP 2746856 B2	06.05.1998
		JP 2954499 B2	27.09.1999
KR 10-2003-000517 A	06.01.2003	None	