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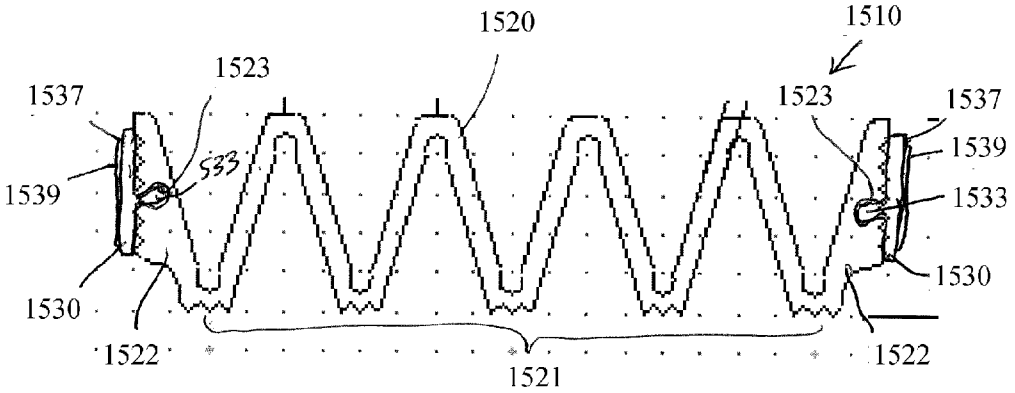


FIG. 15

(57) Abstract: An expansion joint includes a foam strip having first and second lateral side surfaces extending axially outward to an outer edge surface, and an elongated gasket having a laterally expandable portion adhered to the outer edge surface of the foam strip, with the laterally expandable portion extending between first and second lateral end portions. The first and second lateral end portions each define at least one of a laterally outward facing bonding surface and an axially inward facing bonding surface, with the at least one bonding surface being spaced apart axially outward from the corresponding one of the first and second lateral side surfaces of the foam strip.

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GASKET SEALING ARRANGEMENTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and all benefit of U.S. Provisional Patent Application Serial No. 62/733,758, filed on September 20, 2018 and entitled EXPANSION JOINT SYSTEM, and U.S. Provisional Patent Application Serial No. 62/733,756, filed on September 20, 2018 and entitled ADHESION ADAPTER ARRANGEMENTS FOR COMPONENTS WITH LOW SURFACE TENSION, the entire disclosures of each of which are incorporated herein by reference.

BACKGROUND

[0002] Conventional gasket sealing arrangements for building and construction applications include expansion joint systems that accommodate thermal and/or seismic movements of the substrates relative to each other, for example, through use of a compressed open celled foam material sandwiched between the adjacent structures. Other such sealing arrangements include a variety of polymeric sheets or gaskets installed in architectural applications.

SUMMARY

[0003] According to an exemplary embodiment of the present disclosure, an expansion joint includes a foam strip having first and second lateral side surfaces extending axially outward to an outer edge surface, and an elongated gasket having a laterally expandable portion adhered to the outer edge surface of the foam strip, with the laterally expandable portion extending between first and second lateral end portions. The first and second lateral end portions each define at least one of a laterally outward facing bonding surface and an axially inward facing bonding surface, with the at least one bonding surface being spaced apart axially outward from the corresponding one of the first and second lateral side surfaces of the foam strip.

[0004] According to another exemplary embodiment, an architectural joint system includes a first substrate having a lateral end surface extending axially outward to an outer surface, a second substrate having a lateral end surface facing the lateral end surface of the first substrate and extending axially outward to an outer surface, and an expansion joint compressed between the first substrate and the second substrate. The expansion joint includes a foam strip and an elongated gasket. The foam strip includes first and second lateral side surfaces extending axially outward to an outer edge surface recessed from the outer surfaces of the first and second substrates, with the first lateral side surface engaging the lateral end surface of the first substrate and the second lateral side surface engaging the lateral end surface of the second substrate. The elongated gasket includes a laterally expandable portion adhered to the outer edge surface of the foam strip and extending between first and second lateral end portions. The first lateral end portion is bonded to the first substrate at a location spaced apart axially outward from the first lateral side surface, and the second lateral end portion is bonded to the second substrate at a location spaced apart axially outward from the second lateral side surface.

[0005] According to still another exemplary embodiment, a method of installing an expansion joint between first and second substrates is contemplated. In the exemplary method, a pre-compressed foam strip is installed between the first and second substrates, such that a first lateral side surface of the foam strip engages a lateral end surface of the first substrate, a second lateral side surface of the foam strip engages a lateral end surface of the second substrate, and an outer edge surface of the foam strip is recessed from outer surfaces of the first and second substrates. An elongated gasket is provided, having a laterally expandable portion extending between first and second lateral end portions. The laterally expandable portion of the elongated gasket is adhered to the outer edge surface of the foam strip. The first lateral end portion of the elongated gasket is adhered to the first substrate, and the second lateral end portion of the elongated gasket to the second substrate.

[0006] According to another exemplary embodiment of the present disclosure, a field bondable polymeric seal member includes a polymeric component having a first surface tension and an adhesion adapter attached to the polymeric component and defining a bonding surface having a second surface tension greater than the first surface tension.

[0007] According to another exemplary embodiment, a bonded seal arrangement includes a polymeric seal member and a substrate. The polymeric seal member includes a polymeric component having a first surface tension and an adhesion adapter attached to the polymeric component and defining a first bonding surface having a second surface tension greater than the first surface tension. The substrate defines a second bonding surface having a third surface tension greater than the first surface tension, with the second bonding surface being bonded to the first bonding surface by an adhesive layer.

[0008] According to still another exemplary embodiment, a method of making a field bondable polymeric seal member is contemplated. In one such exemplary method, a polymeric component having a first surface tension is provided. An adhesion adapter is attached to the polymeric component, with the adhesion adapter defining a bonding surface having a second surface tension greater than the first surface tension.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In the accompanying drawings which are incorporated in and constitute a part of the specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below, serve to provide examples of the principles of this invention.

[0010] FIG. 1 is a longitudinal end schematic view of an architectural expansion joint system, in accordance with an exemplary embodiment of the present disclosure;

[0011] FIG. 1A is an axial end view of a foam strip of an expansion joint installed between adjacent substrates;

[0012] FIG. 2 is a longitudinal end view of an exemplary expansion joint installed between adjacent substrates, according to an embodiment of the present disclosure;

[0013] FIG. 3 is a longitudinal end view of another exemplary expansion joint installed between adjacent substrates, according to another embodiment of the present disclosure;

[0014] FIG. 4 is a longitudinal end view of another exemplary expansion joint installed between adjacent substrates, according to another embodiment of the present disclosure;

[0015] FIG. 5 is a longitudinal end view of another exemplary expansion joint installed between adjacent substrates, according to another embodiment of the present disclosure;

[0016] FIG. 6 is a longitudinal end view of an exemplary expansion joint gasket, according to another embodiment of the present disclosure;

[0017] FIG. 7 is a longitudinal end view of another exemplary expansion joint installed between adjacent substrates, according to another embodiment of the present disclosure;

[0018] FIG. 8 is a longitudinal end view of another exemplary expansion joint installed between adjacent substrates, according to another embodiment of the present disclosure; and

[0019] FIG. 9 is a longitudinal end view of an exemplary expansion joint gasket, according to another embodiment of the present disclosure.

[0020] FIG. 10A is a longitudinal end view of an exemplary expansion joint gasket, according to another embodiment of the present disclosure;

[0021] FIG. 10B is a longitudinal end view of an exemplary expansion joint gasket, according to another embodiment of the present disclosure;

[0022] FIG. 11 is a partial cross-sectional schematic view of an exemplary seal member including a polymeric component and an adhesion arrangement, according to an embodiment of the present disclosure;

[0023] FIGS. 11A – 11F illustrate a variety of exemplary attachment arrangements for a polymeric component and adhesion adapter;

[0024] FIG. 12 is a cross-sectional end view of an exemplary field bondable sealing member including a sheet gasket with an attached adhesion adapter, according to an embodiment of the present disclosure;

[0025] FIG. 13 is a cross-sectional end view of an exemplary field bondable sealing member including a sheet gasket with attached adhesion adapters, according to another embodiment of the present disclosure;

[0026] FIG. 14 is a cross-sectional end view of an exemplary field bondable sealing member including an overlay gasket with attached adhesion adapters, according to another embodiment of the present disclosure; and

[0027] FIG. 15 is a cross-sectional end view of an exemplary field bondable sealing member including an expansion gasket with attached adhesion adapters, according to another embodiment of the present disclosure.

DETAILED DESCRIPTION

[0028] As described herein, when one or more components are described as being assembled, connected, joined, affixed, adhered, coupled, attached, or otherwise interconnected, such interconnection may be direct as between the components or may be indirect such as through the use of one or more intermediary components. Also as described herein, reference to a "member," "component," or "portion" shall not be limited to a single structural member, component, or element but can include an assembly of components, members or elements.

[0029] The Detailed Description merely describes exemplary embodiments and is not intended to limit the scope of the claims in any way. Indeed, the invention as claimed and described is broader than and unlimited by the exemplary embodiments, and the terms used in the claims have their full ordinary meaning.

[0030] Building and construction applications including adjacent substrates formed from rigid materials (e.g., concrete, metal, glass) typically employ expansion joint systems that accommodate thermal and/or seismic movements of the substrates relative to each other, for example, through use of a compressed open celled foam material sandwiched between the adjacent structures. In some conventional expansion joint systems, a foam core is coated with a cured elastomer layer or facing to provide moisture resistance or waterproofing of an exposed

edge of the foam core. Additionally or alternatively, the foam core may be coated with an intumescent layer or infused with a fire retardant to provide fire resistance.

[0031] Conventional coated expansion joint systems are commonly provided as straight sticks held under compression prior to installation, for example, by hardboard and plastic wrapping. Due to the limited lengths (e.g., about 2 meters) of these sticks (for example, to facilitate transportation and storage), multiple full or partial sticks are often required to complete a joint, thus requiring additional sealing between adjacent stick ends, for example, by application of a sealant to the adjoining ends of the elastomer facing. These additional installation steps can result in increased installation time, and/or undesirable appearance of stick end joints.

[0032] The present disclosure contemplates systems and methods for providing an expansion joint between adjacent structures or substrates subject to relative lateral movement over time, such as, for example, thermal and/or seismic movements of the substrates relative to each other. Such expansion joints may, for example, be configures to provide a waterproof seal between the substrates, and/or a fire-resistant barrier. According to an exemplary aspect of the present disclosure, an expansion joint may be formed by adhering a laterally expandable (e.g., corrugated, hinged, elastic) elongated gasket to an outer end surface of a pre-compressed foam strip, either before or after the foam strip is installed between adjacent building material or architectural substrates.

[0033] FIG. 1 schematically illustrates an exemplary expansion joint 100 installed between adjacent building material substrates 10, 20, such as, for example, walls, floors, roofs, or decks of a building or other structure, having opposed, generally parallel lateral end surfaces 11, 21 extending axially outward to outer surfaces 12, 22. The expansion joint 100 includes a foam strip 110 adhered to an elongated gasket 120 configured to be laterally expandable, for example, to maintain a waterproof seal with the substrates 10, 20 along the joint 100.

[0034] The foam strip 110 includes first and second lateral side surfaces 111, 112 extending axially outward from an inner edge surface 113 to an outer edge surface 114 of the foam strip 110. While the foam strip 110 is shown with an elongated gasket adhered to only the outer edge surface 114, it is to be understood that the expansion joint may alternatively include elongated gaskets adhered to both the outer and inner edge surfaces, for example, to provide a

watertight seal at both edges of the joint. In one such embodiment (not shown), the expansion joint may be substantially symmetrical about a plane bisecting the axial length of the expansion joint, such that the expansion joint may be installed in either direction.

[0035] Prior to installation, the foam strip may be pre-compressed (e.g., to 15% - 50% of its original, non-compressed thickness, for example, into sticks or rolls of material, and maintained in a pre-compressed condition, for example, using bindings or shrink-wrap. The foam strip may include an open celled foam material such as, for example, one or more of polyurethane, acrylics, silicone, polyester, or polyether foam materials. The foam material may, but need not, be impregnated with a property enhancing material, such as, for example, an acrylic resin or silicone, for example, to provide one or more enhanced properties, such as, for example, hydrophobic properties, thermal or UV stability, fungal resistance, or fire resistance. In an exemplary embodiment, an illmod® 600 pre-compressed foam seal may be utilized. At least one of the first and second lateral side surfaces 111, 112 may be provided with an adhesive surface (e.g., a pressure sensitive adhesive, hot melt adhesive, or one or two-component chemical bonding adhesive), for example, to facilitate positioning of the installed foam strip at least while the pre-compressed foam strip is expanding into more secure engagement between the substrates 10, 20.

[0036] The elongated gasket 120 includes a laterally expandable portion 125 extending between first and second lateral end portions 121, 122. The gasket 120 may be formed from one or more of a variety of suitable materials, including, for example, silicone, polyethylene, polypropylene, thermoplastic elastomer, ethylene propylene diene monomer (EPDM), polyvinyl chloride (PVC) or other suitable polymers or thermoplastics. The laterally expandable portion 125 may be affixed or adhered to the outer edge surface 114 of the foam strip 110, for example, using a sealant 116 (e.g., silicone, polyurethane, other epoxies or hybrid sealants). While a uniform coating of sealant may be applied between the foam strip 110 and gasket 120 for continuous adhesion of the gasket to the foam strip, in other embodiments, the laterally expandable portion 125 of the gasket 120 may be adhered to the outer edge surface 114 of the foam strip 110 at a plurality of laterally spaced locations. This may be accomplished, for example, by applying discrete beads or other patterns of sealant across the width of the foam strip, and/or due to the shape (e.g., corrugated) of the laterally expandable

portion 125 of the gasket 120, by which spaced apart axially inner portions of the laterally expandable portion make contact with the outer edge surface 114 at discrete, laterally spaced locations.

[0037] While the elongated gasket 120 may be adhered to the outer end surface 114 of the foam strip 110 prior to joint installation, for storage as a pre-fabricated expansion joint, in some applications, the gasket 120 may be adhered to the foam strip 110 after the foam strip is installed between the building material substrates 10, 20. By adhering the elongated gasket to the foam strip after installation of the foam strip, the foam strip and gasket may be more easily transported in longer sections of separate material, for example, as rolls or spools of material, thereby facilitating transportation and storage of the material. Additionally, by providing the foam strips and gaskets in longer lengths, joints between sections of the expansion joint may be eliminated, making installation more efficient and less susceptible to cosmetic issues, such as lack of uniformity. FIG. 1A illustrates an axial end view of a foam strip 110 installed between first and second substrates 10, 20 with a bead of sealant 116 applied to the outer edge surface 114 of the foam strip for subsequent adhesion of an elongated, laterally expandable gasket.

[0038] The first and second lateral end portions 121, 122 of the exemplary gasket 120 define one or more bonding surfaces 123, 124 for adhering and sealing the lateral end portions against the substrates 10, 20 using a sealant (e.g., silicone, polyurethane, other epoxies or hybrid sealants). To facilitate attachment of the gasket 120 after installation of the foam strip 110 between the substrates 10, 20, the bonding surfaces may be configured to be spaced apart axially outward from the lateral side surfaces 111, 112 of the foam strip 110. As described and shown in the various embodiments herein, the bonding surfaces 123, 124 may be oriented laterally outward for adhesive engagement with the lateral end surfaces 11, 21 of the first and second substrates 10, 20, and/or axially inward for adhesive engagement with the outer surfaces 12, 22 of the first and second substrates. To facilitate bonding of the gasket lateral end portions 121, 122 with the substrates 10, 20, the foam strip 110 may be installed with the outer edge surface 114 recessed from the outer surfaces 12, 22 of the substrates, for example, by an axial distance approximately equal to the axial height of the laterally expandable portion 125 of the gasket 120.

[0039] The laterally expandable portion of an expansion joint gasket may be provided in a variety of suitable configurations to facilitate lateral expansion and/or contraction, including, for example, one or more corrugations, hinges, elastic portions, or other such features. FIG. 2 illustrates an exemplary expansion joint 200 installed between adjacent building material substrates 10, 20, including a foam strip 210 adhered to an elongated gasket 220. The gasket 220 has a laterally expandable portion 225 including a plurality of inverted U-shaped corrugations 226, with axially inner portions 227 of the corrugations 226 adhered to the outer end surface 214 of the foam strip 210, and axially outer portions 228 providing flexibility to accommodate lateral movement of the substrates 10, 20 with respect to each other. FIG. 3 illustrates another exemplary expansion joint 300 installed between adjacent building material substrates 10, 20, including a foam strip 310 adhered to an elongated gasket 320. The gasket 320 has a laterally expandable portion 325 including a plurality of V-shaped corrugations 326, with axially inner portions 327 of the corrugations 326 adhered to the outer end surface 314 of the foam strip 310, and axially outer portions 328 providing flexibility to accommodate lateral movement of the substrates 10, 20 with respect to each other. Still other laterally expandable gasket shapes and arrangements may be utilized, including, for example, sinusoidal corrugations, rectangular corrugations, truncated V-shaped corrugations, and U-shaped corrugations.

[0040] An expansion joint gasket may be provided in a variety of suitable dimensions, including, for example, as labeled in FIG. 6, an axial height h of approximately 5/8 inches, or between about ¼ inch and about 1 ½ inches, a corrugation lateral width w of about ½ inch, or between about ¼ inch and about 1 ½ inches, or a corrugation wall thickness t of about 0.07 inches, or between about 0.03 inches and about 1/8 inches. The gasket may be provided in a number of different lateral widths L, for example to accommodate expansion joints of a wide range of widths, with each gasket width being suitable to accommodate a limited width range, due to the lateral expandability and/or compressibility of the gasket. For example, expansion joint gaskets may be provided in nominal widths selected to accommodate expansion joints having width ranges from about 75% smaller to about 100% larger than the nominal width of the expansion joint, or from about 50% smaller to about 50% larger than the nominal width of the expansion joint, or any other suitable range.

[0041] As shown in FIGS. 2 and 3, the gasket corrugations 226, 326 may provide gaps between the gasket 220, 320 and the foam strip 210, 310, such that the gasket only engages the substantially planar outer end surface 214, 314 of the foam strip at the axially inner portions 227, 327. In other embodiments, the outer end surface of the foam strip may be contoured (e.g., by mechanical cutting, laser cutting, water jet cutting, molding, extruding, additive manufacturing) to more closely mate with the axially inner surface of the gasket, to provide more uniform or continuous engagement between the foam strip and the gasket, for example, to provide more uniform compression, improved adhesion to the gasket, or enhanced durability. FIG. 4 illustrates an exemplary foam strip 410 having an outer end surface 414 contoured to closely mate with the axially inner surface of a gasket having a laterally expandable portion comprising inverted U-shaped corrugations, such as, for example, the gasket 220 of FIG. 2. FIG. 5 illustrates an exemplary foam strip 510 having an outer end surface 514 contoured to closely mate with the axially inner surface of a gasket having a laterally expandable portion comprising V-shaped corrugations, such as, for example, the gasket 320 of FIG. 3. While the more uniform or continuous mating contact between the foam strip and gasket may allow for a uniform layer of sealant between the foam strip and the gasket, in other embodiments, as shown in FIGS. 4 and 5, sealant beads 416, 516 may be deposited in recesses or grooves 415, 515 formed in the contoured outer end surfaces 414, 514 for adhesion of the gasket along the axially inner portions of the gasket corrugations.

[0042] The lateral end portion bonding surfaces of an expansion joint gasket may be provided in a variety of suitable configurations to facilitate sealing engagement with the substrates. In some embodiments, the lateral end portions of a gasket may be provided with laterally outward oriented bonding surfaces for adhesive engagement with the lateral end surfaces of the adjacent substrates. In the exemplary embodiment of FIG. 2, the outer wall portions 229 of the endmost corrugations 226 of the gasket 220 define laterally outward oriented bonding surfaces 239, spaced apart axially outward from the lateral side surfaces 211, 212 of the foam strip 210, for adhesive engagement with the lateral end surfaces 11, 21 of the substrates 10, 20. While sealant may be applied to the substantially axially extending surfaces that engage the substrate end surfaces 11, 21, sealant beads may additionally or alternatively be applied along the junctions between the curved portions endmost corrugations 226 and the substrate end surfaces,

as shown at 218. In the exemplary embodiment of FIG. 3, the endmost corrugations 326 of the gasket 320 are provided with laterally outward facing flange portions 329 defining laterally outward oriented bonding surfaces 339, spaced apart axially outward from the lateral side surfaces 311, 312 of the foam strip 310, for adhesive engagement with the lateral end surfaces 11, 21 of the substrates 10, 20. While the flange portions may be substantially planar, in other embodiments, as shown in FIG. 3, the bonding surfaces 339 may be provided with grooves 339a or other such recesses for receiving and retaining an applied sealant or adhesive. FIG. 6 illustrates another exemplary embodiment of an expansion joint gasket 620 having laterally outward facing flange portions 629 defining laterally outward oriented bonding surfaces 639 including a plurality of grooves or recesses 639a, and corrugations 626 (which may, but need not, be similar to the V-shaped corrugations 326 of the embodiment of FIG. 3) having axially inner portions 627 with grooves or recesses 627a for receiving and retaining an applied sealant or adhesive.

[0043] In other embodiments, the lateral end portions of an expansion joint gasket may be provided with axially inward facing bonding surfaces for adhesive engagement with the outer surfaces of the adjacent substrates. Such an arrangement may provide for an expansion joint that is more uniform in appearance, and/or substantially flush with the substrate outer surfaces, and may, for example, limit or eliminate the need for an adhesive on the lateral side surfaces of the foam strip. FIG. 7 illustrates an exemplary installed expansion joint 700 including a foam strip 710 adhered to an elongated gasket 720 including a laterally expandable portion 725 (e.g., a plurality of corrugations 726, which may, but need not, be similar to the V-shaped corrugations 326 of the embodiment of FIG. 3), and laterally outward extending flange portions 729. The flange portions 729 define axially inward facing bonding surfaces 737, spaced apart axially outward from the lateral side surfaces 711, 712 of the foam strip 710, for adhesive engagement with the lateral end surfaces 11, 21 of the substrates 10, 20. Similar to the flange portions 329, 629 of the gaskets 320, 620 of FIGS. 3 and 6, the laterally outward extending flange portions 729 may be provided with grooves or recesses (not shown) to facilitate retention of a bonding adhesive or sealant.

[0044] In still other embodiments, the lateral end portions of an expansion joint gasket may be provided with both laterally outward and axially inward facing bonding surfaces for adhesive

engagement with both the lateral end surfaces and the outer surfaces of the adjacent substrates. FIG. 8 illustrates an exemplary installed expansion joint 800 including a foam strip 810 adhered to an elongated gasket 820 including a laterally expandable portion 825 (e.g., a plurality of corrugations 826, which may, but need not, be similar to the inverted U-shaped corrugations 226 of the embodiment of FIG. 2), and laterally outward extending flange portions 829. The flange portions 829 define laterally outward facing bonding surfaces 839 and axially inward facing bonding surfaces 837, spaced apart axially outward from the lateral side surfaces 811, 812 of the foam strip 810, for adhesive engagement with the lateral end surfaces 11, 21 of the substrates 10, 20. As shown, the bonding surfaces 839, 837 may include grooves or other such recesses 839a, 837a to facilitate retention of a bonding adhesive or sealant.

[0045] Bonding adhesives or sealant used to seal a gasket against an architectural substrate often require substantial curing times to ensure an effective seal. While pressure sensitive adhesives require little or no cure time to effect a seal, gasket materials such as silicone do not allow for adequate adhesion to a pressure sensitive adhesive, for example, due to very low surface tension of the gasket material. According to another aspect of the present disclosure, an expansion joint gasket may include first and second lateral end portions having attached adapter components defining adhesive bearing bonding surfaces, for bonding engagement with the architectural substrates, with the adapter components being provided in a material selected for improved adhesion, including, for example, metals (e.g., aluminum), plastics (e.g., extruded plastics, thermoplastics, PVC), or fibrous materials (e.g., fiberglass).

[0046] FIG. 9 illustrates an exemplary embodiment of an expansion joint gasket 920 having laterally outward facing flange portions 929 configured to attach to adapter components 935 defining laterally outward oriented bonding surfaces 939 carrying a pressure sensitive adhesive 918 for adhesion with the lateral end surfaces of adjacent substrates. While any suitable attachment arrangement may be utilized, in the illustrated embodiment, ribs or other such projections 936 on the adapter components 935 are received in grooves or corresponding recesses 933 in the gasket flange portions 929. The ribs 936 and grooves 933 may be keyed (e.g., dovetail shaped) or otherwise shaped (e.g., press fit or interference fit) for interlocking engagement to facilitate attachment. Additionally, a thin layer of sealant (e.g., silicone) may be sprayed or otherwise applied within the grooves 933, for improved adhesion between the gasket

flanges and the adapter components, thereby providing an additional chemical bond between the gasket flanges and adapter components, as described in greater detail below. In other embodiments, the gasket flanges may be provided ribs/projections, and the adapter components may be provided with grooves/pockets for a similar attachment.

[0047] The adhesive bonding of components, using, for example, structural adhesives (e.g., epoxy, acrylic, urethane), non-structural adhesives (e.g., hot melt, contact adhesives), and/or pressure sensitive adhesives (e.g., peel and stick bonding tape) generally requires a component surface having a relatively high surface tension or surface energy for the adhesive to adequately wet the component surface. Many polymeric materials (e.g., plastics and elastomers), component materials often selected for any number of desirable properties (e.g., compressibility, elasticity, sealability, weight, chemical compatibility, low cost, durability, UV stability, Young's modulus), have relatively low surface tensions or surface energies, making these materials especially resistant to adhesive bonding. Examples of materials having particularly low surface tensions include polyethylene (about 31 mN/m), silicone (about 24 mN/m), and PTFE (about 18.5 mN/m).

[0048] According to another aspect of the present disclosure, an expandable gasket for an expansion joint may be provided with a plurality of corrugations (e.g., U-shaped or V-shaped corrugations, as described herein), with axially inner portions of the corrugations including darts or other such projections configured to be embedded or otherwise received in the outer end surface of a foam strip. FIG. 10A illustrates an exemplary expansion joint 1000a installed between adjacent building material substrates 10, 20, including a foam strip 1010a secured to an elongated gasket 1020a. The gasket 1020a has a laterally expandable portion 1025a including a plurality of V-shaped corrugations 1026a (though other shapes may be used), with axially inner portions 1027a of the corrugations 1026a including darts or other such projections 1040a received in corresponding channels 1017a in the outer edge surface 1014a of the foam strip 1010a, and axially outer portions 1028a providing flexibility to accommodate lateral movement of the substrates 10, 20 with respect to each other. The channels 1017a may be formed in the foam strip 1010a during manufacturing (e.g., as slits, slots, grooves, or raceways) or cut into the foam strip during field installation. The gasket 1020a may include laterally outward facing flange portions 1029a defining laterally outward oriented bonding surfaces 639a (which may

include grooves/recesses as described above) for receiving and retaining an applied sealant or adhesive for direct adhesion to the substrate 10. Alternatively, a bracket 1050a (e.g., aluminum, PVC) may be attached to a substrate 20 to define a channel 1057a to receive a dart/projection 1040a of the gasket 1020a. A sealant 1055a may be applied between the gasket 1020a and the bracket 1050a to seal the gasket to the bracket. A similar bracket attachment arrangement may be utilized with any of the expansion joint embodiments described herein.

[0049] As shown in FIG. 10A, the gasket corrugations 1026a may provide gaps between the gasket 1020a and the foam strip 1010a, such that the gasket only engages the substantially planar outer end surface 1014a of the foam strip at the interlocking projections 1040a and channels 1017a. In other embodiments, the outer end surface of the foam strip may be contoured (e.g., by mechanical cutting, laser cutting, water jet cutting, molding, extruding, additive manufacturing) to more closely mate with the axially inner surface of the gasket, to provide more uniform or continuous engagement between the foam strip and the gasket, for example, to provide more uniform compression, improved adhesion to the gasket, or enhanced durability. FIG. 10B illustrates an exemplary expansion joint 1000b with a foam strip 1010b having an outer end surface 1014b contoured to closely mate with the axially inner surface of a gasket 1020b having a laterally expandable portion comprising V-shaped corrugations 1026b, thereby eliminating the gaps between the foam strip and the gasket. While the interlocking projections 1040b and channels 1017b may provide sufficient attachment of the gasket 1020b to the foam strip 1010b, the more uniform or continuous mating contact between the foam strip and gasket may allow for application of a layer of sealant between the foam strip and the gasket to provide additional adhesion.

[0050] Adhesives that are suitable for bonding to low surface tension polymers typically require substantial curing times, preferably in controlled environments, making such adhesive bonding procedures impractical for field installation in an outdoor environment, as is the case with polymeric sheets or gaskets installed in architectural applications. In some applications, surface modification techniques may be used to increase the surface tension of a material to facilitate adhesion, including, for example, abrasion, corona discharge, plasma treatment, and flame treatment. These techniques, however, may be impractical, undesirable, or impossible to perform on polymeric sheets or gaskets.

[0051] The present disclosure contemplates systems and methods for facilitating adhesion of a low surface tension polymeric component, such as a gasket, to a substrate, such as a building component. According to an aspect of the present disclosure, one or more adhesion adapters may be attached to the polymeric element to provide a bonding surface having a higher surface tension (e.g., at least about 35 mNm). This bonding surface may facilitate field bonding of the polymeric element to a substrate by providing a bonding surface that is more readily wetted by an applied adhesive. In some such embodiments, a pressure sensitive adhesive may be pre-applied to the bonding surface prior to field installation, for example, to simplify and/or accelerate such installation.

[0052] Surface tension increasing adhesion adapters may be applied to a variety of components, including, for example, formed rubber products, such as sheet gaskets, overlay gaskets, expansion gaskets, and window tie-ins, and low friction bearings (e.g., PTFE blocks). The adhesion adapters may be provided in a variety of different shapes and configurations, including, for example, discs, rails, pads, posts, rods, plates, and components having interlocking assembly features, such as darts or slots, configured to provide one or more bonding surfaces sized and shaped for desired adhesion between the seal member and the substrate. While the bonding surfaces are shown herein as being substantially planar, in other embodiments, the bonding surfaces may be contoured (e.g., concave, convex, cylindrical, conical, etc.) to suit a desired application.

[0053] FIG. 11 schematically illustrates a bonded seal arrangement 1100 including a seal member 1110 bonded to a substrate 1105, as contemplated in the various exemplary embodiments of the present disclosure. The seal member 1110 includes a low surface tension polymeric component 1120 (e.g., gasket) and an adhesion adapter 1130 attached to the polymeric component and defining a bonding surface 1137 having a higher surface tension to facilitate adhesion, by a sealant or adhesive 1139, to a bonding surface 1107 of the substrate 1105. In one embodiment, the polymeric component may be fabricated (e.g., extruded, molded, 3D printed, machined) from a material having a surface tension less than about 35 mNm, which may be insufficient for adequate adhesion by a preferred adhesive. Exemplary polymeric component materials include, for example, silicone, epoxies, acrylics, urethanes, and PTFE. The adhesion adapter 1130 may be fabricated from a material having a surface tension

of at least about 35 mNm to allow for adequate adhesion by a preferred adhesive. Exemplary adhesion adapter materials include, for example, metals (e.g., aluminum), plastics (e.g., extruded plastics, thermoplastics, PVC), or fibrous materials (e.g., fiberglass). In other exemplary embodiments, the adhesion adapter may include a bonding surface that is treated (e.g., abrasion, corona discharge, plasma treatment, flame treatment) to have an increased surface tension (e.g., at least about 35 mNm), relative to other surfaces of the adhesion adapter. The substrate may be a conventional building material substrate (e.g., aluminum, concrete, glass, wood, vinyl, and building composites) having a surface tension (e.g., at least about 35 mNm) sufficient to be adequately adhered by the adhesive.

[0054] The adhesive may include any of a variety of suitable adhesive materials, including, for example, acrylics, silicones, and butyls. In some embodiments, the adhesive may be applied in the field to either or both of the substrate and adhesion adapter bonding surfaces 1107, 1137. In other embodiments, the adhesive 1139 may be pre-applied to the bonding surface 1137 of the adhesion adapter 1130, for example, to facilitate adhesion of the seal member 1110 to the substrate 1105. In one such exemplary embodiment, a pressure sensitive adhesive (e.g., a double-sided tape, such as ACX®, manufactured by tesa SE) is pre-applied to the bonding surface 1137. Prior to adhesion of the seal member 1110 to the substrate 1105, the adhesive 1139 may be covered with a release paper to protect and preserve the adhesive.

[0055] The adhesion adapter 1130 may be attached to the polymeric component 1120 using a variety of suitable configurations. In one embodiment, as shown in FIG. 11A, a seal member 1110a may include an adhesion adapter 1130a attached to a polymeric component 1120a by an adhesive 1133a (e.g., a silicone adhesive that may be sprayed, rolled or otherwise applied). By providing this adhesive bond during manufacture of the seal member 1110a, as compared to adhesive bonds formed during field installation, a wider range of suitable curing techniques (e.g., drying, heating, radiation, etc.) may be employed. While the joined surfaces of the polymeric component 1120a and adhesion adapter 1130a are shown as substantially planar, in other embodiments, either or both of the mating surfaces of the polymeric component and adhesion adapter may be contoured, for example, for increased surface contact or to form shallow pockets for retaining the adhesive prior to curing. FIG. 11B illustrates a seal member 1110b including an adhesion adapter 1130b attached to a polymeric component 1120b by an

adhesive 1133b, with the polymeric component provided with a grooved surface 1121b to retain the adhesive and/or to increase surface contact with the adhesive during the curing process.

[0056] In other embodiments, one of the polymeric component and the adhesion adapter may be provided with a recessed pocket, and the other of the polymeric component and the adhesion adapter may be provided with a complementary shaped projection received in the recessed pocket for interlocking engagement of the adhesion adapter with the polymeric component. In one such embodiment, the projection and pocket may be sized for press-fit or interference-fit engagement, with either or both of the polymeric component and the adhesion adapter being flexible enough to facilitate press-fit or interference-fit engagement. FIG. 11C illustrates a seal member 1110c including a polymeric component 1120c having one or more recessed pockets 1123c and an adhesion adapter 1130c having one or more projections 1133c received in press-fit or interference-fit engagement with the corresponding recessed pocket(s) 1123c.

[0057] In other embodiments, the projection(s) and recessed pocket(s) may be shaped (e.g., dovetail-shaped, dart-shaped, hammerhead-shaped, etc.) for interlocking engagement, with an enlarged distal portion of the projection interlocking with a narrowed outer portion of the pocket. A variety of suitable shapes and configurations may be utilized, examples of which are illustrated in FIGS. 11D (hammerhead-shaped projection 1133d), 11E (bulbous or ball-shaped projection 1133e), and 11F (ribbed projection 1133f). To receive the projection into the pocket, either or both of the polymeric component 1120c-f and the adhesion adapter 1130c-f may be sufficiently elastically deformable to facilitate insertion. As shown in the exemplary embodiments of FIGS. 11C and 11E, the projections 1133c, 1133e may be narrower than the bonding surfaces 1137c, 1137e. Alternatively, as shown in the exemplary embodiments of FIGS. 11D and 11F, the narrower portions of the projections 1133d, 1133f may be substantially the same width as bonding surfaces 1137d, 1137f.

[0058] While the embodiments of FIGS. 11B-11F illustrate seal member attachment arrangements including one or more projections 1133b-f disposed on the adhesion adapter 1130b-f and one or more recessed pockets 1123b-f disposed in the polymeric component 1120b-f, in other embodiments (not shown), one or more projections (e.g., similar to the

projections of FIGS. 11C-11F) may be disposed on the polymeric member and one or more recessed pockets may be disposed in the adhesion adapter. Additionally, while the interengaging surfaces of the projections and recessed pocket may provide sufficient attachment of the adhesion adapters to the polymeric component, in other embodiments, an adhesive or sealant may be applied between the projection and the corresponding pocket (e.g., sprayed into the pocket prior to insertion of the projection) to provide an additional chemical bond between the polymeric component and the adhesion adapter.

[0059] The surface tension increasing adhesion adapter arrangements described herein may be employed with many different types of seal members. FIG. 12 illustrates an exemplary sheet gasket seal member 1210 for use, for example, in sealing between a window frame and an adjoining building wall (not shown). The exemplary gasket 1210 includes a polymeric sheet 1220 and a plurality of adhesion adapters 1230 attached to the sheet 1220 at spaced apart locations. In the exemplary embodiment, the adhesion adapters 1230 are attached to the sheet 1220 by an adhesive or sealant 1233 (e.g., a cured silicone adhesive). The adhesion adapters 1230 provide spaced apart bonding surfaces 1237 to which adhesive 1239 (e.g., pressure sensitive adhesive) may be applied.

[0060] In other embodiments, the adhesion adapters may be attached to the sheet using other arrangements (e.g., the interlocking projections and recessed pockets of FIGS. 11B-11F). FIG. 13 illustrates an exemplary sheet gasket seal member 1310 including a polymeric (e.g., silicone) sheet 1320 and an adhesion adapter 1330 having an enlarged end (e.g., hammerhead-shaped as shown) projection 1333 retained in interlocking engagement (and optionally also chemically bonded by a layer of adhesive) with a complementary shaped recessed pocket 1323 in the sheet 1320, which may include an enlarged portion 1324 in which the pocket 1323 is disposed, to adequately receive and retain the projection 1333. The adhesion adapter 1330 defines a bonding surface 1337 carrying a pressure sensitive adhesive 1339 for bonding the sheet gasket 1310 to a substrate. While the bonding side of the sheet gasket may be substantially planar, in the illustrated embodiment, ribs 1328 may be provided to define gaps between the sheet gasket and the substrate, for example, to receive additional sealant for additional bonding of the gasket 1310 to the substrate at a separate bonding surface spaced apart from the adhesion adapter bonding surface 1337.

[0061] FIG. 14 illustrates an exemplary overlay gasket seal member 1410 for use, for example, to seal over a mullion or other cross bar component. The exemplary overlay gasket 1410 includes a polymeric (e.g., silicone) overlay member 1420 and first and second adhesion adapters 1430 each having an enlarged end (e.g., hammerhead-shaped as shown) projection 1433 retained in interlocking engagement (and optionally also chemically bonded by a layer of adhesive) with a complementary shaped recessed pocket 1423 in enlarged side portions 1424 of the overlay member. The adhesion adapters 1430 define bonding surfaces 1437 carrying pressure sensitive adhesive 1439 for bonding the overlay gasket 1410 to a substrate. The side portions 1424 may be provided with fillets or other such recesses 1428 for receiving additional adhesive material (e.g., beads of silicone sealant).

[0062] FIG. 15 illustrates an exemplary expansion gasket seal member 1510 for use, for example, with an attached foam strip as an expansion joint between adjacent architectural substrates, which may be similar to, or incorporate features of, any of the expansion joints described above. The exemplary expansion gasket 1510 includes a polymeric (e.g., silicone) elongated gasket member 1520 including a laterally expandable (e.g., hinged or corrugated) portion 1521 extending between first and second lateral end portions 1522, and first and second adhesion adapters 1530 each having an enlarged end (e.g., bulbous or ball-shaped as shown) projection 1533 retained in interlocking engagement (and optionally also chemically bonded by a layer of adhesive) with a complementary shaped recessed pocket 1523 in the lateral end portions 1522. The adhesion adapters 1530 define bonding surfaces 1537 carrying pressure sensitive adhesive 1539 for bonding the lateral end portions 1522 of the expansion gasket 1510 to opposed surfaces of the adjacent substrates.

[0063] While various inventive aspects, concepts and features of the inventions may be described and illustrated herein as embodied in combination in the exemplary embodiments, these various aspects, concepts and features may be used in many alternative embodiments, either individually or in various combinations and sub-combinations thereof. Unless expressly excluded herein all such combinations and sub-combinations are intended to be within the scope of the present inventions. Still further, while various alternative embodiments as to the various aspects, concepts and features of the inventions--such as alternative materials, structures, configurations, methods, circuits, devices and components, alternatives as to form,

fit and function, and so on--may be described herein, such descriptions are not intended to be a complete or exhaustive list of available alternative embodiments, whether presently known or later developed. Those skilled in the art may readily adopt one or more of the inventive aspects, concepts or features into additional embodiments and uses within the scope of the present inventions even if such embodiments are not expressly disclosed herein. Additionally, even though some features, concepts or aspects of the inventions may be described herein as being a preferred or desired arrangement or method, such description is not intended to suggest that such feature is required or necessary unless expressly so stated. Still further, exemplary or representative values and ranges may be included to assist in understanding the present disclosure, however, such values and ranges are not to be construed in a limiting sense and are intended to be critical values or ranges only if so expressly stated. Parameters identified as "approximate" or "about" a specified value are intended to include both the specified value and values within 10% of the specified value, unless expressly stated otherwise. Further, it is to be understood that the drawings accompanying the present application may, but need not, be to scale, and therefore may be understood as teaching various ratios and proportions evident in the drawings. Moreover, while various aspects, features and concepts may be expressly identified herein as being inventive or forming part of an invention, such identification is not intended to be exclusive, but rather there may be inventive aspects, concepts and features that are fully described herein without being expressly identified as such or as part of a specific invention, the inventions instead being set forth in the appended claims. Descriptions of exemplary methods or processes are not limited to inclusion of all steps as being required in all cases, nor is the order that the steps are presented to be construed as required or necessary unless expressly so stated.

[0064] While the present invention has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the invention to such detail. Additional advantages and modifications will readily appear to those skilled in the art. For example, the specific locations of the component connections and interplacements can be modified. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative apparatus, and illustrative examples shown and described. Accordingly,

departures can be made from such details without departing from the spirit or scope of the applicant's general inventive concept.

Claims

1. An expansion joint comprising:

a foam strip having first and second lateral side surfaces extending axially outward to an outer edge surface; and

an elongated gasket having a laterally expandable portion adhered to the outer edge surface of the foam strip, the laterally expandable portion extending between first and second lateral end portions each defining at least one of a laterally outward facing bonding surface and an axially inward facing bonding surface, the at least one bonding surface being spaced apart axially outward from the corresponding one of the first and second lateral side surfaces of the foam strip.

2. The expansion joint of claim 1, wherein the outer edge surface of the foam strip is a substantially planar surface.

3. The expansion joint of claim 1, wherein the outer edge surface of the foam strip is contoured to be closely received in a plurality of corrugations of the laterally expandable portion of the elongated gasket.

4. The expansion joint of any of claims 1-3, wherein the laterally expandable portion of the elongated gasket includes a plurality of V-shaped corrugations.

5. The expansion joint of any of claims 1-3, wherein the laterally expandable portion of the elongated gasket includes a plurality of inverted U-shaped corrugations.

6. The expansion joint of any of claims 1-5, wherein the elongated gasket comprises at least one of silicone, polyethylene, polypropylene, thermoplastic elastomer, ethylene propylene diene monomer (EPDM), polyvinyl chloride (PVC), and other suitable polymers or thermoplastics.

7. The expansion joint of any of claims 1-6, wherein the elongated gasket is adhered to the foam strip by a sealant comprising at least one of silicone, polyurethane, other epoxies, and hybrid sealants.

8. The expansion joint of any of claims 1-7, wherein the foam strip comprises at least one of polyurethane, polyurethane, acrylics, silicone, polyester, or polyether foam materials.

9. The expansion joint of any of claims 1-8, wherein at least one of the first and second lateral side surfaces of the foam strip comprises a pressure sensitive adhesive.

10. The expansion joint of any of claims 1-9, wherein the at least one bonding surface of the first and second lateral end portions defines a recessed portion for receiving a sealant.

11. The expansion joint of claim 10, wherein the recessed portion includes a plurality of grooves.

12. The expansion joint of any of claims 1-11, wherein the first and second lateral end portions of the elongated gasket include laterally outward extending flange portions defining axially inward facing bonding surfaces.

13. The expansion joint of any of claims 1-12, wherein the elongated gasket further comprises first and second adapter components secured to the corresponding ones of the first and second lateral end portions of the elongated gasket, the first and second adapter components defining the at least one bonding surface of the corresponding ones of the first and second lateral end portions.

14. The expansion joint of claim 13, wherein the elongated gasket comprises silicone and the first and second adapter components comprise at least one of metals (e.g., aluminum), plastics (e.g., extruded plastics, thermoplastics, PVC), and fibrous materials (e.g., fiberglass).

15. The expansion joint of any one of claims 13 and 14, wherein each of the first and second lateral end portions of the elongated gasket comprises a recessed pocket, and each of the first and second adapter components comprises a complementary shaped projection received in interlocking engagement with the corresponding one of the recessed pockets.

16. The expansion joint of any of claims 13-15, wherein the first and second adapter components are chemically bonded to the corresponding ones of the first and second lateral end portions of the elongated gasket by a silicone sealant.

17. The expansion joint of any of claims 1-16, wherein the elongated gasket has an axial height of approximately 5/8 inch, or between about ¼ inch and about 1 ½ inches.

18. The expansion joint of any of claims 1-17, wherein the elongated gasket has a nominal lateral width selected to accommodate expansion joints having width ranges from about 75% smaller to about 100% larger than the nominal width of the expansion joint, or from about 50% smaller to about 50% larger than the nominal width of the expansion joint.

19. The expansion joint of any of claims 1-18, wherein the laterally expandable portion has a wall thickness of approximately 0.07 inches, or between about 0.03 inches and about 1/8 inches.

20. The expansion joint of any of claims 1-19, wherein the laterally expandable portion includes a plurality of corrugations each having a lateral width of approximately ½ inch, or between about ¼ inch and about 1 ½ inches.

21. The expansion joint of any of claims 1-20, wherein the laterally expandable portion is adhered to the outer edge surface of the foam strip at a plurality of laterally spaced locations.

22. The expansion joint of any of claims 1-21, wherein the at least one bonding surface of the corresponding ones of the first and second lateral end portions includes a pressure sensitive adhesive.

23. The expansion joint of any of claims 1-22, wherein the laterally expandable portion includes downward projections received in corresponding channels in the outer edge surface of the foam strip.

24. An architectural joint system comprising:

a first substrate having a lateral end surface extending axially outward to an outer surface;

a second substrate having a lateral end surface facing the lateral end surface of the first substrate and extending axially outward to an outer surface; and

an expansion joint compressed between the first substrate and the second substrate, the expansion joint comprising:

a foam strip having first and second lateral side surfaces extending axially outward to an outer edge surface recessed from the outer surfaces of the first and second substrates, the first lateral side surface engaging the lateral end surface of the first substrate and the second lateral side surface engaging the lateral end surface of the second substrate; and

an elongated gasket having a laterally expandable portion adhered to the outer edge surface of the foam strip and extending between first and second lateral end portions, the first lateral end portion being bonded to the first substrate at a location spaced apart axially outward from the first lateral side surface and the second lateral end portion being bonded to the second substrate at a location spaced apart axially outward from the second lateral side surface.

25. The system of claim 24, wherein the first and second lateral end portions of the elongated gasket are bonded to the lateral surfaces of the first and second substrates.

26. The system of any of claims 24 and 25, wherein the first and second lateral end portions of the elongated gasket are bonded to the outer surfaces of the first and second substrates.

27. The system of any of claims 24-26, wherein an outer surface of the laterally expandable portion of the elongated gasket is substantially flush with the outer surfaces of the first and second substrates.

28. The system of any of claims 24-27, wherein the foam strip is compressed between the first and second substrates.

29. The system of any of claims 24-28, wherein the expansion joint comprises the expansion joint of any of claims 1-21.

30. A method of installing an expansion joint between first and second substrates having opposed lateral end surfaces extending axially outward to outer surfaces, the method comprising:

installing a pre-compressed foam strip between the first and second substrates, such that a first lateral side surface of the foam strip engages the lateral end surface of the first substrate, a second lateral side surface of the foam strip engages the lateral end surface of the second substrate, and an outer edge surface of the foam strip is recessed from the outer surfaces of the first and second substrates;

providing an elongated gasket having a laterally expandable portion extending between first and second lateral end portions;

adhering the laterally expandable portion of the elongated gasket to the outer edge surface of the foam strip;

adhering the first lateral end portion of the elongated gasket to the first substrate; and

adhering the second lateral end portion of the elongated gasket to the second substrate.

31. The method of claim 30, wherein the outer edge surface of the foam strip is a substantially planar surface.

32. The method of claim 30, wherein the outer edge surface of the foam strip is contoured to be closely received in a plurality of corrugations of the laterally expandable portion of the elongated gasket.

33. The method of any of claims 30-32, wherein the laterally expandable portion of the elongated gasket includes a plurality of V-shaped corrugations.

34. The method of any of claims 30-32, wherein the laterally expandable portion of the elongated gasket includes a plurality of inverted U-shaped corrugations.

35. The method of any of claims 30-34, wherein the elongated gasket comprises at least one of silicone, polyethylene, polypropylene, thermoplastic elastomer, ethylene propylene diene monomer (EPDM), polyvinyl chloride (PVC), and other suitable polymers or thermoplastics.

36. The method of any of claims 30-35, wherein adhering the laterally expandable portion of the elongated gasket to the outer edge surface of the foam strip comprises applying a sealant to the outer edge surface of the foam strip.

37. The method of claim 36, wherein the sealant comprises at least one of silicone, polyurethane, other epoxies, and hybrid sealants.

38. The method of any of claims 30-37, wherein the foam strip comprises at least one of polyurethane, polyurethane, acrylics, silicone, polyester, or polyether foam materials.

39. The method of any of claims 30-38, wherein at least one of the first and second lateral side surfaces of the foam strip comprise a pressure sensitive adhesive.

40. The method of any of claims 30-39, wherein adhering the first and second lateral end portions of the elongated gasket to the first and second substrates comprises applying an sealant to at least one bonding surface of each of the first and second lateral end portion of the elongated gasket.

41. The method of claim 40, wherein applying the sealant to the at least one bonding surface of each of the first and second lateral end portion of the elongated gasket comprises applying a bead of sealant in a recessed portion of each of the at least one bonding surface.

42. The method of claim 41, wherein the recessed portion includes a plurality of grooves.

43. The method of any of claims 30-42, wherein adhering the first and second lateral end portions of the elongated gasket to the first and second substrates comprises adhering laterally outward extending flange portions of the first and second lateral end portions to the outer surface of the first and second substrates.

44. The method of any of claims 30-43, wherein the elongated gasket further comprises first and second adapter components secured to the corresponding ones of the first and second lateral end portions of the elongated gasket, wherein adhering the first and second lateral end portions of the elongated gasket to the first and second substrates comprises adhering the first and second adapter components to the first and second substrates.

45. The method of claim 44, wherein the elongated gasket comprises silicone and the first and second adapter components comprise at least one of metals (e.g., aluminum), plastics (e.g., extruded plastics, thermoplastics, PVC), and fibrous materials (e.g., fiberglass).

46. The method of any of claims 44 and 45, wherein each of the first and second lateral end portions of the elongated gasket comprises a recessed pocket, and each of the first and second adapter components comprises a complementary shaped projection received in interlocking engagement with the corresponding one of the recessed pockets.

47. The method of any of claims 44-46, wherein the first and second adapter components are chemically bonded to the corresponding ones of the first and second lateral end portions of the elongated gasket by a silicone sealant.

48. The method of any of claims 30-47, wherein the elongated gasket has an axial height of approximately 5/8 inch, or between about ¼ inch and about 1 ½ inches.

49. The method of any of claims 30-48, wherein the elongated gasket has a nominal lateral width selected to accommodate expansion joints having width ranges from about 75% smaller to about 100% larger than the nominal width of the expansion joint, or from about 50% smaller to about 50% larger than the nominal width of the expansion joint.

50. The method of any of claims 30-49, wherein the laterally expandable portion has a wall thickness of approximately 0.07 inches, or between about 0.03 inches and about 1/8 inches.

51. The method of any of claims 30-50, wherein the laterally expandable portion includes a plurality of corrugations each having a lateral width of approximately ½ inch, or between about ¼ inch and about 1 ½ inches.

52. The method of any of claims 30-51, wherein adhering the laterally expandable portion of the elongated gasket to the outer edge surface of the foam strip comprises adhering the laterally expandable portion to the outer edge surface of the foam strip at a plurality of laterally spaced locations.

53. The method of any of claims 30-52, wherein adhering the first and second lateral end portions of the elongated gasket to the first and second substrates comprises adhering the first and second lateral end portions to the lateral end surfaces of the first and second substrates.

54. The method of any of claims 30-53, wherein adhering the first and second lateral end portions of the elongated gasket to the first and second substrates comprises adhering the first and second lateral end portions to the outer surfaces of the first and second substrates.

55. The method of any of claims 30-54, wherein installing the pre-compressed foam strip between the first and second substrates comprises positioning the foam strip such that an outer surface of the laterally expandable portion of the elongated gasket is substantially flush with the outer surfaces of the first and second substrates when the laterally expandable portion of the elongated gasket is adhered to the outer edge surface of the foam strip.

56. The method of any of claims 30-55, wherein adhering the first and second lateral end portions of the elongated gasket to the first and second substrates comprises engaging a pressure sensitive adhesive coating on a bonding surface of each of the first and second lateral end portions of the elongated gasket to a corresponding one of the first and second substrates.

57. A field bondable polymeric seal member, comprising:

a polymeric component having a first surface tension; and

an adhesion adapter attached to the polymeric component and defining a bonding surface having a second surface tension greater than the first surface tension.

58. The seal member of claim 57, wherein the first surface tension is less than about 35 mNm, and the second surface tension is at least about 35 mNm.

59. The seal member of any of claims 57 and 58, wherein the polymeric component comprises at least one of silicone, epoxies, acrylics, urethanes, and PTFE.

60. The seal member of any of claims 57-59, wherein the adhesion adapter comprises at least one of metals (e.g., aluminum), plastics (e.g., extruded plastics, thermoplastics, PVC), or fibrous materials (e.g., fiberglass).

61. The seal member of any of claims 57-60, wherein the polymeric component comprises a gasket.

62. The seal member of any of claims 57-61, wherein the gasket comprises one of a sheet gasket, an overlay gasket, and an expansion gasket.

63. The seal member of any of claims 57-62, wherein the adhesion adapter is chemically bonded to the polymeric component.

64. The seal member of any of claims 57-63, wherein one of the polymeric component and the adhesion adapter comprises a recessed pocket, and the other of the polymeric component and the adhesion adapter comprises a complementary shaped projection received in interlocking engagement with the recessed pocket to attach the adhesion adapter to the polymeric component.

65. The seal member of claim 64, wherein the projection comprises an enlarged distal portion that interlocks with a narrow outer portion of the recessed pocket.

66. The seal member of any of claims 64 and 65, wherein the polymeric component comprises the recessed pocket, and the adhesion adapter comprises the projection.

67. The seal member of any of claims 57-66, wherein the adhesion adapter comprises a first adhesion adapter attached to a first portion of the polymeric component and defining a first bonding surface, the seal member further comprising a second adhesion adapter attached to a second portion of the polymeric component and defining a second bonding surface spaced apart from the first bonding surface.

68. The seal member of claim 67, wherein the polymeric component comprises an elongated gasket having a laterally expandable portion extending between first and second lateral end portions, with the first adhesion adapter attached to the first lateral end portion and the second adhesion adapter attached to the second lateral end portion.

69. The seal member of any of claims 57-68, further comprising an adhesive disposed on the bonding surface.

70. The seal member of any of claim 69, wherein the adhesive comprises a pressure sensitive adhesive.

71. The seal member of any of claims 57-70, wherein the polymeric component comprises one of an extruded component and a molded component.

72. A bonded seal arrangement, comprising:

a polymeric seal member, comprising:

a polymeric component having a first surface tension; and

an adhesion adapter attached to the polymeric component and defining a first bonding surface having a second surface tension greater than the first surface tension;

a substrate defining a second bonding surface having a third surface tension greater than the first surface tension; and

an adhesive layer bonding the first bonding surface to the second bonding surface.

73. The arrangement of claim 73, wherein the seal member comprises the seal member of any of claims 57-71.

74. The arrangement of any of claims 72 and 73, wherein the substrate comprises at least one of aluminum, concrete, glass, wood, vinyl, and building composites.

75. The arrangement of any of claims 72-74, wherein the third surface tension is at least about 35mNm.

76. The arrangement of any of claims 72-75, wherein the polymeric component defines a third bonding surface spaced apart from the first bonding surface, and the substrate defines a fourth bonding surface affixed to the third bonding surface.

77. The arrangement of claim further comprising a cured sealant adhering the third bonding surface to the fourth bonding surface.

78. A method of making a field bondable polymeric seal member, the method comprising:

providing a polymeric component having a first surface tension; and

attaching an adhesion adapter to the polymeric component, the adhesion adapter defining a bonding surface having a second surface tension greater than the first surface tension.

79. The method of claim 78, further comprising applying an adhesive to the bonding surface.

80. The method of claim 79, wherein the adhesive comprises a pressure sensitive adhesive.

81. The method of any of claims 78-80, wherein the first surface tension is less than about 35 mNm, and the second surface tension is at least about 35mNm.

82. The method of any of claims 78-81, wherein the polymeric component comprises at least one of silicone, epoxies, acrylics, urethanes, and PTFE.

83. The method of any of claims 78-82, wherein the adhesion adapter comprises at least one of metals (e.g., aluminum), plastics (e.g., extruded plastics, thermoplastics, PVC), or fibrous materials (e.g., fiberglass).

84. The method of any of claims 78-83, wherein the polymeric component comprises a gasket.

85. The method of claim 84, wherein the gasket comprises one of a sheet gasket, an overlay gasket, and an expansion gasket.

86. The method of any of claims 78-85, wherein attaching the adhesion adapter to the polymeric component comprises chemically bonding the adhesion adapter to the polymeric component.

87. The method of any of claims 78-86, wherein attaching the adhesion adapter to the polymeric component comprises inserting a projection disposed on one of the polymeric component and the adhesion adapter into interlocking engagement with a complementary shaped recessed pocket disposed in the other of the polymeric component and the adhesion adapter.

88. The method of claim 87, wherein the projection comprises an enlarged distal portion that interlocks with a narrow outer portion of the recessed pocket.

89. The method of any of claims 87 and 88, wherein the recessed pocket is disposed in the polymeric component, and the projection is disposed on the adhesion adapter.

90. The method of any of claims 78-89, wherein attaching the adhesion adapter to the polymeric component comprises attaching a first adhesion adapter defining a first bonding

surface to a first portion of the polymeric component, the method further comprising attaching a second adhesion adapter to a second portion of the polymeric component adhesion adapter, the second adhesion adapter defining a second bonding surface spaced apart from the first bonding surface and having a third surface tension greater than the first surface tension.

91. The method of claim 90, wherein the polymeric component comprises an elongated gasket having a laterally expandable portion extending between first and second lateral end portions, wherein attaching the first adhesion adapter to the first portion of the polymeric component comprises attaching the first adhesion adapter to the first lateral end portion, and attaching the second adhesion adapter to the second portion of the polymeric component comprises attaching the second adhesion adapter to the second lateral end portion.

92. The method of any of claims 78-91, wherein the polymeric component comprises one of an extruded component and a molded component.

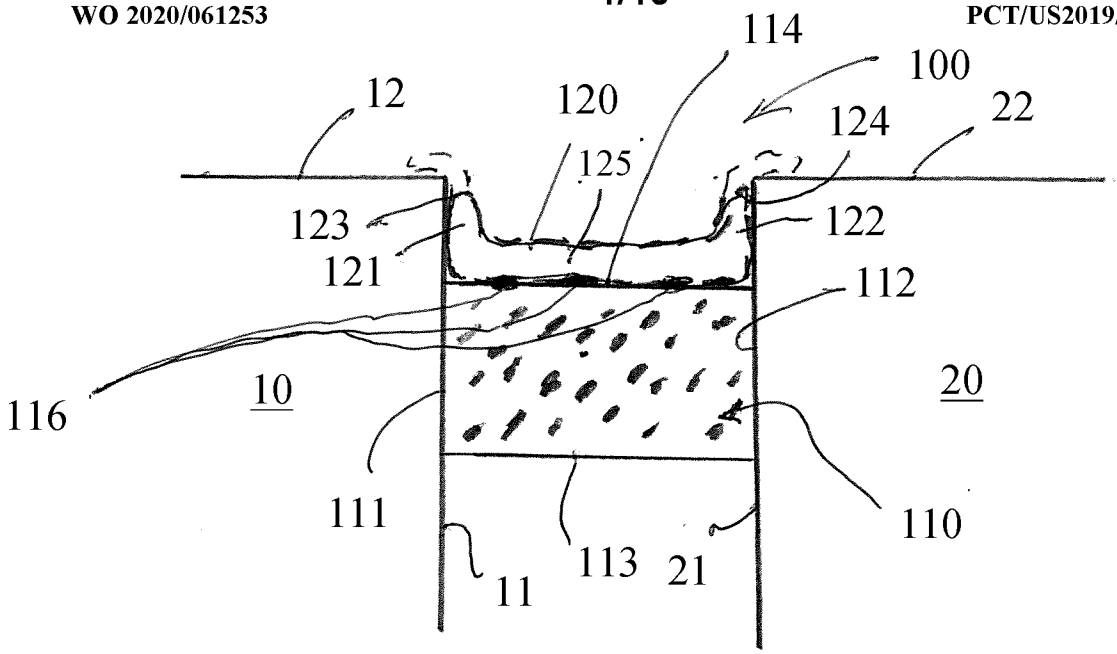

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FIG. 1

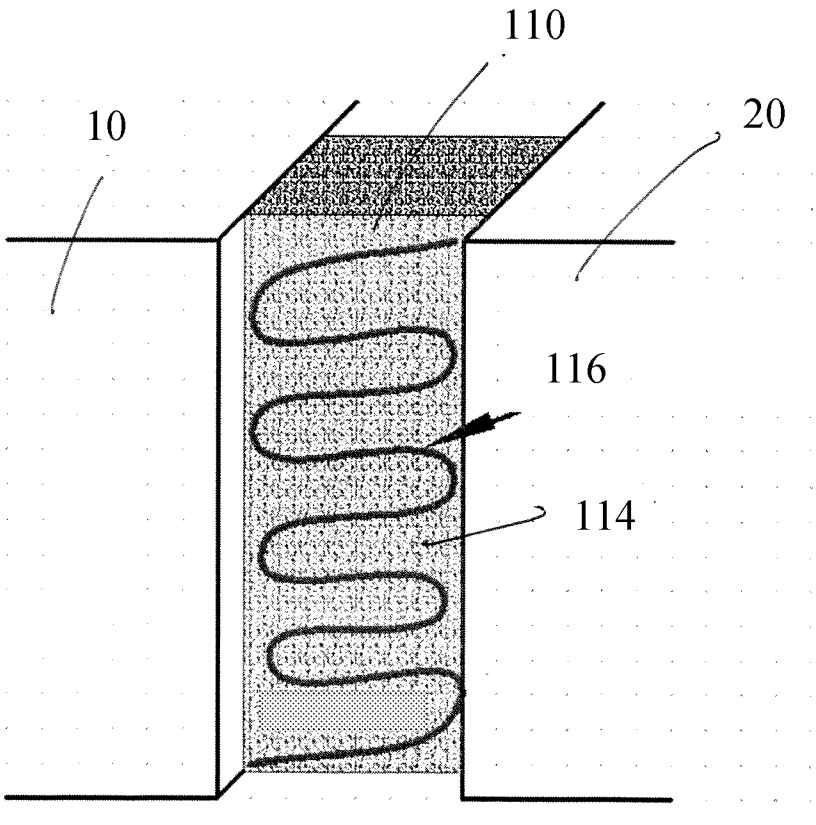

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FIG. 1A

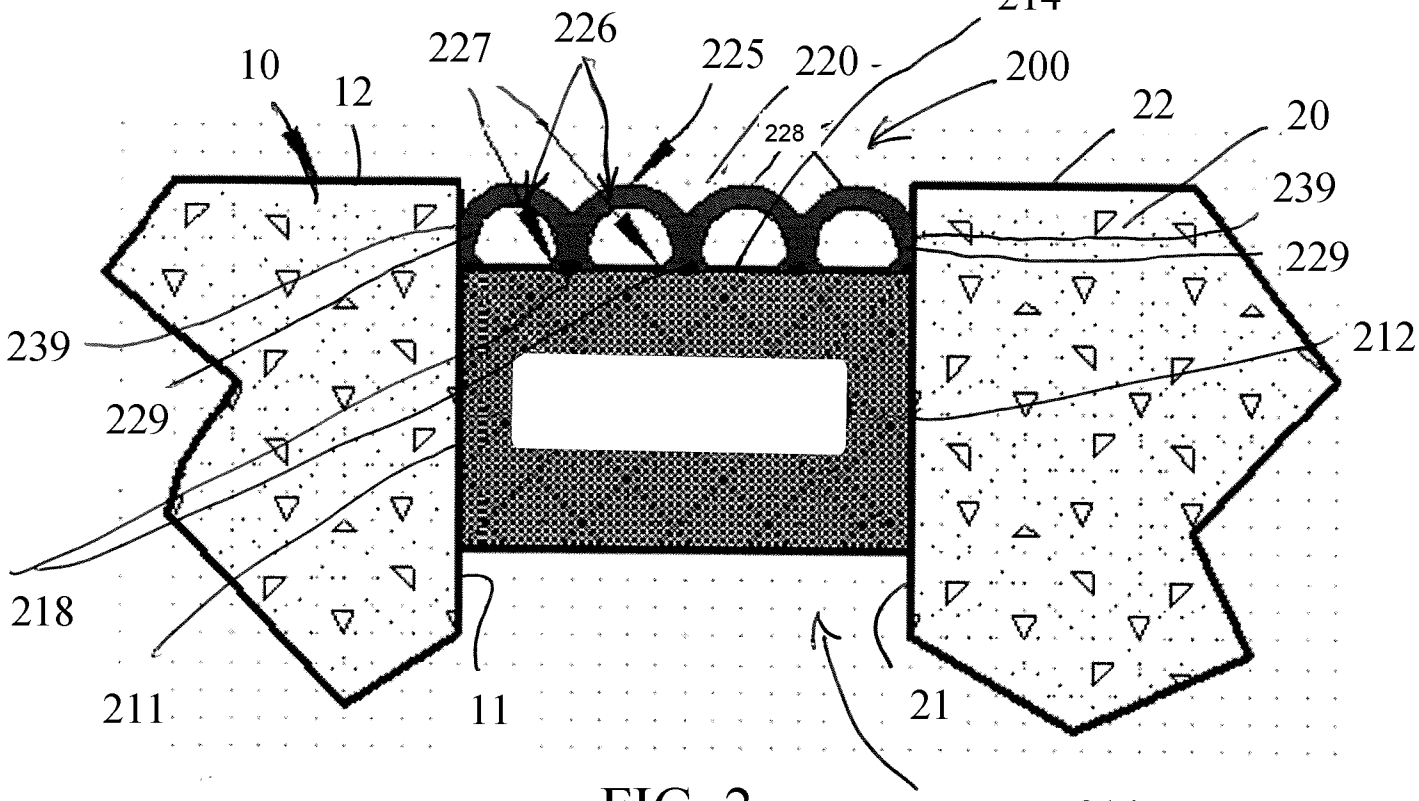

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FIG. 2

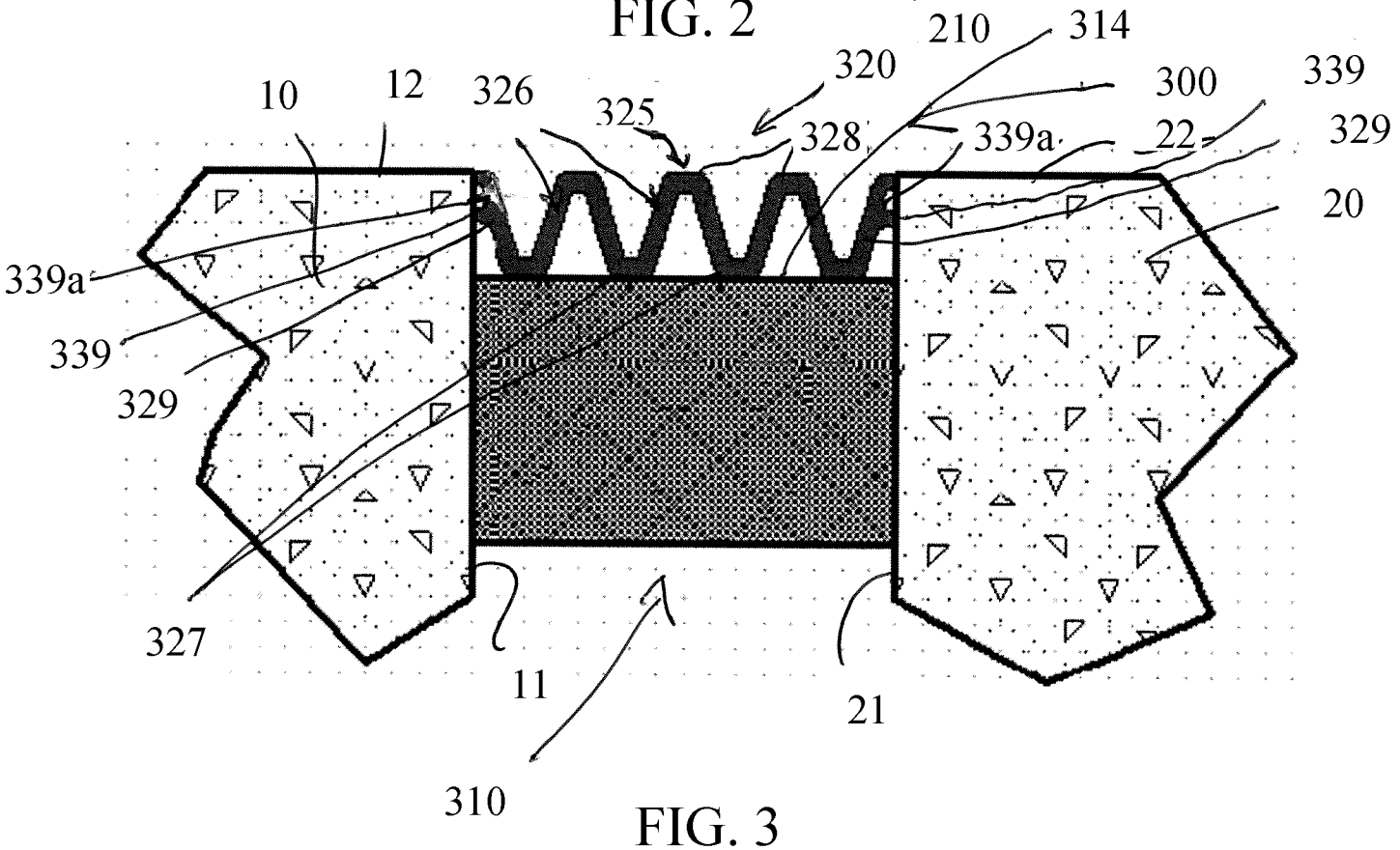

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FIG. 3

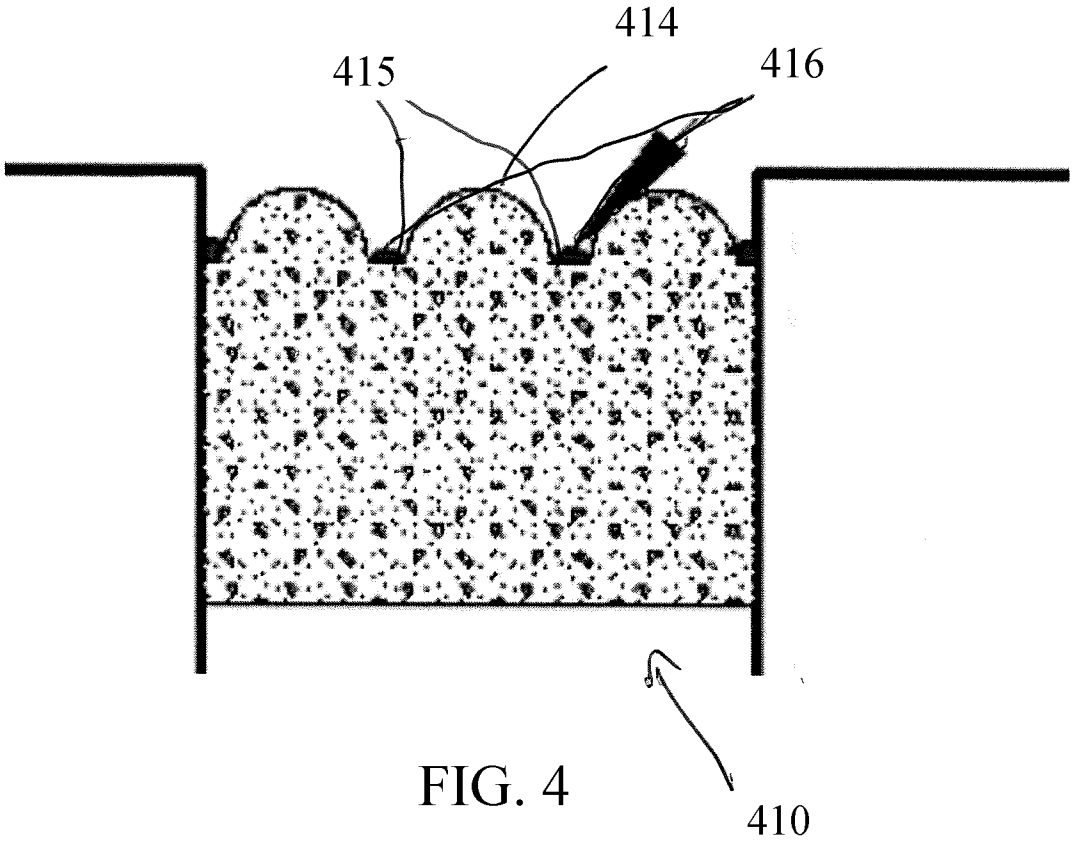


FIG. 4

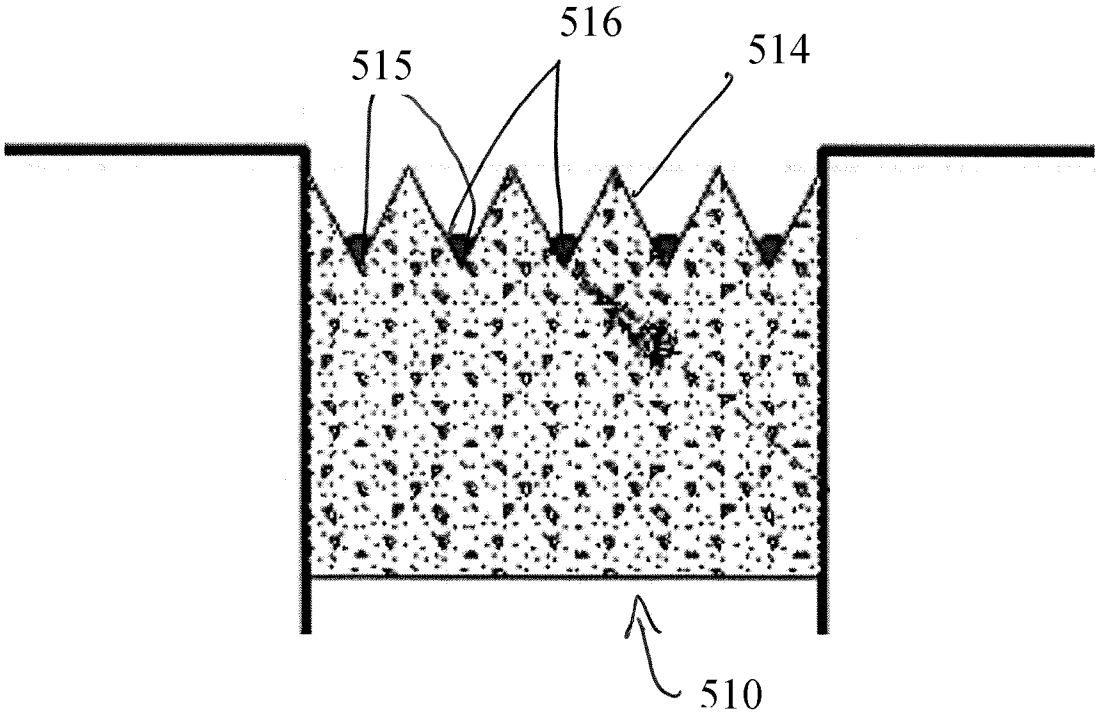


FIG. 5

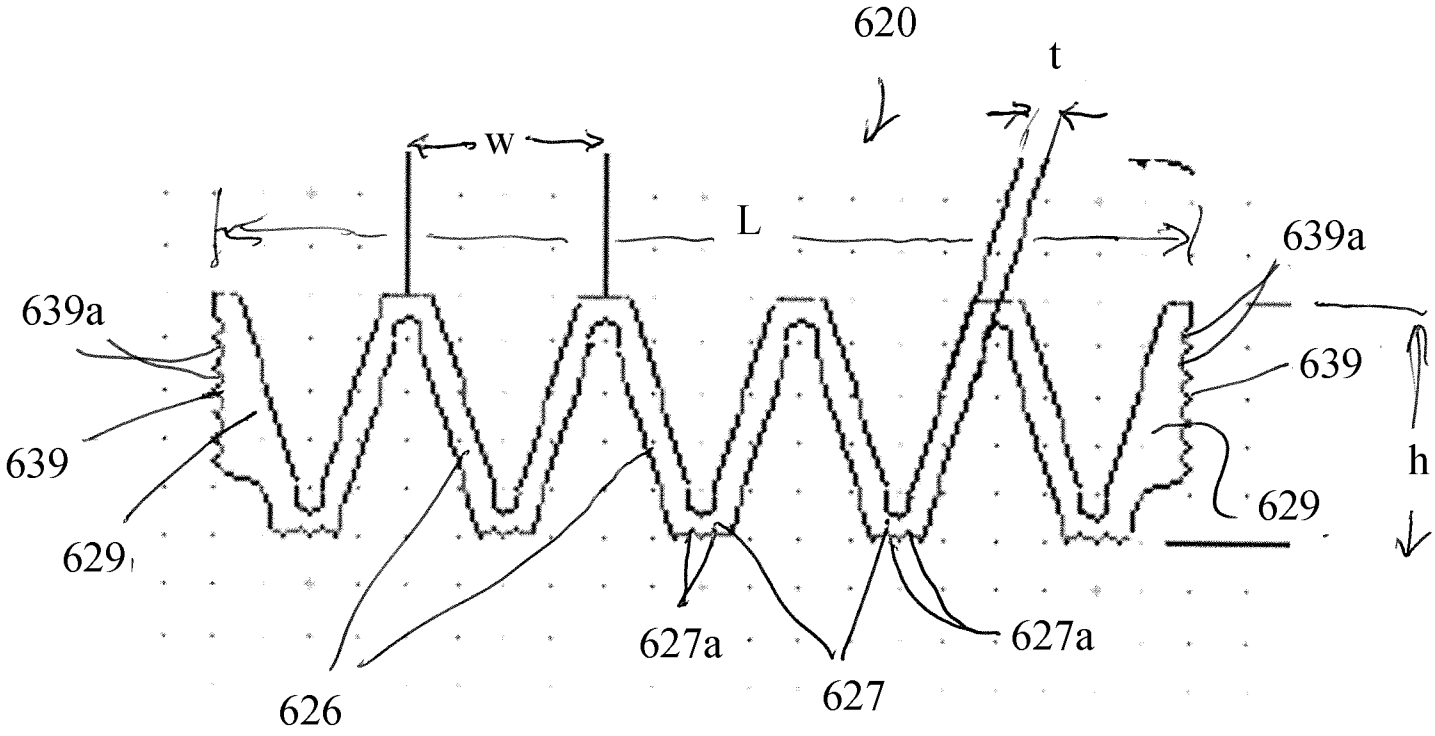

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FIG. 6

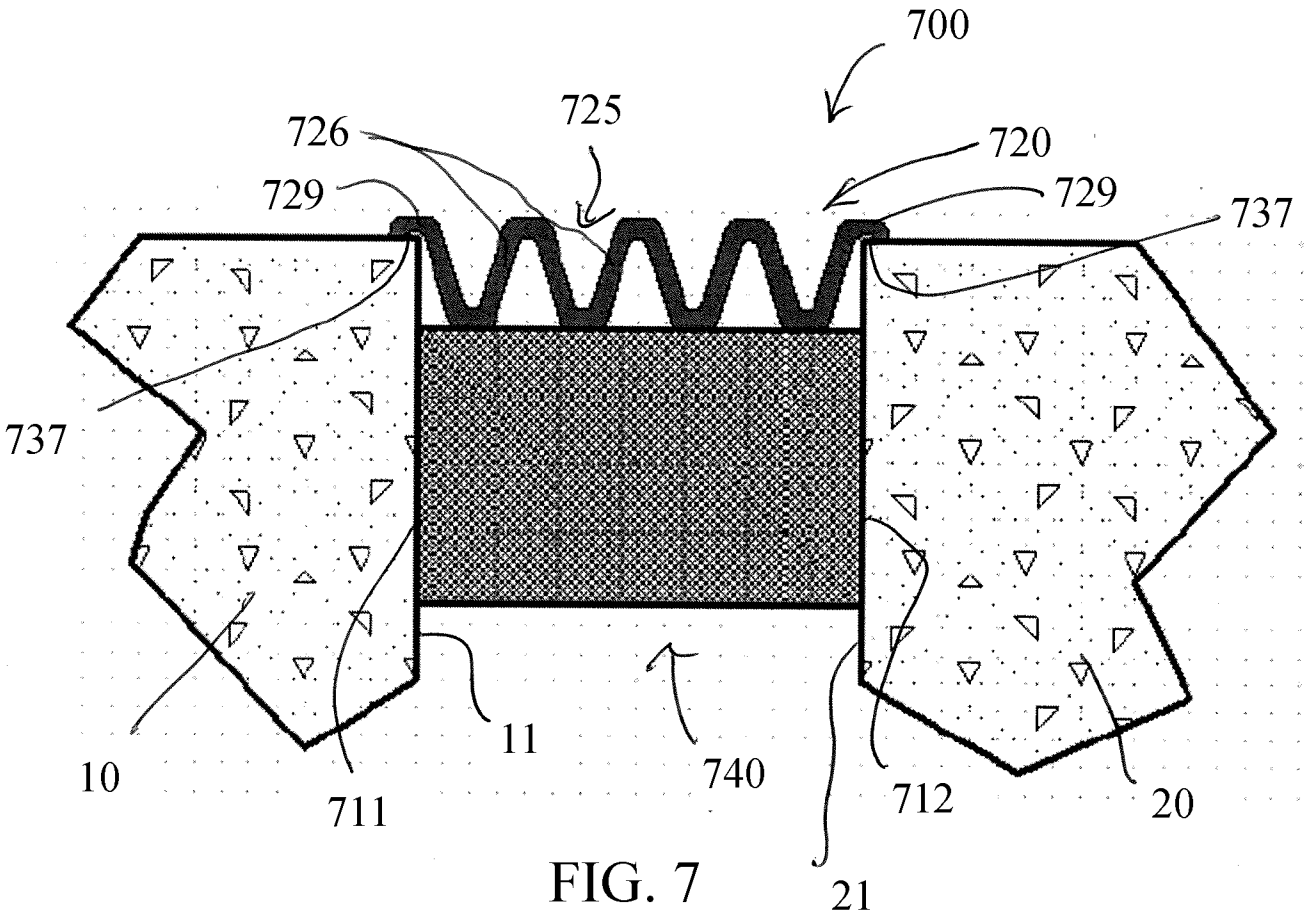

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FIG. 7

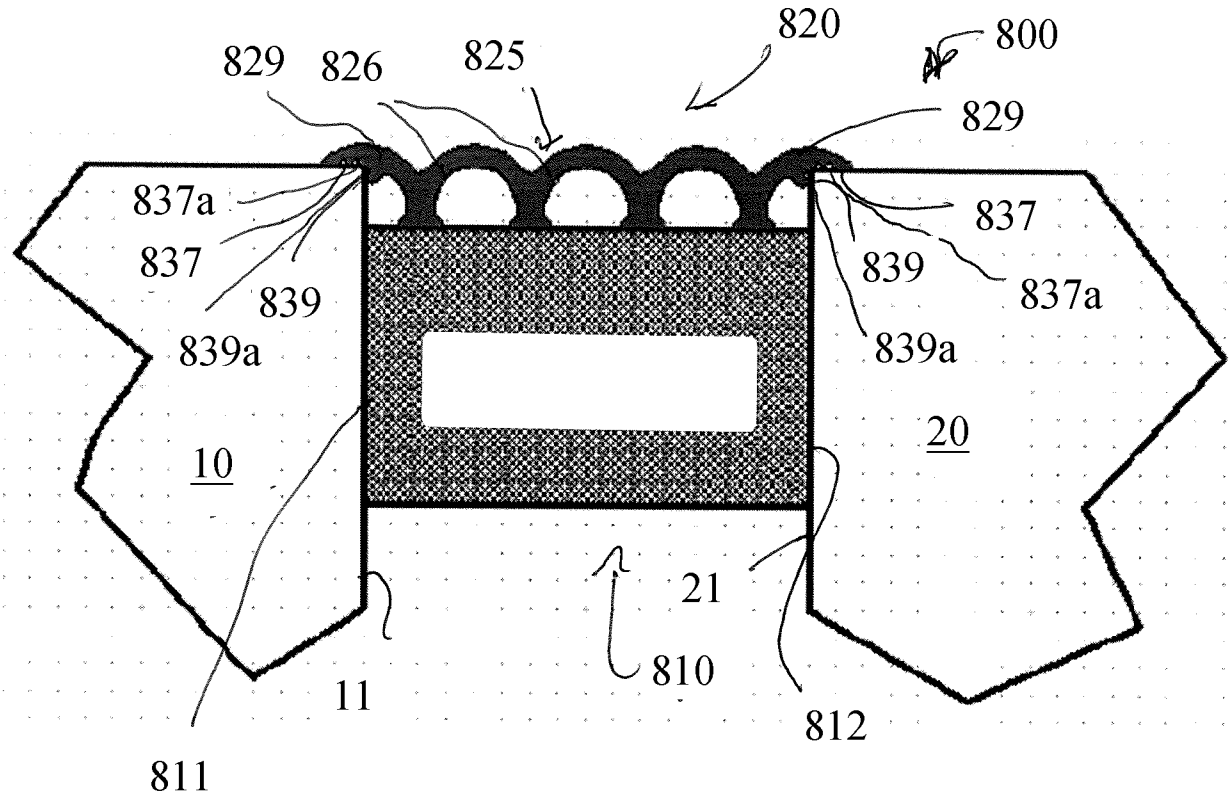

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FIG. 8

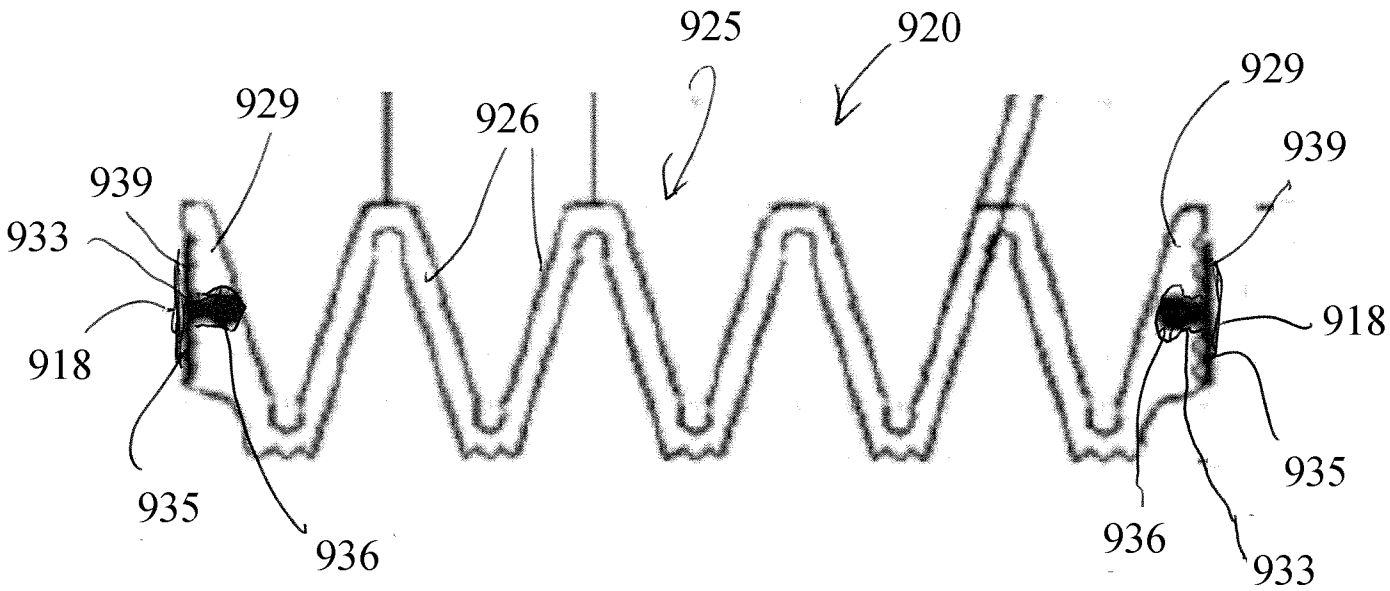

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FIG. 9

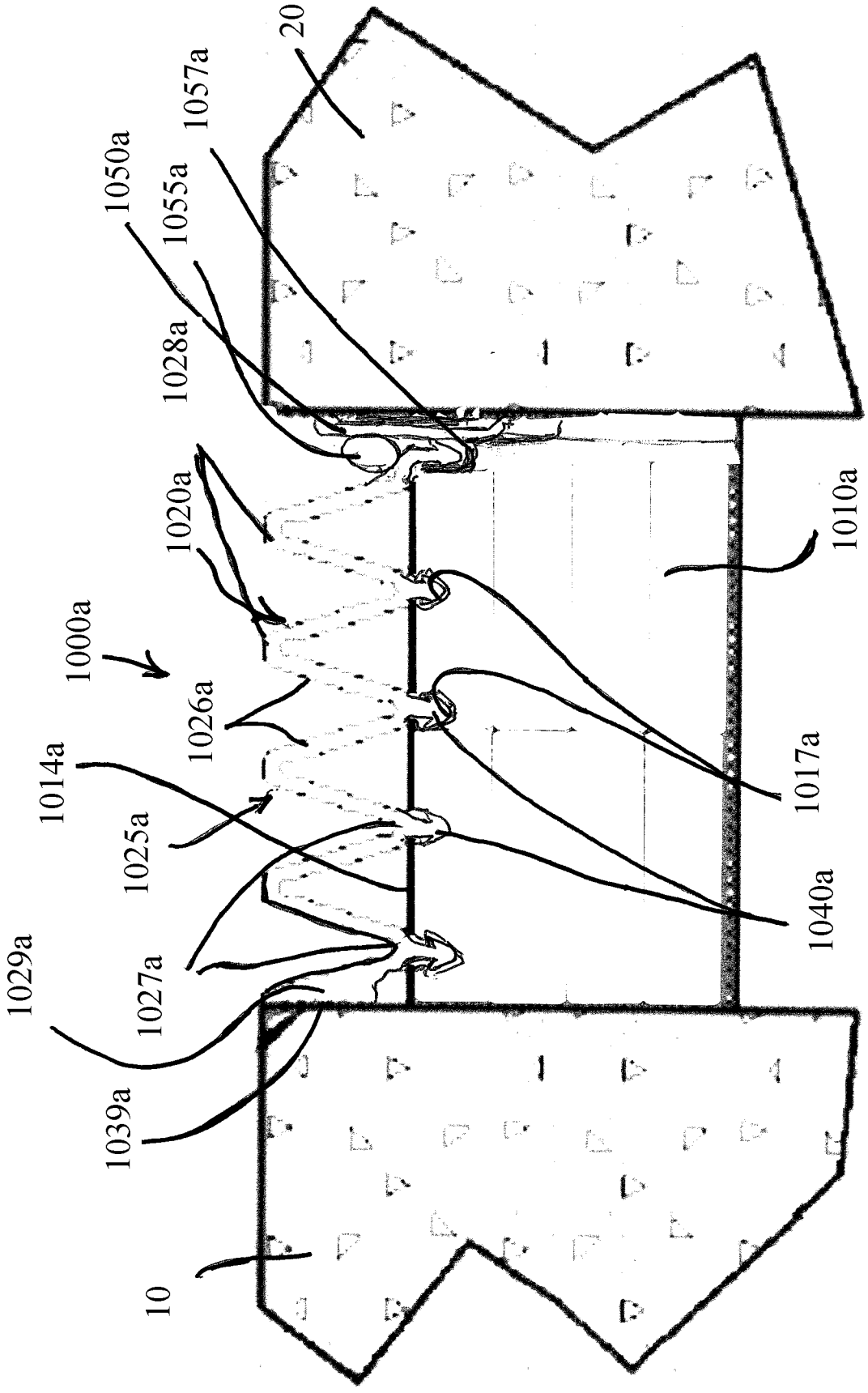

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FIG. 10A

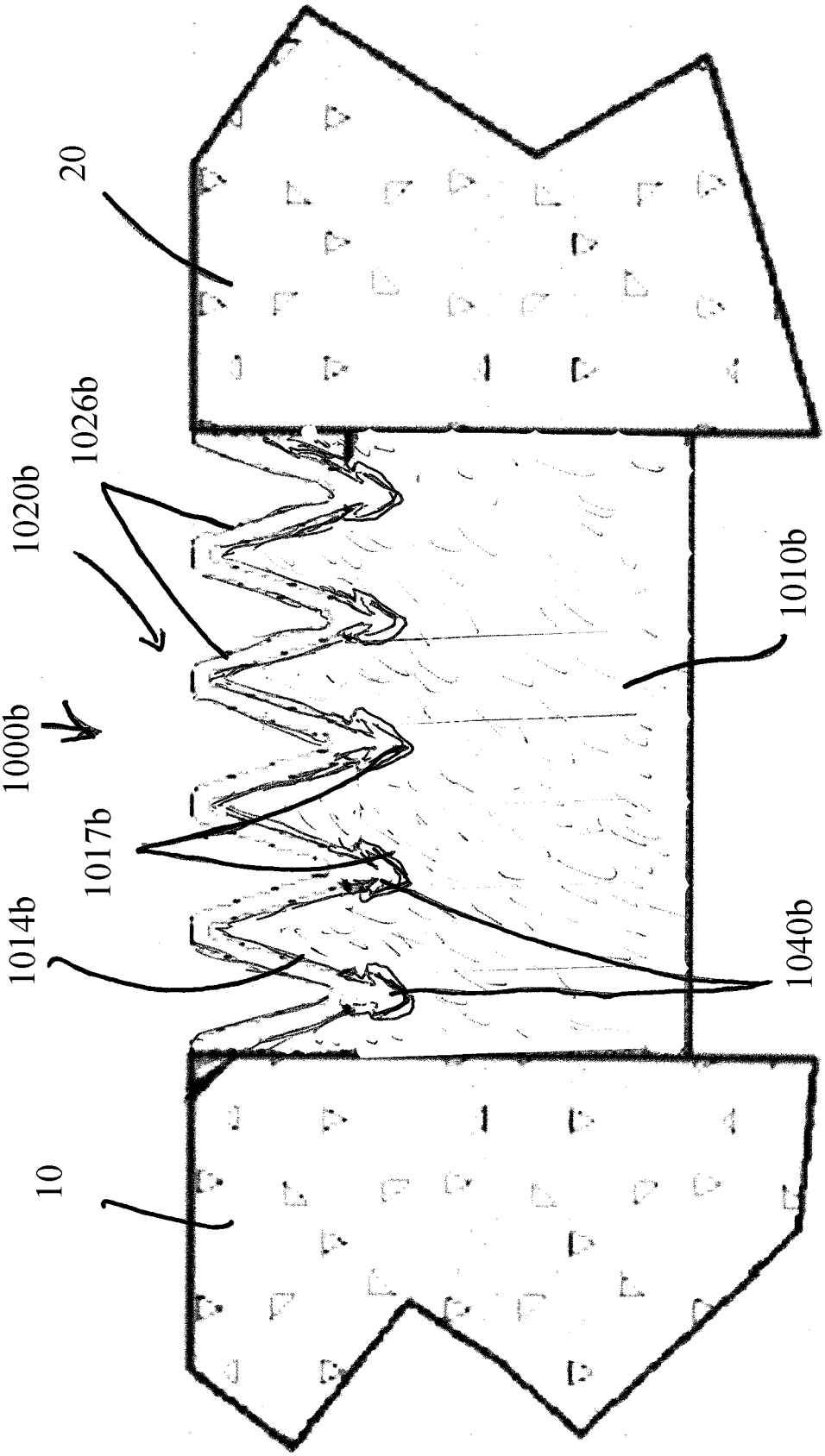


FIG. 10B

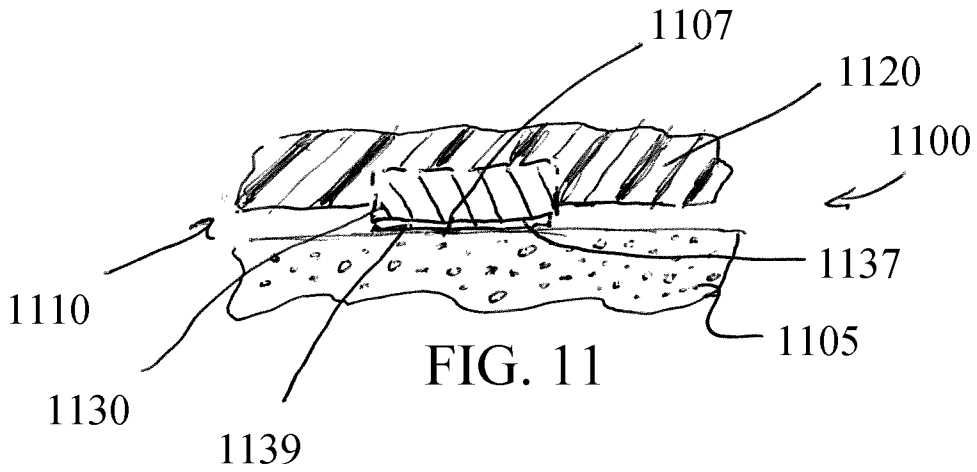


FIG. 11

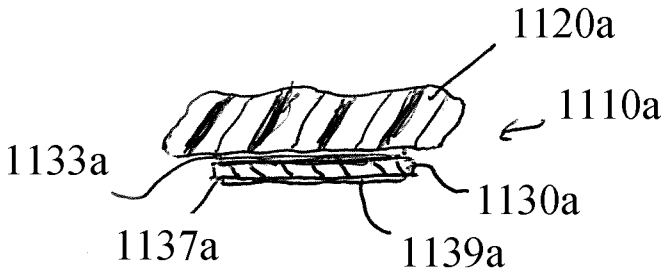


FIG. 11A

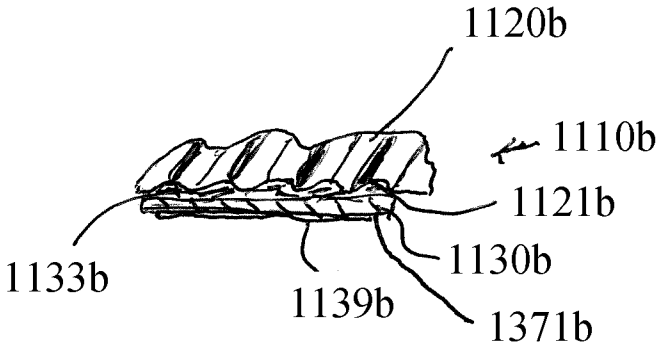


FIG. 11B

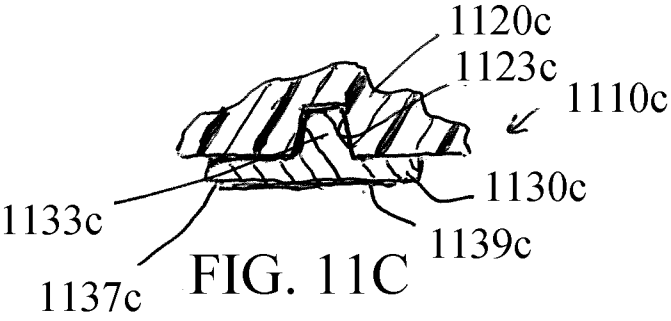


FIG. 11C

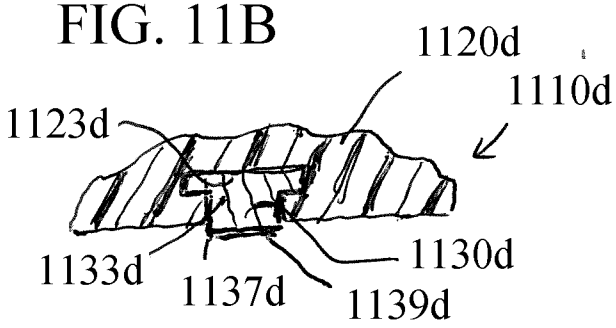


FIG. 11D

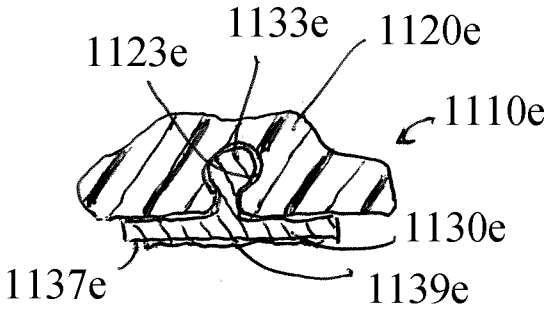


FIG. 11E

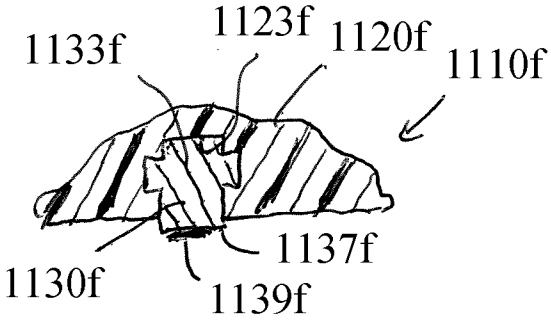


FIG. 11F

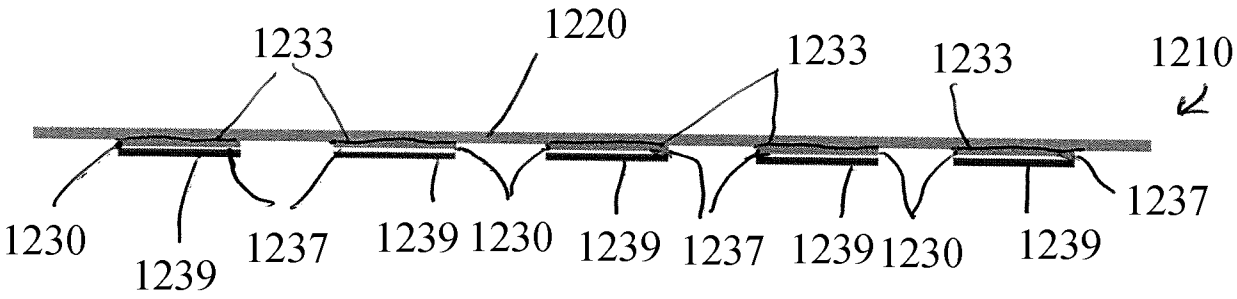

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FIG. 12

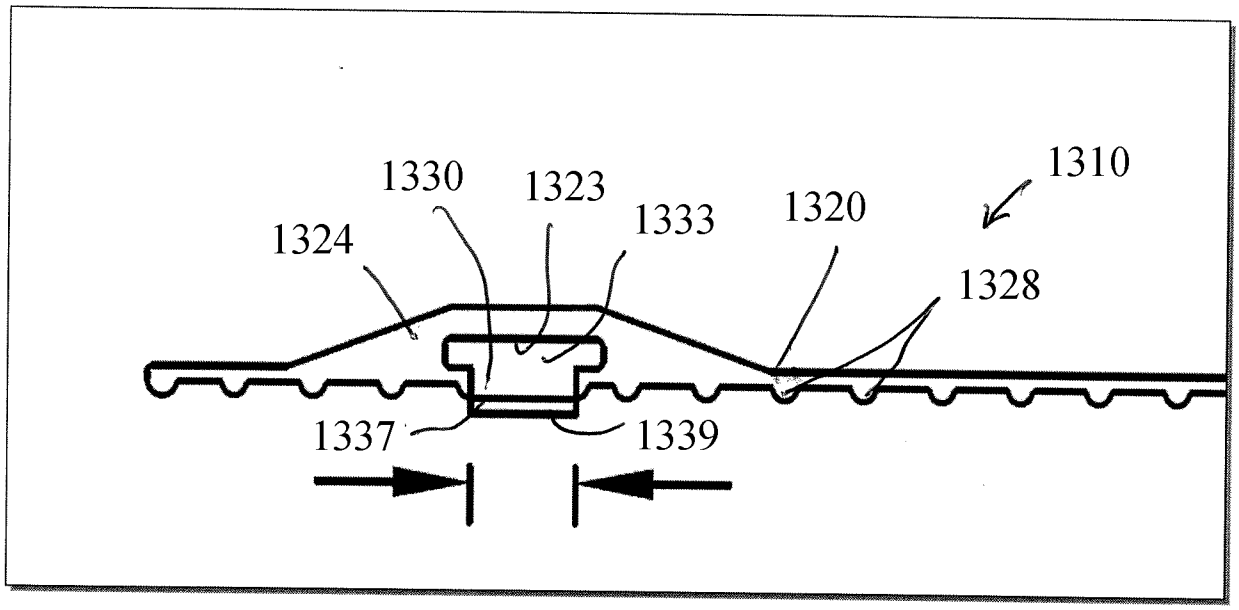

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FIG. 13

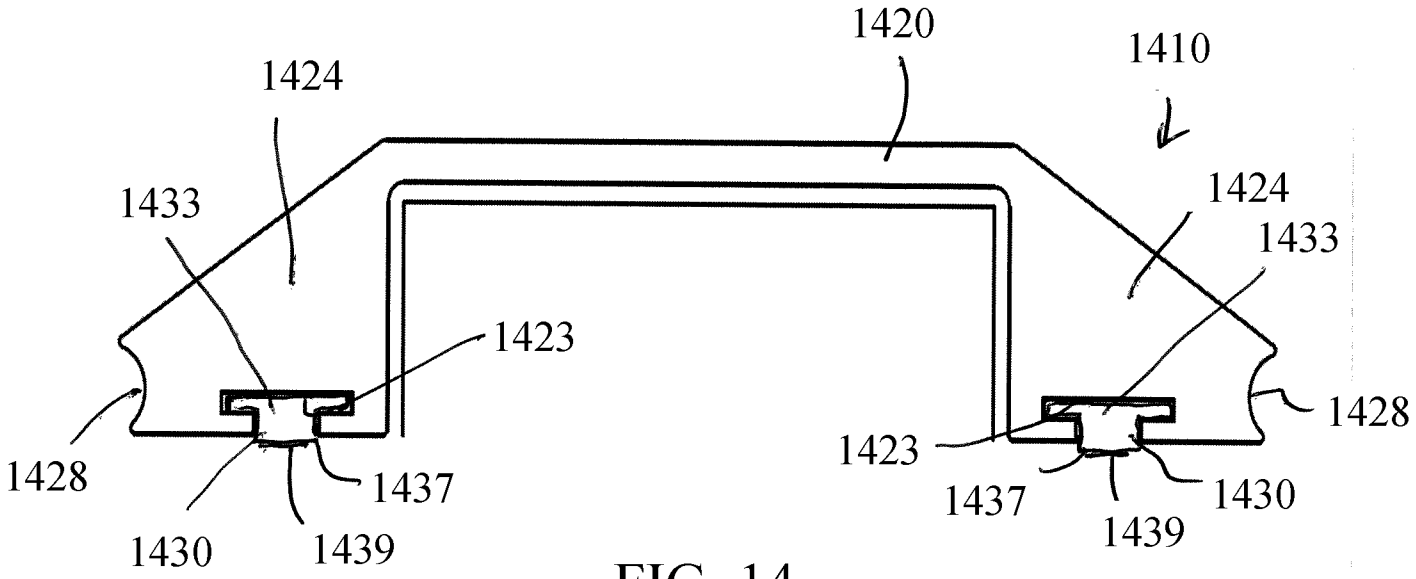

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FIG. 14

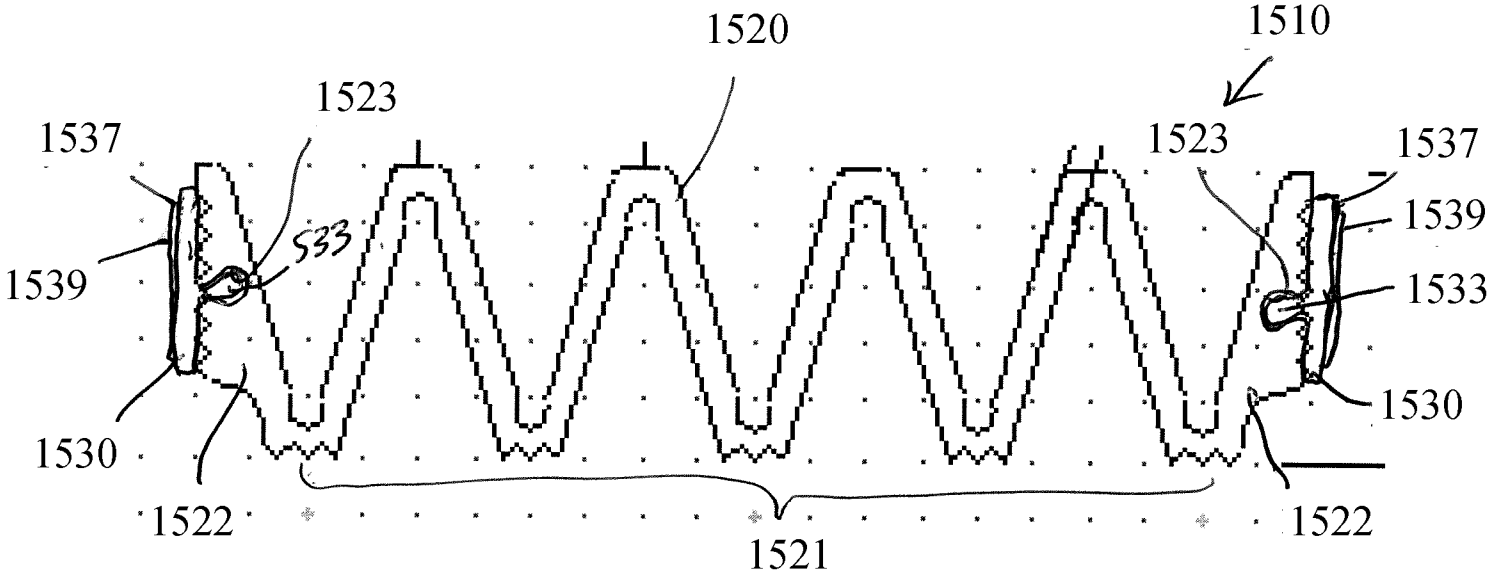

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FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/051829

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 6-23, 27-29, 35-56, 60-71, 73-76, 82-92
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See extra sheet(s).

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-5, 24-26, 30-34

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/051829

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - E04B 1/68; E01C 11/02; E01D 19/06; E02B 3/16; E02D 29/16; E04B 1/66 (2019.01)
CPC - E04B 1/68; B29L 2031/265; E04B 1/6812; F16L 5/02 (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 - 220/378; 277/395; 277/590; 277/628 (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 --- Y	US 6,491,468 B1 (HAGEN) 10 December 2002 (10.12.2002) entire document	1, 2, 24-26, 30, 31 --- 3-5, 32-34
Y	US 2015/0068139 A1 (EMSEAL JOINT SYSTEMS, LTD. et al) 12 March 2015 (12.03.2015) entire document	3, 5, 32, 34
Y	US 9,435,114 B1 (PRESTON) 06 September 2016 (06.09.2016) entire document	4, 33
A	US 2015/0328635 A1 (SONY DADC AUSTRIA AG) 19 November 2015 (19.11.2015) entire document	1-5, 24-26, 30-34
A	US 4,736,558 A (TARABA, JR.) 12 April 1988 (12.04.1988) entire document	1-5, 24-26, 30-34

☐ 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
11 December 2019	06 JAN 2020

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/051829

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-5, 24-26 and 30-34, are drawn to an expansion joint comprising: a foam strip having first and second lateral side surfaces extending axially outward to an outer edge surface.

Group II, claims 57-59, 72 and 77-81, are drawn to a field bondable polymeric seal member, comprising: a polymeric component having a first surface tension.

Note: Claim 73 is objected under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claim 73 is indefinite for the following reasons: Claim 73 is stated to depend from claim 73 itself which is improper. Further, claim 73 refers to "arrangement" which has antecedent basis in claim 72. Therefore, for the purposes of this opinion, claim 73 is best understood to depend from claim 72.

Claim 77 is objected under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claim 77 is indefinite for the following reasons: Claim 77 refers to "arrangement of claim" and lacks dependency. Further, claim 73 refers to "arrangement" which has antecedent basis in claim 72. Therefore, for the purposes of this opinion, claim 77 is best understood to depend from claim 72.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a foam strip having first and second lateral side surfaces extending axially outward to an outer edge surface; and an elongated gasket having a laterally expandable portion adhered to the outer edge surface of the foam strip, the laterally expandable portion extending between first and second lateral end portions each defining at least one of a laterally outward facing bonding surface and an axially inward facing bonding surface, the at least one bonding surface being spaced apart axially outward from the corresponding one of the first and second lateral side surfaces of the foam strip as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: a polymeric component having a first surface tension; and an adhesion adapter attached to the polymeric component and defining a bonding surface having a second surface tension greater than the first surface tension as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a substrate comprising a bonding surface this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2015/0328635 A1 to SONY DADC AUSTRIA AG teaches a substrate comprising a bonding surface (Para. [0050]).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.