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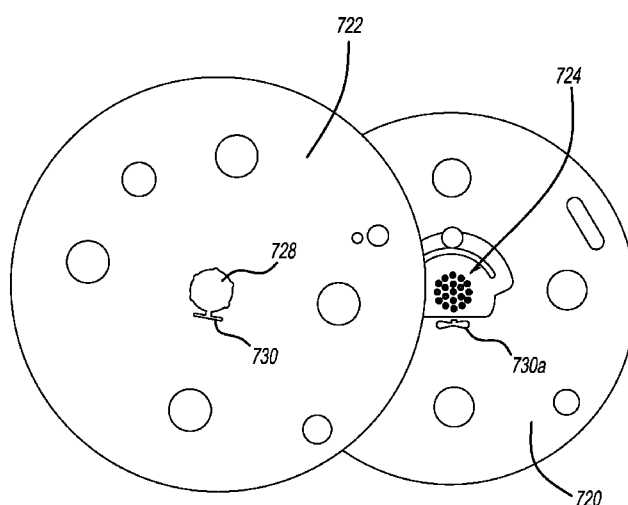


FIG - 10

(57) **Abstract:** Extruded seals (300) including a sealing portion (1002, 102, 1102, 1202, 1302, 1402, 202, 2052, 302, 352, 402, 502, 602, 702) with a honeycomb profile and method for making extruded seals (300) with honeycomb profiles. An extrusion tool is provided with a first (1700) and second plate (1502, 1602, 722, 742, 762, 782, 802, 822, 832, 850) connected together. The first plate (1700, 1800, 1900, 2001, 720, 800) has a plurality of pins (1505, 1605, 1705, 1804, 724, 744, 745, 765, 785, 805, 825, 835, 850, 855, 911), which are vented to form a honeycomb profile. The second plate (1502, 1602, 722, 742, 762, 782, 802, 822, 832, 850) has a profiled opening (1510, 1610, 1804, 1904, 746, 766, 836, 856) receiving the plurality of pins (1505, 1605, 1705, 1804, 724, 744, 745, 765, 785, 805, 825, 835, 850, 855, 911) and forming the overall shape of the part, including the outermost surfaces of the part. The pins (1505, 1605, 1705, 1804, 724, 744, 745, 765, 785, 805, 825, 835, 850, 855, 911) serve as mandrels for extruded molten material to flow around. Varying



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the pin (1605A, 1705A) configuration and dimensions changes the honeycomb profile. The honeycomb structure (14, 360) is provided in the sealing portion (1002, 102, 1102, 1202, 1302, 1402, 202, 2052, 302, 352, 402, 502, 602, 702) of the extrusion. The honeycomb profile is formed by itself, co-extruded with a rigid or semi-rigid structural member (1004, 104, 1104, 1204, 1304, 1404, 204, 2054, 304, 358, 404, 504, 604), or applied to the rigid or semi-rigid structural member (1004, 104, 1104, 1204, 1304, 1404, 204, 2054, 304, 358, 404, 504, 604) after the structural member (1004, 104, 1104, 1204, 1304, 1404, 204, 2054, 304, 358, 404, 504, 604) is formed.

SEALS AND METHOD FOR MAKING SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 62/337,969,
5 filed May 18, 2016 and U.S. Provisional Application No. 62/377,320 filed August 19, 2016.
The disclosures of the above applications are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to seals and trim and a method for making extruded
seals and trims for attachment to motor vehicle components.

10

BACKGROUND OF THE INVENTION

Gaskets, seals, e.g., resilient bulb seals and lip type seals, and trims are generally
known and are commonly used for vehicle window, trunk, door and other component
sealing. Seals and trims are often placed along the sealing edge of components and
15 along the interface of abutting surfaces of parts to prevent water, debris, and air drafts
from entering the interior of the vehicle. Common seals include at least two sub-parts; a
sealing portion, e.g., bulb portion, and a structural member for attachment to the vehicle,
which structural member generally has a greater stiffness and higher durometer for
installation. Seals are conventionally made by a co-extrusion process where the
20 mounting portion and sealing portion are co-extruded.

Typical gaskets and seals for doors and windows are manufactured with
thermoplastic vulcanizates (TPV) or EPDM (ethylene propylene diene monomer)
material. Commonly known seals have a solid cross section, that is, without honeycomb
or other internal structure. Other seals are foamed or otherwise opened cell structured.
25 These generally have a lower tear strength, non uniform density, and are known to absorb
moisture.

Therefore, it is desirable to have a seal and method for making same, which has a closed cell structure and honeycomb profile that provides a higher tear strength, more uniform density and repeatability and which does not absorb moisture, and without compromising the mounting and sealing characteristics.

5

SUMMARY OF THE INVENTION

The present invention is generally directed to extruded seals, e.g., extruded automotive seals, and a method for making seals usable for attachment to components for final assembly in vehicles. There is provided at least one extrusion tool assembly
10 having at least two plates connected together and operably mounted to an extruder. A first plate is operably provided with a series of holes in a predetermined configuration depending on the particular application. Typically, a plurality of pins are provided which serve as mandrels for molten material, e.g., TPV, to flow around the pins. A second plate is provided operable to form the outermost shape of the part. Typically, the second plate
15 has a profiled opening for forming the outermost shape depending on the particular application, wherein the plurality of pins, which are vented, fit within this profiled opening in a predetermined configuration.

The extruded seals have a honeycomb-like extrusion part profile, most preferably, honeycombed-like structure substantially throughout a sealing portion of the extruded
20 seal. There are various pin layouts and configurations for forming different seal shapes and honeycomb profiles, and various profiled opening shapes and sizes for forming the desired outermost shapes. In one embodiment, the extruded seals are also provided with a rigid or semi-rigid structure (or "structural member" or "carrier member") for mounting to a vehicle, most preferably, of a higher durometer than the sealing portion. The
25 honeycomb profile is formed as itself (alone), co-extruded with the structural member, or applied to the structural member after the structural member is formed.

Preferably, the method is performed with in-line processing steps, upstream to downstream, arranged generally along the longitudinal axis with pulled material moving in a forward direction toward a cutting device that cuts the extrusion to predetermined length.

5 Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

10

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

Figure 1 is a front elevation view of an extruded seal, according to an embodiment
15 of the present invention;

Figure 2 is a front elevation view of an extruded seal, according to another embodiment of the present invention;

Figure 3 is a front elevation view of a conventional seal;

Figure 3B is a front elevation view of an extruded seal in an exemplary environment
20 of use, according to another embodiment of the present invention;

Figure 3C is a front elevation view of an extruded seal, according to another embodiment of the present invention;

Figure 3D is a front elevation view of the extruded seal of Fig. 3C;

Figure 4 is a front elevation view of an extruded seal, according to another
25 embodiment of the present invention;

Figure 5 is a front elevation view of an extruded seal, according to another embodiment of the present invention;

Figure 6 is a front elevation view of an extruded seal, according to another embodiment of the present invention;

5 Figure 7 is a front elevation view of an extruded seal, according to another embodiment of the present invention;

Figures 8A-8B are top plan views of a first plate and second plate of an extrusion tool assembly for manufacturing extruded seals, in accordance with another embodiment of the present invention;

10 Figure 9 is a perspective view of Figs. 8A-8B;

Figure 10 is an enlarged top plan view of Figs. 8A-8B;

Figure 11 is a top plan view of stacked first plate and second plates of the extrusion tool assembly for manufacturing the extruded seal of Figs. 3C-3D, in accordance with another embodiment of the present invention;

15 Figure 12 is a top plan view of stacked first plate and second plates of the extrusion tool assembly for manufacturing the extruded seal of Fig. 5, in accordance with another embodiment of the present invention;

Figure 13 is a top plan view of the plates of Fig. 9 stacked for manufacturing the extruded seal of Fig. 6, in accordance with another embodiment of the present invention;

20 Figures 14-15 are top plan views of stacked first plate and second plates of the extrusion tool assembly for manufacturing the extruded seal of Fig. 4, in accordance with another embodiment of the present invention;

Figures 16-17 are top plan views of stacked first plate and second plates of the extrusion tool assembly for manufacturing extruded seals, in accordance with another
25 embodiment of the present invention;

Figures 18A-18B are top plan views of stacked first plate and second plates of the extrusion tool assembly for manufacturing the extruded seal of Fig. 2, in accordance with another embodiment of the present invention;

Figure 19 is a top plan view of stacked first plate and second plates of the extrusion
5 tool assembly for manufacturing extruded seals, in accordance with another embodiment of the present invention; Figure 20 is a top plan view of stacked first plate and second plates of the extrusion tool assembly for manufacturing the extruded seal of Fig. 7, in accordance with another embodiment of the present invention;

Figure 21 is a front elevation view of an extruded seal, according to an embodiment
10 of the present invention;

Figure 22 is a front elevation view of an extruded seal, according to another embodiment of the present invention;

Figure 23 is a front elevation view of an extruded seal, according to an embodiment of the present invention;

15 Figure 24 is a front elevation view of an extruded seal, according to another embodiment of the present invention;

Figure 25 is a front elevation view of an extruded seal, according to an embodiment of the present invention;

Figure 26 is a top plan view of a first plate of an extrusion tool assembly for
20 manufacturing the extruded seal of Fig. 25, in accordance with another embodiment of the present invention;

Figure 27 is a perspective view of stacked first and second plates of the extrusion tool assembly for manufacturing the extruded seal of Fig. 23, in accordance with another embodiment of the present invention;

Figure 28 is a top plan view of first plate of the extrusion tool assembly for manufacturing the extruded seal of Fig. 22, in accordance with another embodiment of the present invention;

Figure 29 is a top plan view of first plate of the extrusion tool assembly for manufacturing an extruded seal, in accordance with another embodiment of the present invention;

Figure 30 is a top plan view of a first plate of the extrusion tool assembly for manufacturing the extruded seal of Fig. 21, in accordance with another embodiment of the present invention;

Figures 31A-B are a top plan views of first and second plates of the extrusion tool assembly for manufacturing the extruded seal of Fig. 24, in accordance with another embodiment of the present invention; and

Figure 32 is a front elevation view of an extruded seal, according to an embodiment of the present invention

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

Referring to the figures generally, in accordance with the present invention there is provided an extruded seal with a honeycomb like internal profile and tooling and method of manufacturing same. Figures 1-2, 3B-7, 21-25 and 32 illustrate exemplary embodiments of extruded seals, according to the present invention, having honeycomb profiles. Most preferably, the honeycomb profile is a predetermined configuration of a plurality of apertures (or "honeycomb apertures") formed in at least a sealing portion of the seal. The honeycomb profile allows a good seal between two or more objects and

with significant advantages over traditional seals, such as not holding moisture, being more robust and durable and lower compression set.

It is understood that the terms "honeycomb" or "honeycomb structure" are not intended to be limiting to only hexagon shapes or hexagonal prismatic honeycomb.

5 While the apertures are illustrated as generally circular cross section, it is understood that any alternative shape depending on the application is contemplated without departure from the scope of the present invention, e.g., square, hexagon, etc. It is further understood that the extruded seals are formed or cut to a predetermined length, e.g., continuous extrusion cut to length, and that the apertures of the honeycomb structure
10 are elongated interior voids extending the length of the extruded seal. Alternative shapes and geometries are contemplated depending on the application without departure from the scope of the present invention. The apertures are at least provided on at least one sealing portion. In addition, while the apertures are illustrated as generally uniformly sized, it is understood that, alternatively, larger or smaller sized or multiple sized holes in
15 the same seal can be used depending on the application without departure from the scope of the present invention. It is further understood that the distance between adjacent apertures can be more or less than depicted depending on the application without departure from the scope of the present invention.

 There are several benefits to the honeycomb extrusion part profile in accordance
20 with the present invention over that of conventional parts, e.g., the present invention is a closed cell structure (not foamed), has higher tear strength, will not absorb moisture (e.g., that can wick or otherwise transfer to the interior of the vehicle), is more uniform in density and has more repeatability. The seal 10 is illustrated attached to a structure 14, such as a channel formed in an automobile.

25 Figure 1 illustrates an extruded seal shown generally at 100, according to an embodiment of the present invention, that includes a bulb seal. At least one sealing

portion shown generally at 102 and at least one structural member shown generally at 104 is provided. The sealing portion 102 has a plurality of apertures 106 forming a honeycomb configuration, e.g., substantially aligned circularly. The structural member 104 has no apertures 106. At least one flange 108 is also provided to provide another
5 sealing surface for further sealing engagement against an object to be sealed. The structural member 104 is suitable for attachment to predetermined component(s) of a vehicle. In a preferred embodiment, a central opening 110 is provided in the sealing portion 102. The structural member 104 includes a T-shaped retainer 112, e.g., for sliding into a corresponding opening to affix the seal 100 to the vehicle. Alternative cross sections
10 besides T-shaped are contemplated depending on the application without departing from the scope of the present invention.

Typically, the extruded seal 100 is formed of at least two materials. Preferably, one material is a polypropylene. Preferably, the other material is a thermoplastic vulcanizate (TPV). Both materials have a predetermined durometer. The TPV is
15 generally 20-60 Shore A durometer ("A") typically, 30-50A, preferably, 30-40A, most preferably, 35A. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 2 illustrates an extruded seal shown generally at 200, according to an
20 embodiment of the present invention, that is a glazing seal. At least one sealing portion shown generally at 202 and at least one structural member shown generally at 204 is provided. The sealing portion 202 has a plurality of apertures 206 forming the honeycomb structure, e.g., substantially aligned parallel on the same plane. The structural member 204 has no apertures 206. The structural member 204 has at least one barb 208,
25 preferably a plurality of barbs. The structural member 204 is suitable for attachment to

predetermined component(s) of a vehicle. Preferably, a slipcoat is provided on at least the sealing portion 202.

Typically, the extruded seal 200 is formed of at least two materials. Preferably, one material is a polypropylene. Preferably, the other material is a TPV. The TPV is generally 30-60 Shore A durometer (A) typically, 40-50A, preferably, 43-48A, most preferably, 45A. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 3A illustrates an example of a known seal shown generally at 10, which has a solid sealing portion 12 with no honeycomb structure.

Figure 3B illustrates an extruded seal shown generally at 300, according to an embodiment of the present invention. At least one sealing portion shown generally at 302 and at least one structural member shown generally at 304 is provided. The sealing portion 302 has a plurality of apertures 306 forming a honeycomb configuration. A strengthening strip 308 or web is provided. The structural member 304 has no apertures 308. The structural member 304 is suitable for attachment to predetermined components of a vehicle. In accordance with a preferred embodiment, the base of the extruded seal 300 fits within a channel of predetermined component(s) of a vehicle.

Figures 3C and 3D illustrate an extruded seal shown generally at 350, according to an embodiment of the present invention, which is similar to the extruded seal 300, but the sealing portion 352 has no strengthening strip 308. The sealing portion 352 has a plurality of apertures 356 forming a honeycomb configuration. At least one structural member 358 is provided and has no apertures 356. In a preferred embodiment, the extruded seal 350 has a central or middle area open space 354 along the longitudinal length of the extruded seal 350.

The seals 300,350 are illustrated attached to an exemplary structure 360, but other attachment structures are contemplated. The seals 300,350 seal or close out multiple objects such as rigid objects.

Figure 4 illustrates an extruded seal shown generally at 400, according to an embodiment of the present invention, that is a bulb seal. At least one sealing portion shown generally at 402 and at least one structural member shown generally at 404 is provided. The sealing portion 402 has a plurality of apertures 406 forming a honeycomb configuration, e.g., substantially circular pattern. The structural member 404 has no apertures 406. Preferably, a central opening 410 is provided in the sealing portion 402. The structural member 404 is suitable for attachment to predetermined component(s) of a vehicle. At least one barb 408, preferably a plurality of barbs 408, is also provided on the at least the structural member 404 for attachment to opposing features of the vehicle component.

The sealing portion 402 material and structural member 404 material is preferably thermoplastic vulcanizate (TPV), most preferably, having different durometers. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 5 illustrates an extruded seal shown generally at 500, according to an embodiment of the present invention, that is a door seal. At least one sealing portion shown generally at 502 and at least one structural member shown generally at 504 is provided. The sealing portion 502 has a plurality of apertures 506 forming a honeycomb configuration, e.g., substantially aligned in at least two lines curved and/or straight. The structural member 504 has no apertures 506. The structural member 504 is suitable for attachment to predetermined component(s) of a vehicle. At least one barb 508, preferably a plurality of barbs 508, is also provided on the at least the structural member 504 for attachment to opposing features of the component.

The sealing portion 502 material is generally 50 - 90 Shore A durometer (A) thermoplastic (TPV), typically, 60-80A TPV, preferably, 60-70A TPV, most preferably, 67A TPV. The structural member 504 is generally at least 40 Shore D ("D") TPV, typically, 40-60D TPV, preferably, 45-55D TPV, most preferably 50D TPV. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 6 illustrates an extruded seal shown generally at 600, according to an embodiment of the present invention, that is a bulb seal. At least one sealing portion shown generally at 602 and at least one structural member shown generally at 604 is provided. The sealing portion 602 has a plurality of apertures 606 forming a honeycomb configuration. The structural member 604 has no apertures 606. The structural member 604 is suitable for attachment to predetermined component(s) of a vehicle. In a preferred embodiment, the sealing portion 602 has no central opening (e.g., unlike Figs. 1 and 4). The structural member 604 includes a T-shaped retainer profile, e.g., for sliding into a corresponding opening to affix the seal the vehicle, but alternative shapes are contemplated depending on the application without departing from the scope of the present invention.

The sealing portion 602 material is preferably polypropylene. The structural member 604 is preferably thermoplastic vulcanizate (TPV). Any other suitable materials are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 7 illustrates an extruded seal shown generally at 700, according to an embodiment of the present invention, that is a micro hole bulb. At least one sealing portion shown generally at 702 is provided. The sealing portion 702 has a plurality of apertures 706 forming a honeycomb configuration. In a preferred embodiment, there is no structural member portion with no apertures 706. In a preferred embodiment, the

sealing portion 702 has no central opening. In another embodiment, the sealing portion 702 is also contoured in a way suitable to create ridges or other curved features to retain within a corresponding channel of the vehicle component.

The sealing portion 702 material is preferably TPV. The sealing portion 702 material is generally 35-95 Shore A durometer (A) TPV typically, 50-80A TPV, preferably, 60-70A TPV, most preferably, 64A TPV. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 21 illustrates an extruded seal shown generally at 1000, according to an embodiment of the present invention, that is a door seal. At least one sealing portion shown generally at 1002 and at least one structural member shown generally at 1004 is provided. The sealing portion 1002 has a plurality of apertures 1006 forming a honeycomb configuration, e.g., generally forming at least two lines of apertures. The structural member 1004 has no apertures 1006. The structural member 1004 is suitable for attachment to predetermined component(s) of a vehicle. At least one barb 1008, preferably a plurality of barbs 1008, is also provided on the at least the structural member 1004 for attachment to opposing features of the component. Preferably, a slipcoat is provided on at least the sealing portion.

The structural member 1004 material is generally 68 - 90 Shore A durometer (A) thermoplastic (TPV), typically, 70-86A TPV, preferably, 75-82A TPV, most preferably, 80A TPV. The sealing portion 1002 is generally at least 40A TPV, typically, at least 60A TPV, preferably, 60-68A TPV, most preferably 67A TPV. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 22 illustrates an extruded seal shown generally at 1100, according to an embodiment of the present invention, that is a vent head gasket bulb seal. At least one

sealing portion shown generally at 1102 and at least one structural member shown generally at 1104 is provided. The sealing portion 1102 has a plurality of apertures 1106 forming a honeycomb configuration. The structural member 1104 has no apertures 1106. The structural member 1104 is suitable for attachment to predetermined component(s) of a vehicle. The structural member 1104 includes a winged clip portion 1108. Preferably, an outer layer 1102b is provided on the outer circumference of the sealing portion 1102.

A plurality of materials are typically used. In a preferred embodiment, the sealing portion 1102 is polypropylene, the outer layer 1102b is TPV, and/or the structural member 1104 is TPV. The sealing portion 1002 material is generally 20-60 Shore A durometer (A) TPV, typically, 25-50A TPV, preferably, 30-40 TPV, most preferably, 35A TPV. The structural member 1104 material is generally 60-95A TPV typically, 75-90A TPV, preferably, 80-90A TPV, most preferably, 87A TPV. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 23 illustrates an extruded seal shown generally at 1200, according to an embodiment of the present invention, that is a flex seal. At least one sealing portion shown generally at 1202 and at least one structural member shown generally at 1204 is provided. The sealing portion 1202 has a plurality of apertures 1206, 1206a forming a honeycomb structure. The structural member 1204 is suitable for attachment to predetermined component(s) of a vehicle. The structural member 1204 has no apertures 1202. Preferably, at least one pressure sensitive adhesive (PSA) tape shown generally at 1210 is provided for attaching to the vehicle. Preferably, a slipcoat is applied to at least the sealing portion 1202. Preferably, an adhesive promoter is applied to the bottom surface 1212 of the structural member 1204 adjacent the PSA tape 1210.

A plurality of materials are typically used. In a preferred embodiment, the sealing portion 1202 material is generally 20-60 Shore A durometer (A) TPV, typically, 25-50A

TPV, preferably, 40-50 TPV, most preferably, 45A TPV. The structural member 1204 material is generally 60-95A TPV typically, 75-90A TPV, preferably, 80-90A TPV, most preferably, 85A TPV. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Figure 24 illustrates an extruded seal shown generally at 1300, according to an embodiment of the present invention forming a generally square-like shape. At least one sealing portion shown generally at 1302 is provided. The sealing portion 1302 has a plurality of apertures 1306 forming a honeycomb structure. Preferably, at least one tape, e.g., TESA™ 4965 tape, shown generally at 1310 is provided. Preferably, an adhesive promoter indicated generally at 1312 is applied to the bottom surface of the structural member 1304 adjacent the TESA tape 1310. Preferably, a flock sheet shown generally at 1314 is operably applied to at least the sealing portion 1302, e.g., operably applied to the top surface of the sealing portion 1302. A central opening 1316 is provided, preferably, having a square cross section. Alternatively, there is no central opening 1316.

In a preferred embodiment, the sealing portion 1302 material is generally 20-60 Shore A durometer (A) TPV, typically, 25-50A TPV, preferably, 30-40 TPV, most preferably, 35A TPV. Any other suitable materials and durometers are contemplated depending on the particular application without departing from the scope of the present invention. Optionally, a structural member, preferably of higher durometer, is additionally provided.

Figure 25 illustrates an extruded seal shown generally at 1400, according to an embodiment of the present invention, that is a bulb seal. At least one sealing portion shown generally at 1402 and at least one structural member shown generally at 1404 is provided. The sealing portion 1402 has a plurality of apertures 1406 forming a honeycomb configuration. The structural member 1404 has no apertures 1406. The

structural member 1404 is suitable for attachment to predetermined component(s) of a vehicle. At least one barb 1408, preferably a plurality of barbs 1408, is also provided on the at least the structural member 1404 for attachment to opposing features of the component. Preferably, a slipcoat is applied to at least the sealing portion 1402.

5 A plurality of materials are generally used. The sealing portion 1402 is preferably polypropylene and the structural member 1404 is preferably TPV.

Figure 32 illustrates an extruded seal shown generally at 2050, according to an embodiment of the present invention, that includes a micro hole bulb seal. At least one sealing portion shown generally at 2052 and at least one structural member shown
10 generally at 2054 is provided. The sealing portion 2052 has a plurality of apertures 2056 forming a honeycomb configuration, e.g., substantially aligned circularly. The structural member 2054 has no apertures 2056. The structural member 2054 has no apertures 2056. The structural member 2054 has at least one barb 2058, preferably a plurality of barbs. The structural member 2054 is suitable for attachment to predetermined
15 component(s) of a vehicle.

Typically, the extruded seal 2050 is formed of at least two materials. Preferably, one material is a polypropylene. Preferably, the other material is a thermoplastic vulcanizate (TPV). The TPV is generally 20-60 Shore A durometer ("A") typically, 30-50A, preferably, 30-40A, most preferably, 35A. Any other suitable materials and
20 durometers are contemplated depending on the particular application without departing from the scope of the present invention.

Referring generally to Figs. 1-7, 21-25 and 32, at least one extruded material is provided for forming the extruded seals. Typically, at least one first extruded material forms the sealing portion and at least one second extruded material forms the structural
25 member. Preferably, a first extruded material is provided forming the sealing portion and a second extruded material, e.g., having a higher durometer than the first material, forms

the structural member. Preferably, the at least one second material(s) has/have a higher durometer than the at least one first material(s).

Depending on the application the extruded materials are generally polypropylene (PP), medium density polyethylene (MDPE), thermoplastic vulcanizates (TPV), or other material suitable for making the extruded seal incorporating a honeycomb structure. If more than one extruded material is used the extruded materials are compatible materials to melt bond to one another under pressure or otherwise bond together. Typically, the sealing portions are TPV, preferably, about 35 Shore A TPV to 67 Shore A TPV or more, most preferably, 35A TPV to 67A TPV. Typically, the structural members are polypropylene, TPV or any other suitable material for providing a carrier, preferably, at least 67A TPV, most preferably 67A.

The extruded seal of the present invention is a bulbous seal, dual-bulb seal, door belt, micro hole bulb, door seal, window seal, flex seal, gasket, gasket bulb, glazing seal, anything being sealed by traditional TPV and EPDM seals, or any other extruded seal or extruded automotive seal - with or without at least one structural member, flange, retention barb, or any other secondary portion(s), and combinations thereof.

Referring to the figures generally, all the seals can include slip coats, specialty coatings and/or flock, e.g., tape or otherwise, depending on the particular applications without departing from the scope of the present invention. By non-limiting example, low friction coatings, etc.

Any other shapes, sizes and configurations of the extruded seal components and apertures, and combinations thereof, are contemplated without departing from the scope of the present invention.

Referring to Figures 8A-20B and 26-31B generally, in accordance with another embodiment of the present invention, there is provided a process for making extruded seals for attachment to vehicles. There is provided at least one extrusion tool assembly

including an extrusion tool with at least two plates connected together and operably mounted to at least one extruder for extruding the material set forth previously. The plates are stacked together and doweled with at least one dowel and/or fastener (e.g., such as a plurality of dowels or bolts 849 or other fasteners). The plates are either fastened
5 together, preferably, bolted, to an extruder head and other material is brought in from the side via a medium conduit (e.g., pipe) or the plates are simply attached to the extruder from the side via a pipe. In general, the extrusion tool has multiple vented pins nested in a way that allows for the material to flow around the pins producing a honeycomb shaped part. Some variations are multiple sized holes within the same profile, or varying sizes
10 spread across different tools and different substrates. When the material is extruded through the plates, the shape of a profiled opening provided on at least one of the plates forms the profile of the extruded sealing portion and structural member, while the vented pins form the honeycomb structure in at least the sealing portion.

In general, the vented pins are small multiple vented pins that are either grouped
15 together tightly or not, depending on the particular application. These pins are provided in predetermined configurations dependant on the application.

The pins are preferably ported to ambient air. Alternatively, the pins are operably connected to a forced air conduit to achieve a desired shape. Preferably, the pins are hardened steel and are welded into place (or other suitable method for attachment to the
20 metal plate), most preferably, welded to the first plate to extend from the center of the outward surface of the first plate. Typically, pins are provided which serve as mandrels for molten material, e.g., TPV, to flow around the pins.

Varying the pin nest layout varies the honeycomb produced. There are several variations based on the size and shape and desired performance. Several examples are
25 illustrated of different shapes (e.g., in Figs. 1-2, 3B-7, 21-25 and 32) and the respective tools used to create them (e.g., in Figs. 8A-20B and 26-31B). Different pin nesting

configurations are contemplated without departing from the scope of the present invention. Pin configuration and honeycomb profile depends on desired performance requirements, e.g., softness, flexibility and compression.

There are multiple pin sizes and extruded part aperture sizes (or "holes"). In one
5 embodiment, if the apertures are applied (e.g., with the extrusion of the sealing portion) after the structural member has been extruded, the ratio is about 1:1 (pin dimension: hole dimension). If the apertures are provided at the same time as the structural member (or there is no rigid or structural member), the ratio is 2:1 (2 millimeter (mm) pin makes 1 mm hole), but can be drawn down as much as 4:1. Alternative ratios are contemplated without
10 departing from the scope of the present invention.

Other factors besides pin configuration and pin outer diameter that contribute to the diameter of the honeycomb holes include, the level of forced air.

Preferably, the method is performed with in-line processing steps, upstream to downstream, arranged generally along the longitudinal axis with pulled material moving
15 in a forward direction toward a cutting device that cuts the extrusion to predetermined length. Depending on the particular applications, cooling, such as by at least one cooling tank, etc, and calibration, such as by at least one vacuum calibrator, etc. are performed prior to cutting. Using more than one extrusion tool device for extruding the extruded seal is contemplated depending on the application without departure from the scope of the
20 present invention.

Referring more particularly to Figs. 8A-10 and 13, according to an embodiment of the present invention, an extrusion tool shown generally at 718 is provided having least one first plate 720 and at least one second plate 722. A plurality of pins shown generally at 724 are provided and welded to the first plate 720 in a generally circular central packed
25 space forming a pin configuration indicated generally at 724a. The pins 724 are

preferably ported to ambient air. Alternatively, the pins 724 are operably connected to a forced air conduit to achieve a desired shape.

The second plate 722 has at least one opening shown generally at 726. The opening 726 includes at least one first portion 728 to shape the at least one sealing portion
5 of the extruded seal and at least one second portion 730 to form the shape of the at least one structural member of the extruded seal. Preferably, the first plate 800 has a corresponding second portion 730a aligned with second portion 730 of the second plate 722. There are no pins 724 in the aligned structural portions 730, 730a. When the plates are connected together (Fig. 13), the pins 724 nest into the first portion 728 of the opening
10 726. The pins 724 serve as mandrels for molten material to flow around the pins 724 as the material passes through the opening 726 in forming the sealing portion with apertures. Extruding a first material through the opening 726 forming the at least one sealing portion is either before or after the at least one structural member has been extruded extrusion with a material (either the same or a different material as the first material). Alternatively,
15 the material(s) are co-extruded. Figures 8A-10 and 13 illustrate the first plate 720 and second plate 722 of the extrusion tool assembly for manufacturing the extruded seal of Fig. 6.

Referring more particularly to Figures 11-12, 14-20B and 26-31B, these are similar to Figs. 8A-10 and 13, however, there are provided first and second plates with various
20 pin configurations and profiled openings to form other extruded seal profiles and honeycomb structures, in accordance with other embodiments of the present invention.

Figure 11 illustrates an extrusion tool shown generally at 738 including at least one first plate and at least one second plate 742 stacked together and having a pin configuration, shown generally at 744, with a plurality of pins 745 within a profiled opening
25 746, and no pins within at least one pin less segment 748. At least one insert portion 750 or block is connected to the first plate. This insert portion 750 allows the central gap or

opening, where there is no material, in the extruded seal of Figs. 3C-3D. When the first and second plates are connected together, the pins 744 and insert portion 750 of the first plate extend into the opening 746 of the second plate 742 for manufacturing the extruded seal of Figs. 3C-3D. Preferably, the insert portion 750 is a larger profiled piece with at least one venting aperture 752.

Figure 12 an extrusion tool shown generally at 758 including at least one first plate and at least one second plate 762 stacked together and having a pin configuration, shown generally at 764, with a plurality of pins 765 of the first plate within a profiled opening 766 for manufacturing the extruded seal of Fig 5. No pins are within the structural member forming portion 768 of opening 766.

Figures 14-15 illustrate an extrusion tool shown generally at 778 including at least one first plate and at least one second plate 782 stacked together and having a pin configuration, shown generally at 784, with a plurality of pins 785 within a profiled opening shown generally at 786, and no pins 911 within at least one pin less segment 788 of the opening. At least one insert portion 790 is connected to the first plate. This insert portion 790 allows the central gap or opening, where there is no material, in the extruded seal of Fig. 4. When the first and second plates are connected together, the pins 785 and insert portion 790 of the first plate extend into the opening 786 of the second plate 782 for manufacturing the extruded seal of Fig. 4. Preferably, the insert portion 790 is a larger pin diameter with a venting aperture 792.

Figures 16 and 17 illustrate an extrusion tool shown generally at 798 including at least one first plate and at least one second plate 802 stacked together and having a pin configuration, shown generally at 804, with a plurality of pins 805 mounted on the first plate and located within a profiled opening shown generally at 806 when the plates are stacked. There are no pins within at least one pin less segment 808 of the opening. At least one insert portion 810 is also mounted to the first plate. This insert portion 810

allows the central gap or opening, where there is no material, in the extruded seal of Fig.

1. When the first and second plates are connected together, the pins 805 and insert portion 810 of the first plate extend into the opening 806 of the second plate 782 for manufacturing the extruded seal of Fig. 1. Preferably, the insert portion 810 is a larger pin diameter with a venting aperture 812.

Figures 18A-18B illustrate an extrusion tool shown generally at 818 including at least one first plate and at least one second plate 822 stacked together and having a pin configuration, shown generally at 824, with a plurality of pins 825 within a profiled opening shown generally at 826, and no pins within at least one pin less segment 828 of the opening, for manufacturing the extruded seal of Fig. 2. When the first and second plates 822 are connected together, the pins 825 mounted on the first plate extend into the opening 826 of the second plate 822 for manufacturing the extruded seal of Fig. 2.

Figure 19 illustrates an extrusion tool shown generally at 828 including at least one first plate and at least one second plate 832 stacked together and having a pin configuration, shown generally at 834, with a plurality of pins 835 mounted to the first plate and located within a profiled opening 836 when the plates are stacked to form an extruded seal with a honeycomb structure.

Figure 20 illustrates an extrusion tool shown generally at 848 including at least one first plate and at least one second plate 850 stacked together (e.g., with at least one dowel 849 or bolt or other fastener) and having a pin configuration, shown generally at 854, with a plurality of pins 855 within a profiled opening 856 for manufacturing the extruded seal of Fig. 7. When the first and second plates 850 are connected together, the pins 850 mounted on the first plate extend into the opening 856 of the second plate 850 for manufacturing the extruded seal of Fig. 7.

Figure 26 illustrates an extrusion tool shown generally at 1500 including at least one first plate and at least one second plate 1502 stacked together and having a pin

configuration, shown generally at 1504, with a plurality of pins 1505 within a profiled opening 1510, and no pins within at least one pin less segment 1512. At least one insert portion 1514 is connected to the first plate. This insert portion 1514 allows the central gap or opening 1407 (e.g., obround shaped opening), where there is no material, in the extruded seal of Fig 25. At least one channel 1516 or pocket is preferably formed in at least the first plate of a predetermined depth. When the first and second plates are connected together, the pins 1505 and insert portion 1514 of the first plate extend into the opening 1510 of the second plate 1502 for manufacturing the extruded seal of Fig. 25. Preferably, the insert portion 1514 is a larger profiled piece with at least one venting aperture than the plurality of smaller vented pins 1505.

Figure 27 illustrates an extrusion tool shown generally at 1600 including at least one first plate and at least one second plate 1602 stacked together and having a pin configuration, shown generally at 1604, with a plurality of pins 1605 and 1605a within a profiled opening 1610, and no pins within at least one pin less segment 1612. At least one pin 1605a is a larger diameter pin to create a larger hole 1206a in the honeycomb structure. At least one insert portion 1606 is connected to the first plate. This insert portion 1606 allows the central gap or opening 1211, where there is no material, in the extruded seal of Fig 23. The insert portion 1606 is also vented by a plurality of apertures 1614. When the first and second plates are connected together, the pins 1605, 1605a and insert portion 1606 of the first plate extend into the opening 1610 of the second plate 1602 for manufacturing the extruded seal of Fig. 23. The insert portion 1606 extends above the opening 1610. Alternatively, the insert portion 1606 is captured within the opening 1610 substantially flush with the top of the opening in the second plate 1602.

Figure 28 illustrates a first plate 1700 for stacking to a second plate to form an extrusion tool. A plurality of pins 1705, 1705a are mounted to the first plate 1700 to form a pin configuration, shown generally at 1704. At least one pin 1705a is a larger diameter

pin to create a larger hole in the honeycomb structure, such as the central opening 1110 in the extruded seal of Fig. 22. A pin less segment 1706 forms the structural member of Fig. 22. At least one channel 1708 or pocket is preferably formed in at least the first plate 1700. The first plate 1700 is stackable with a second plate having at least one opening
5 for receiving the pins and corresponding area of no pins. When the first 1700 and second plates are connected together, the pins 1705, 1705a of the first plate extend into part of the opening of the second plate for manufacturing the extruded seal of Fig. 22. An outer layer 1102b (slip coat, etc) can also be provided on the outer circumference of the sealing portion 1102 of the seal 1100.

10 Figure 29 illustrates a first plate 1800 having a pin configuration, shown generally at 1802 and profiled opening 1804 with no pins, stackable with a second plate having at least one opening for receiving the pins and corresponding area of no pins, for manufacturing an extruded seal with a honeycomb structure. In this embodiment the pins 1804 are each generally rectangular and vented as previously described.

15 Figure 30 illustrates a first plate 1900 having a pin configuration, shown generally at 1902 and profiled opening 1904 with no pins, stackable with a second plate having at least one opening for receiving the pins and corresponding area of no pins, for manufacturing the extruded seal of Fig. 21.

Figures 31A-31B illustrate a first plate 2001 having holes provided corresponding
20 to a pin configuration, shown generally at 2002 for manufacturing the honeycomb structure of the extruded seal of Fig. 24. Drill blanks are inserted and welded on the back. Then a vent hole through, e.g., about 0.5mm vent hole. A dam 2006 and packets 2008, 2010 are also provided on the back plate 2000.

Figure 32 depicts an extruded seal shown generally at 2050, according to another
25 embodiment of the present invention, with a sealing portion shown generally at 2052

including a honeycomb structure with a plurality of apertures 2056, and a structural member shown generally at 2054 with at least one barb 2058.

The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the essence of the invention are intended to be within the scope
5 of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A method for making an extruded seal including a honeycomb profile, comprising:
 - providing a plurality of pins that are operably vented to serve as mandrels for extruded molten material to flow around the plurality of pins;
 - providing a first plate, said plurality of pins operably connected to the first plate in a predetermined configuration;
 - providing a second plate including a profiled opening;
 - aligning the plurality of pins of the first plate into the profiled opening of the second plate and connecting the first and second plates together;
 - extruding at least one molten material through the first and second plates while venting the plurality of pins to form at least a sealing portion of the extruded seal, wherein the extruded molten material flows through the profiled opening and around the plurality of pins in forming the honeycomb profile, and, wherein the configuration and size of the plurality of pins in combination with venting the plurality of pins determines the honeycomb profile.
2. The method of claim 1, wherein the honeycomb profile comprises the sealing portion with a plurality of holes through the longitudinal length of the sealing portion of the extruded seal.
3. The method of claim 1, wherein the plurality of pins are ported to ambient air.
4. The method of claim 1, wherein the plurality of pins are operably connected to receive a predetermined level of forced air, and, wherein varying the level of forced air also changes the diameter of a plurality of holes of the honeycomb profile.

5. The method of claim 1, wherein the profiled opening includes a first portion to define a predetermined outer shape of the sealing portion.

6. The method of claim 5, further comprising providing a second portion of the profiled opening to form the shape of at least one structural member of the extruded seal, said second portion having no pins, and, extruding the same molten material or a different molten material through the second portion.

7. The method of claim 6, wherein the structural member is formed of a second material having a higher durometer than the sealing portion, and operable for attaching the extruded seal to a vehicle part.

8. The method of claim 5, wherein the sealing portion is co-extruded with the structural member.

9. The method of claim 8, wherein a ratio of pin size, of each of the plurality of pins, to a hole size formed by each pin is in a range of 2:1 to 4:1.

10. The method of claim 5, wherein the sealing portion is extruded and applied to the structural member after the structural member is formed.

11. The method of claim 10, wherein a ratio of pin size, of each of the plurality of pins, to a hole size formed by each pin is 1:1.

12. An extruded seal, comprising:
a sealing portion having a closed cell non-foamed structure with a plurality of apertures located through the sealing portion forming a honeycomb profile;
a carrier for attaching to a part, said carrier coupled to the sealing portion and having no apertures.

13. The extruded seal of claim 12, wherein the plurality of apertures are substantially the same size.

14. The extruded seal of claim 12, wherein a portion of the plurality of apertures are a first width and the remaining plurality of apertures are a second width.

15. The extruded seal of claim 12, wherein the sealing portion is thermoplastic vulcanizates.

16. The extruded seal of claim 12, wherein the carrier is thermoplastic vulcanizates or polypropylene.

17. An extruded seal for a vehicle, comprising:
a sealing portion that is moisture resistant, said sealing portion having a honeycomb profile comprised of a plurality of holes with circular cross sections that are spaced apart.

18. The extruded seal of claim 17, wherein the extruded seal is selected from the group consisting of bulbous seal, dual-bulb seal, door belt, micro hole bulb, door seal, window seal, flex seal, gasket, gasket bulb, and glazing seal.

19. The extruded seal of claim 17, wherein the sealing portion is thermoplastic vulcanizates.

20. The extruded seal of claim 17, further comprising a structural member for mounting to the vehicle, the structural member having no honeycomb profile.

21. The extruded seal of claim 20, wherein the structural member further comprises a plurality of barbs for connecting to the vehicle.

22. The extruded seal of claim 17, wherein the extruded seal is formed of at least one extruded material selected from the group consisting of polypropylene, medium density polyethylene, ethylene propylene diene monomer, thermoplastic vulcanizates and combinations thereof.

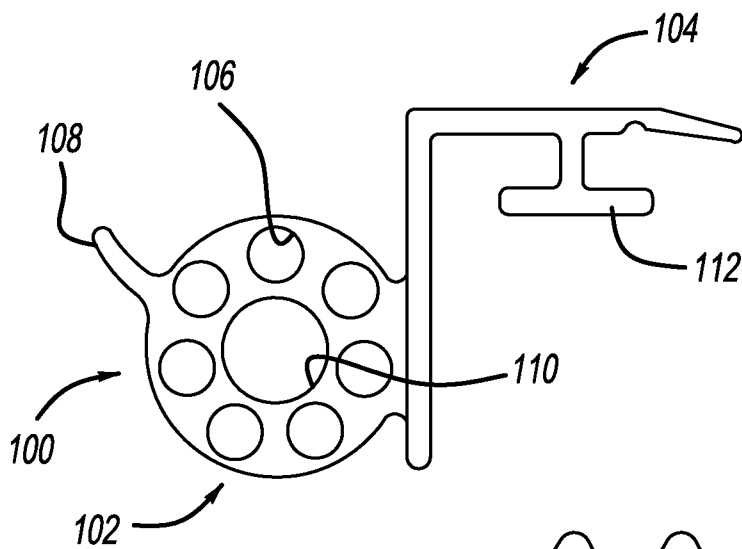


FIG - 1

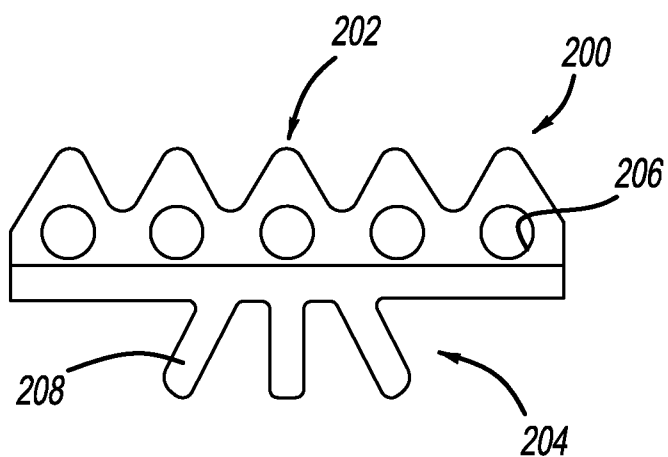


FIG - 2

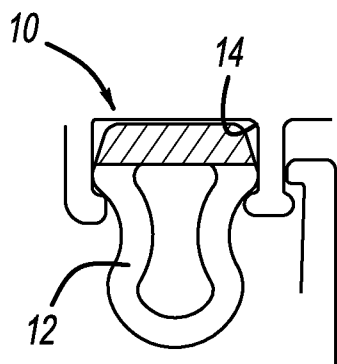


FIG - 3A

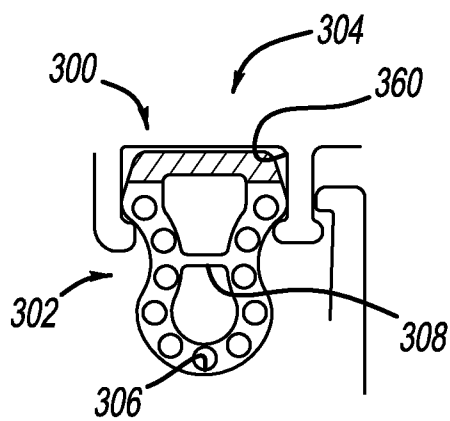


FIG - 3B

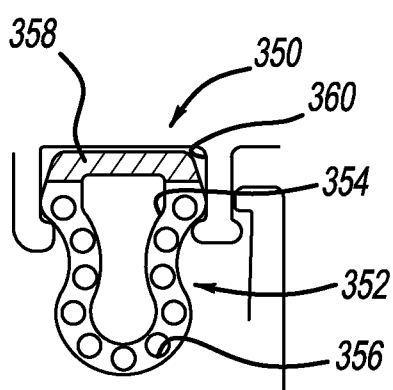


FIG - 3C

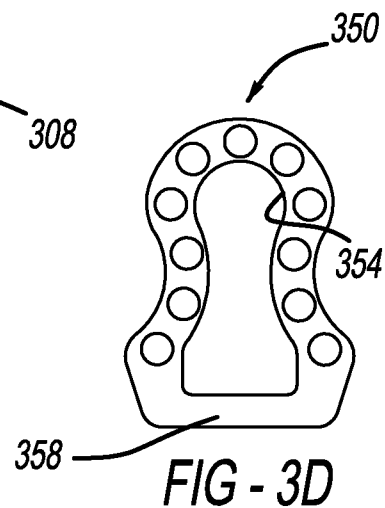


FIG - 3D

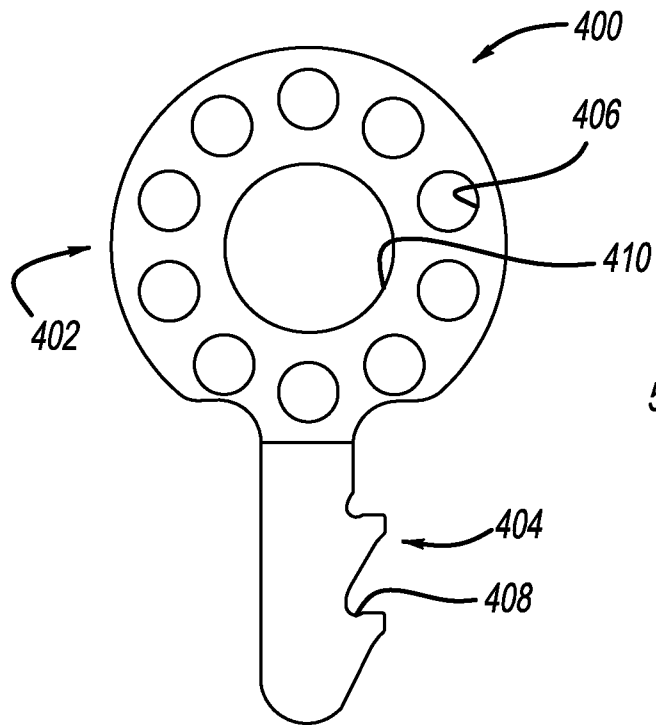


FIG - 4

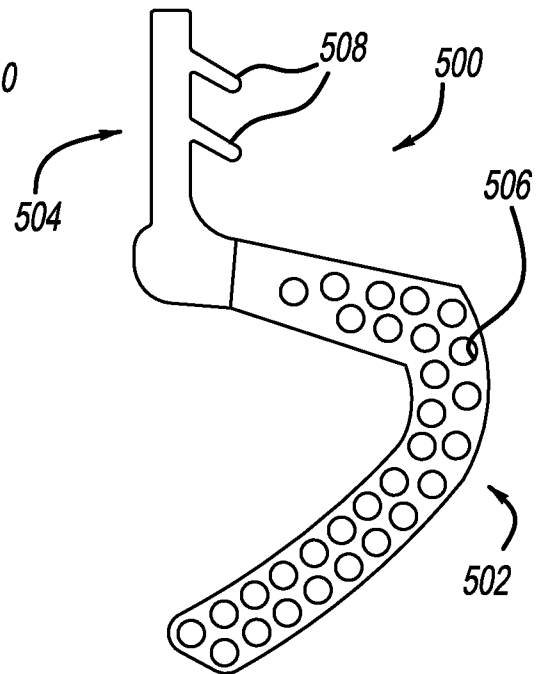


FIG - 5

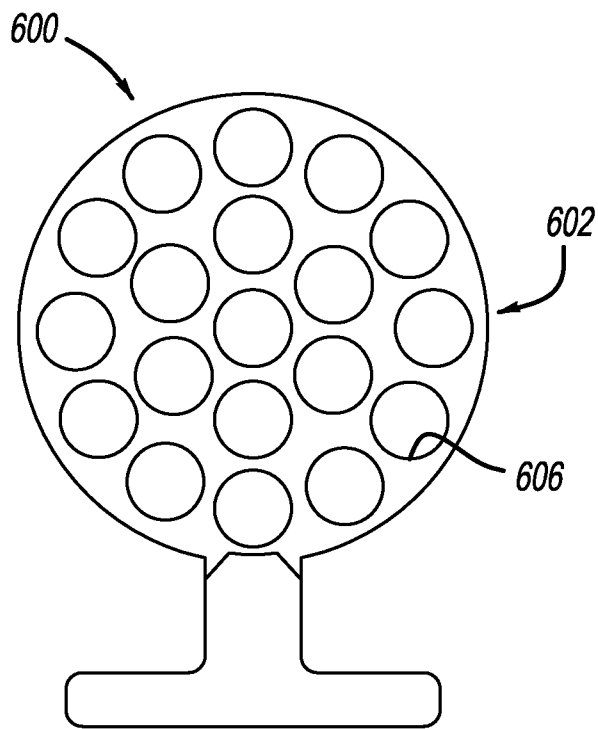


FIG - 6

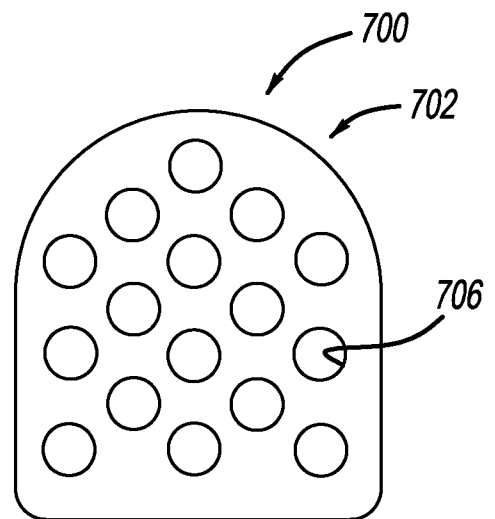
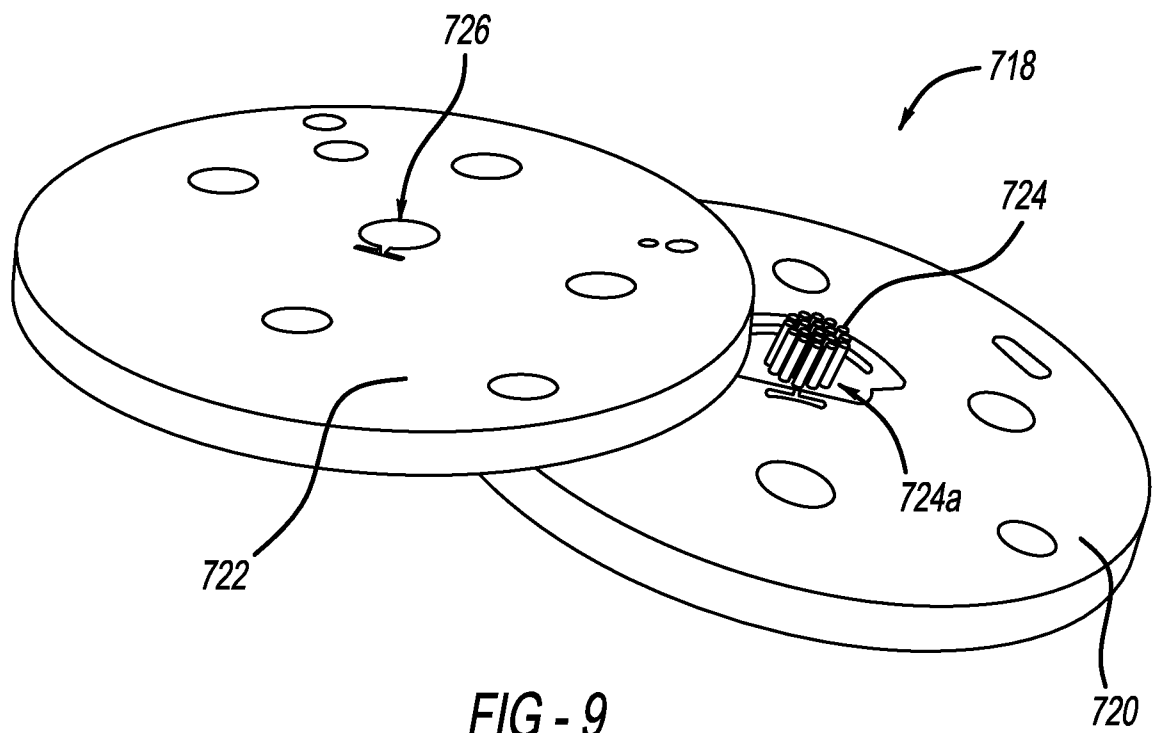
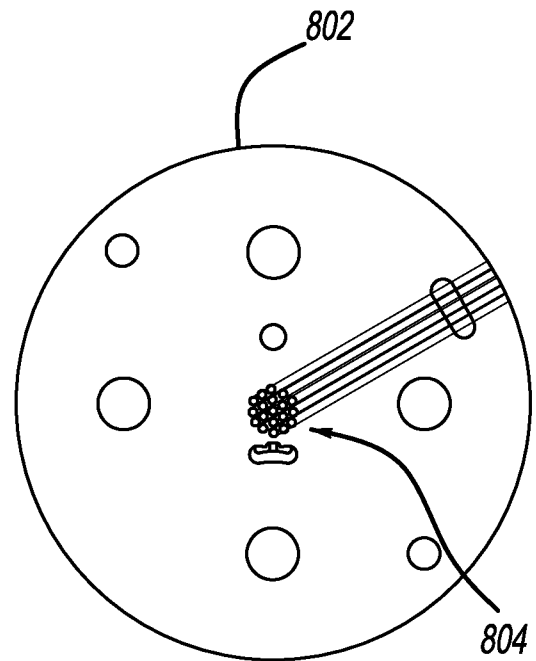
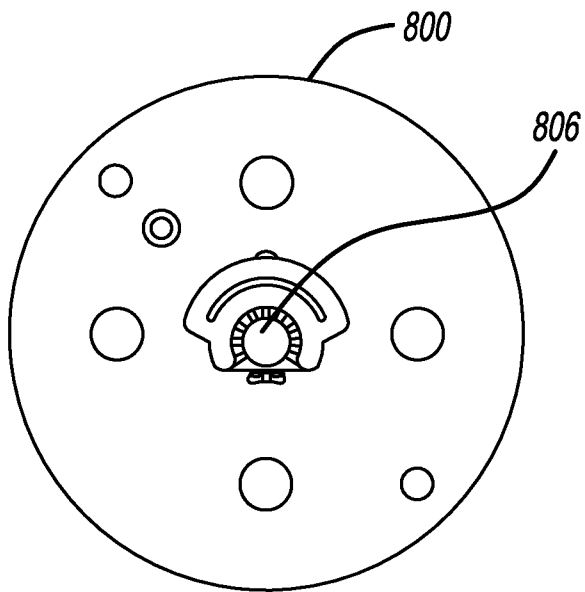


FIG - 7



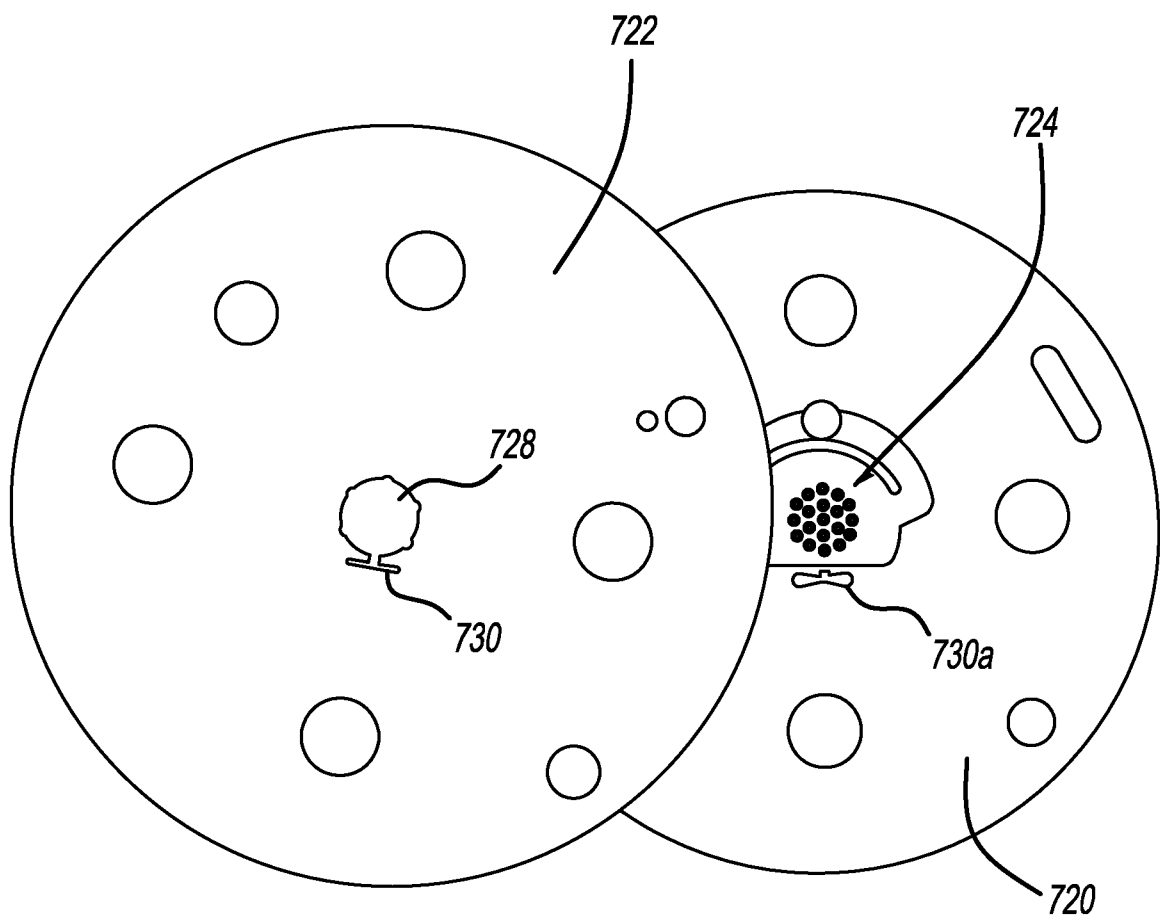
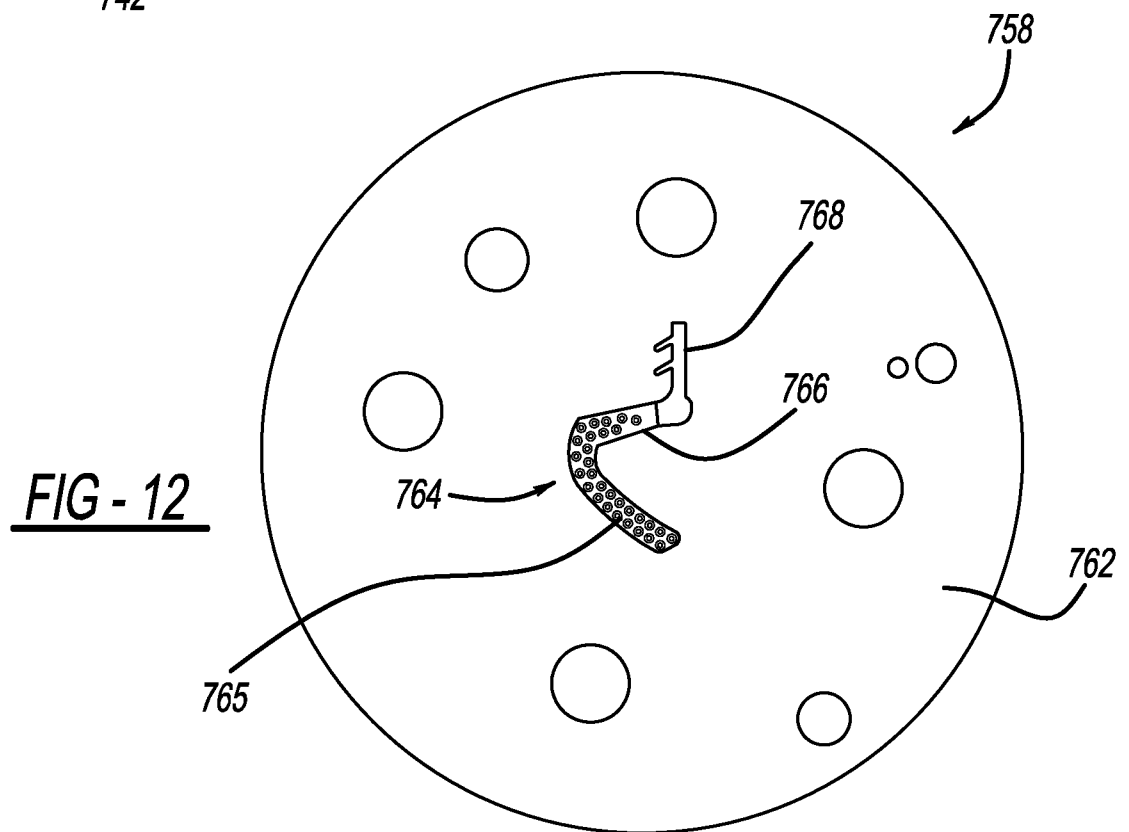
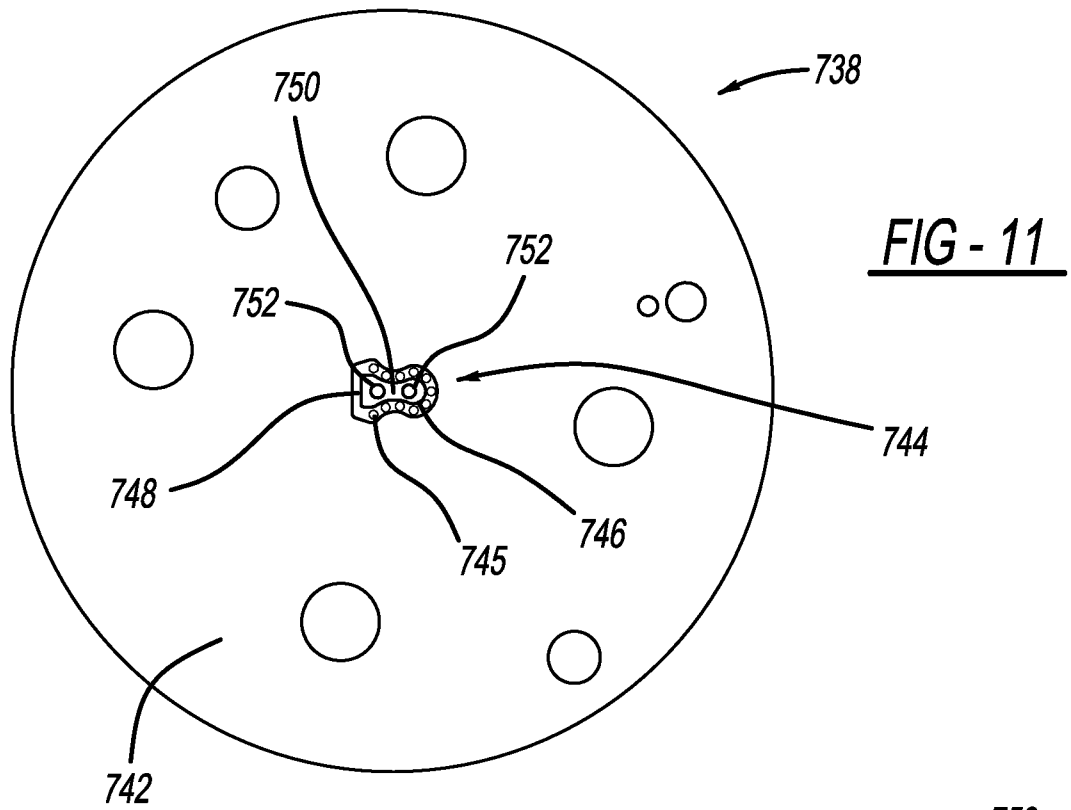
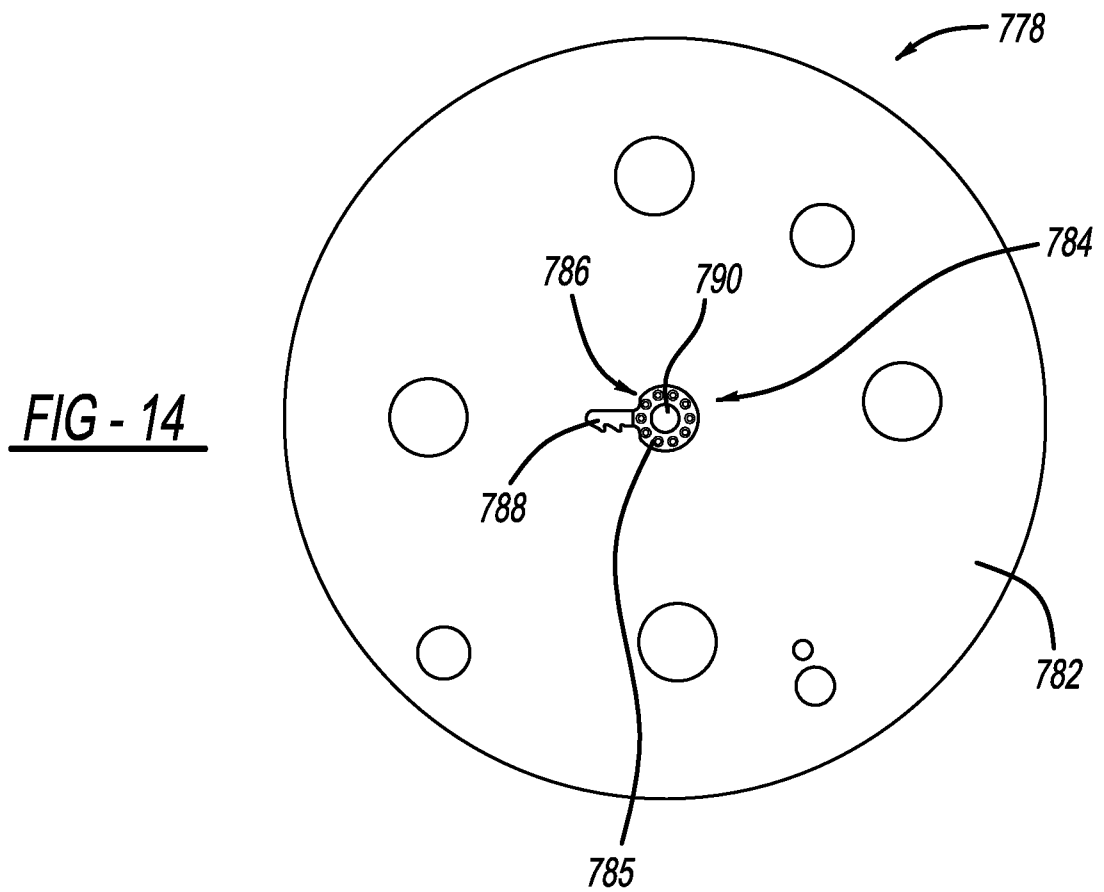
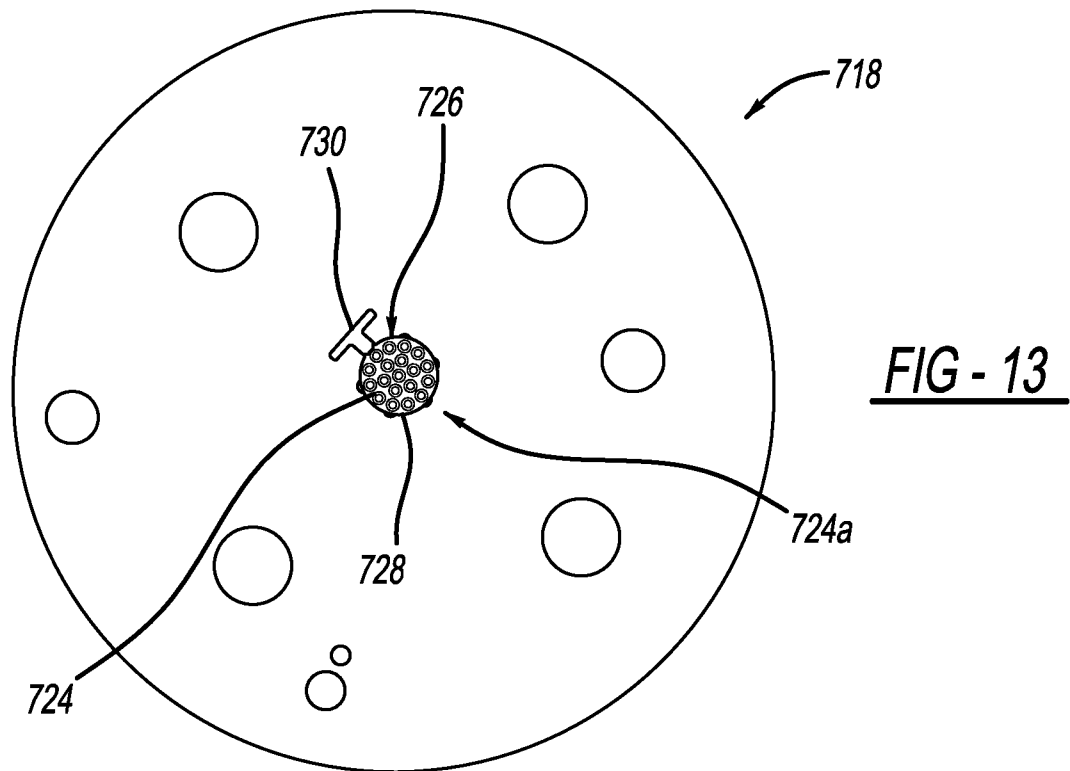
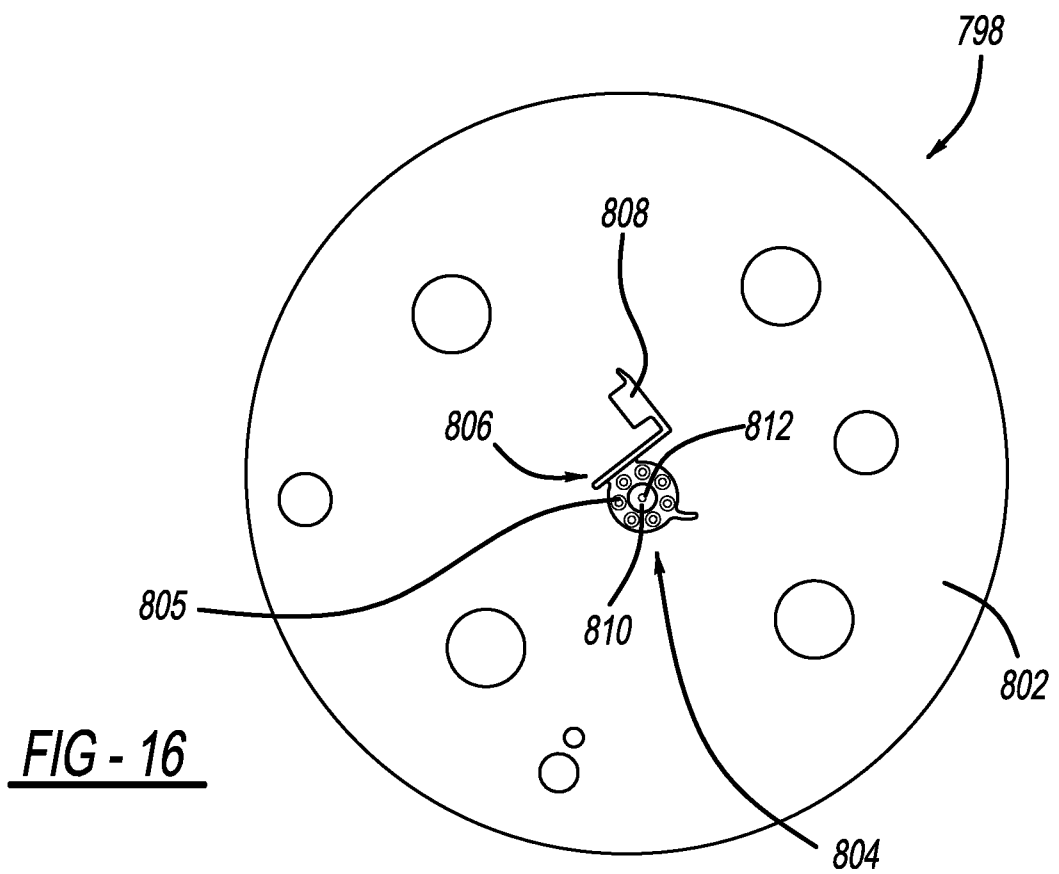
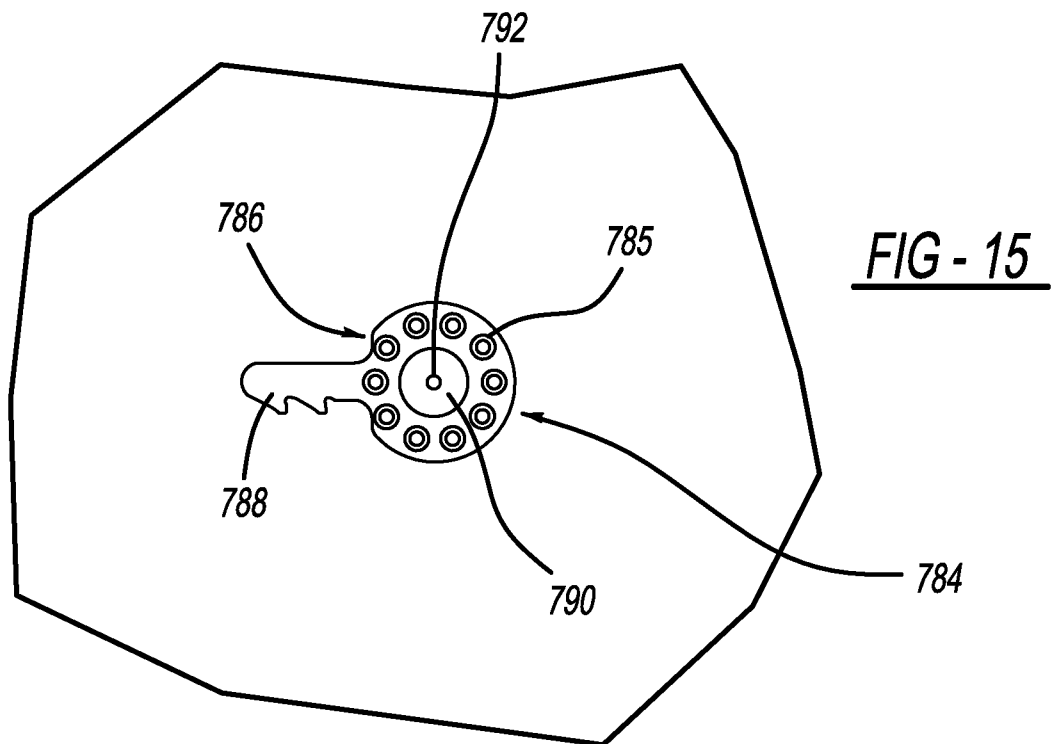


FIG - 10







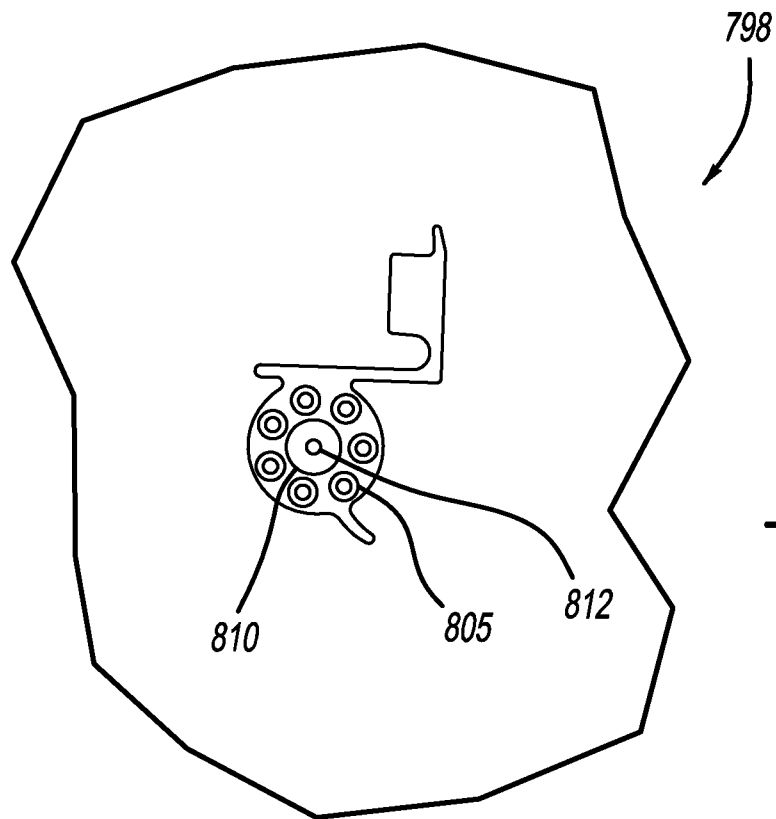


FIG - 17

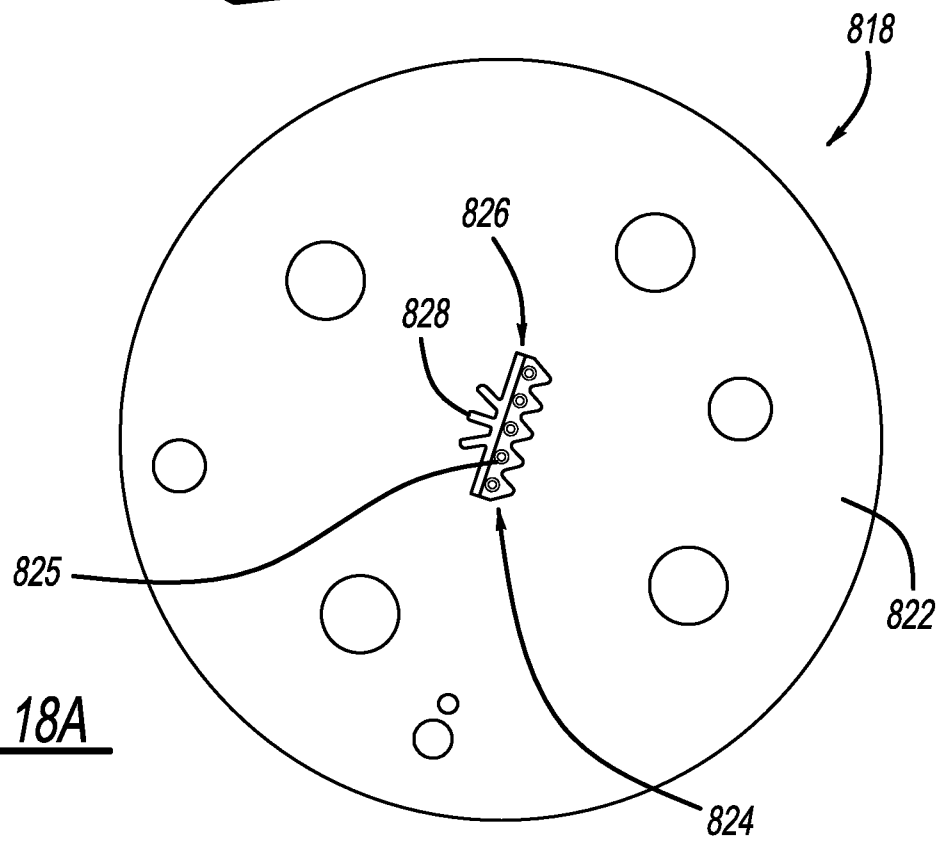


FIG - 18A

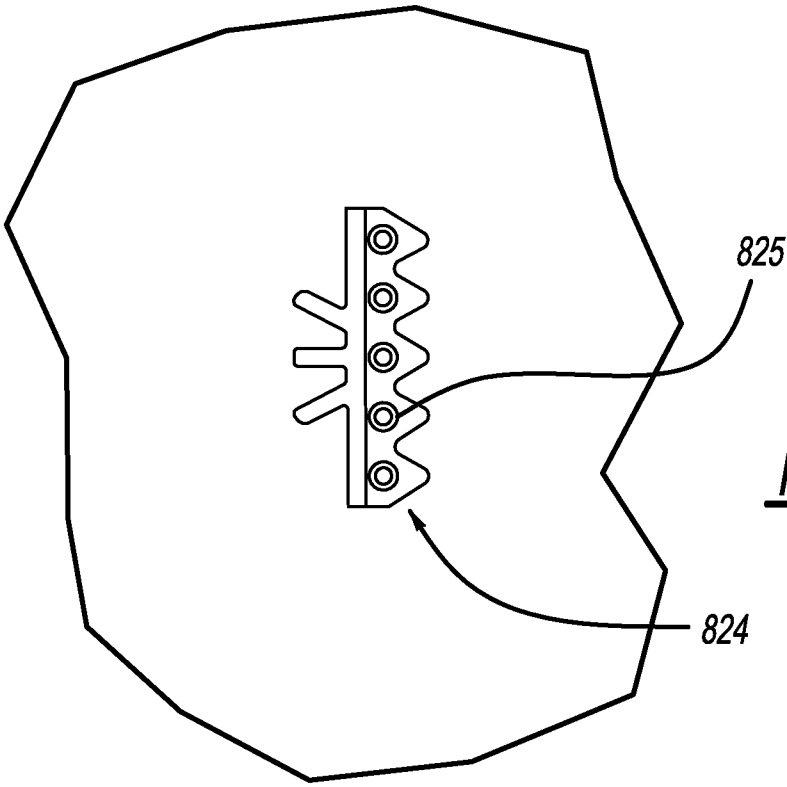


FIG - 18B

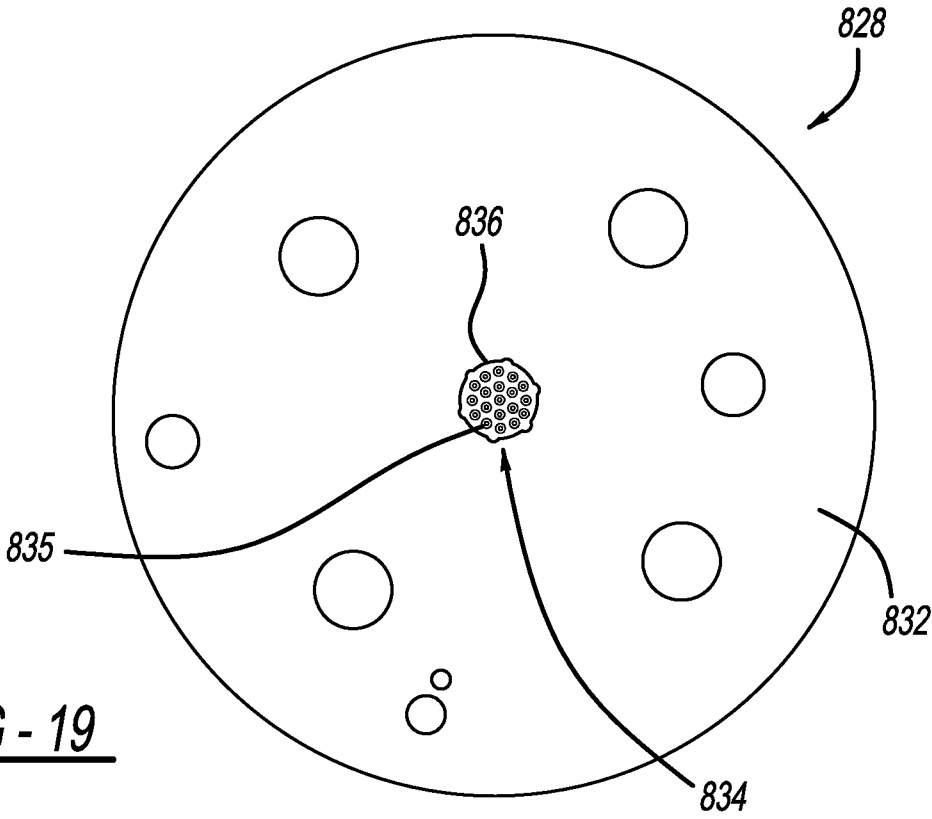


FIG - 19

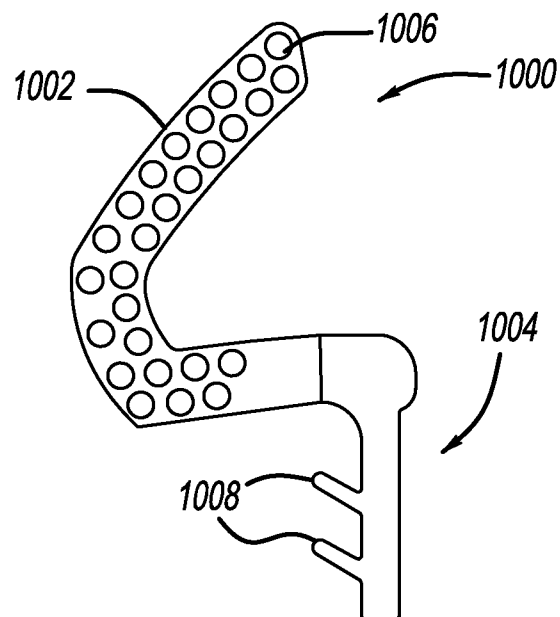
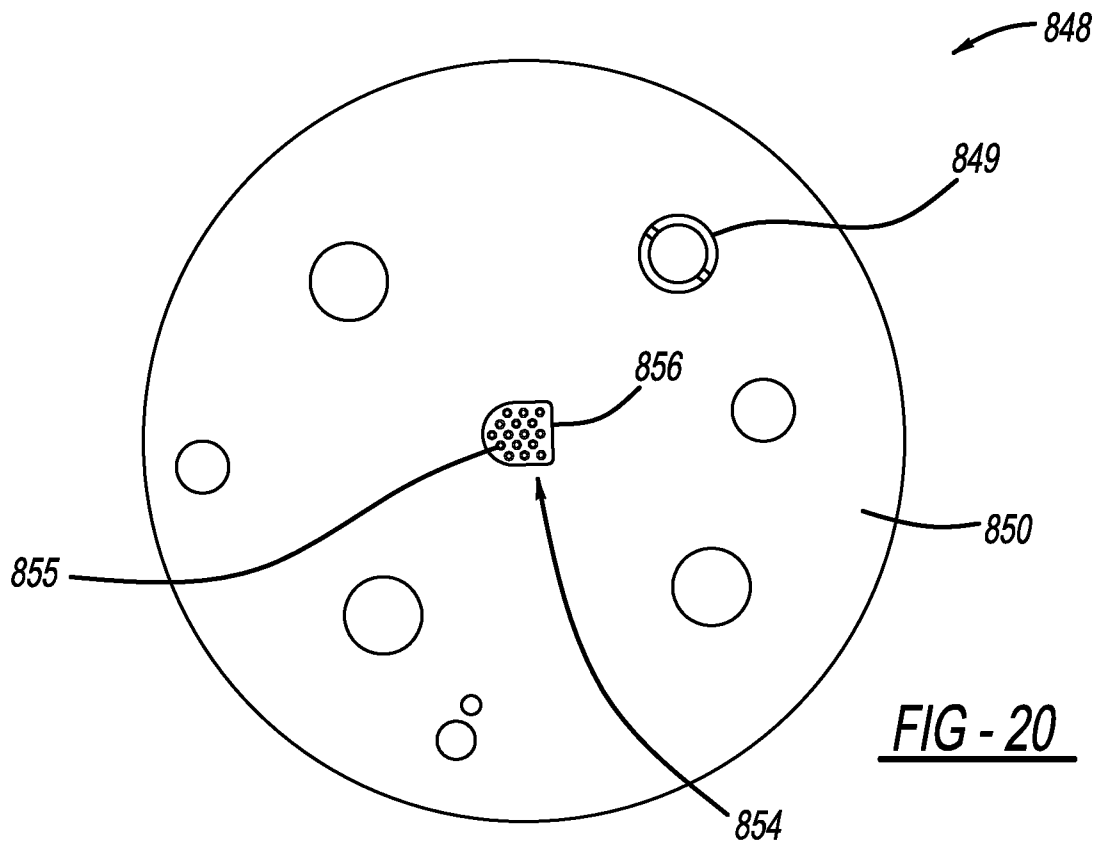


FIG - 22

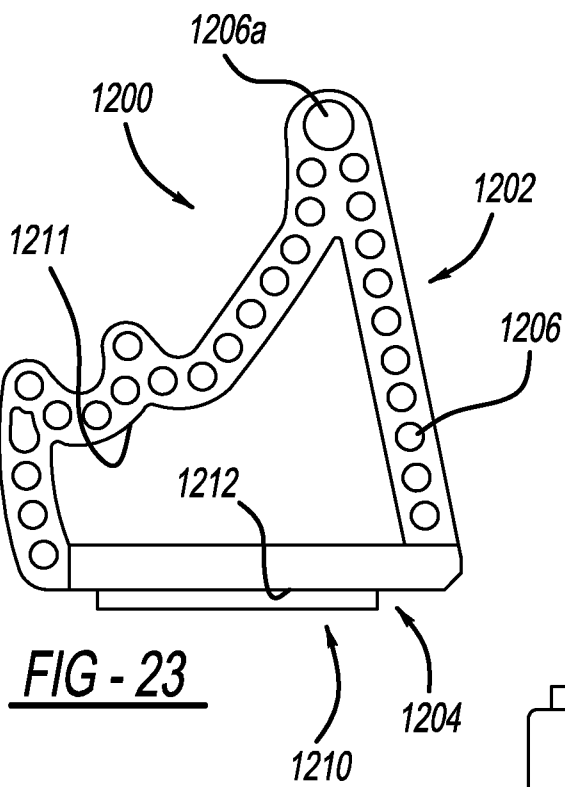
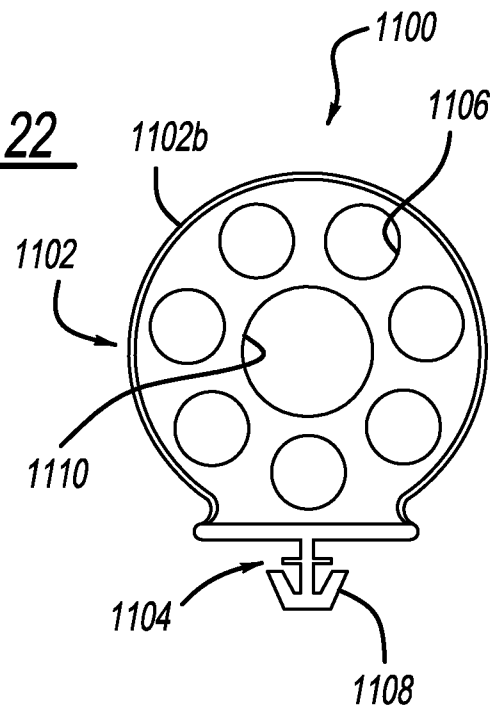


FIG - 23

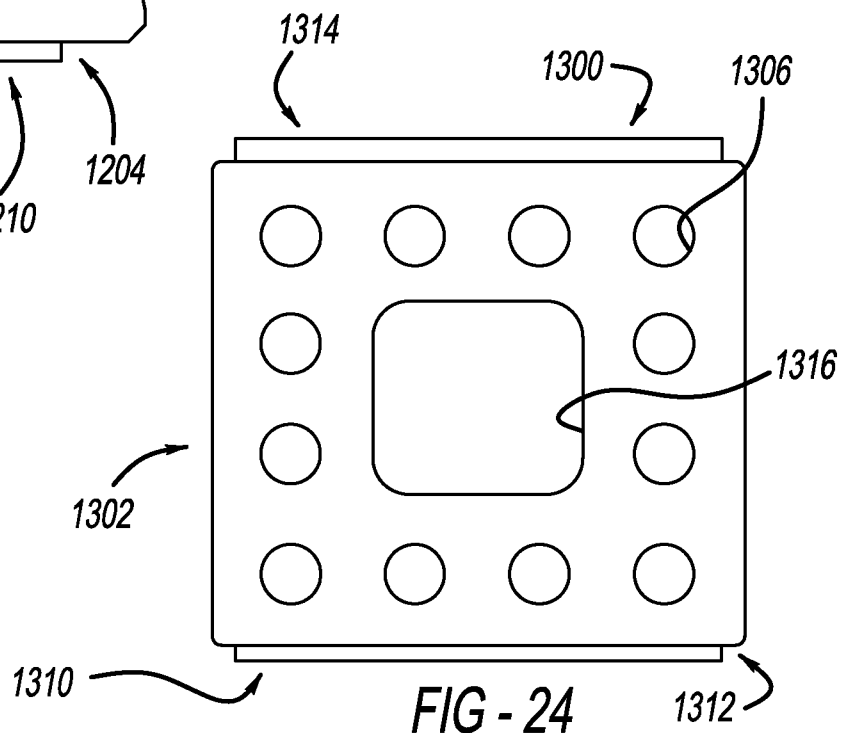
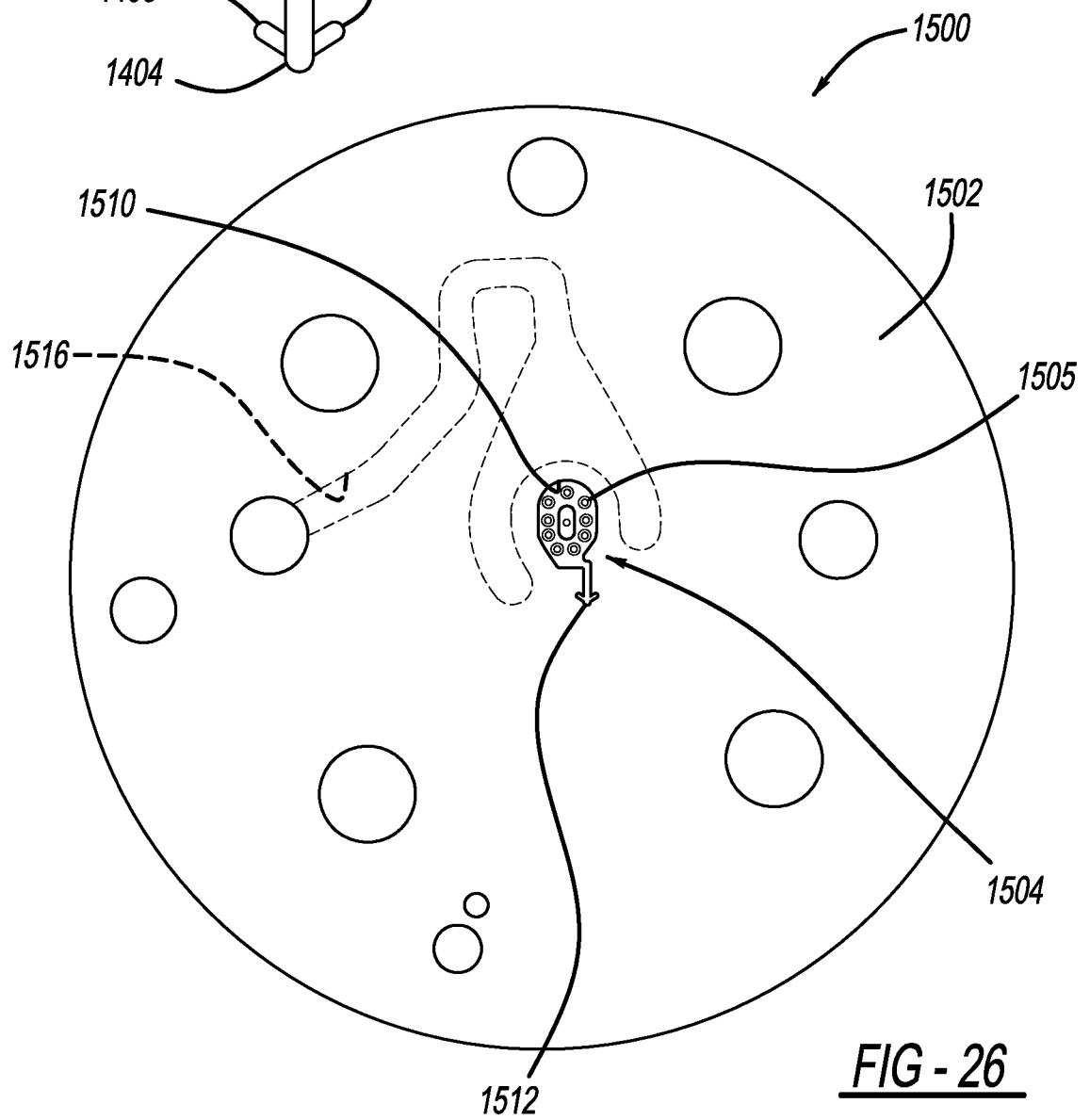
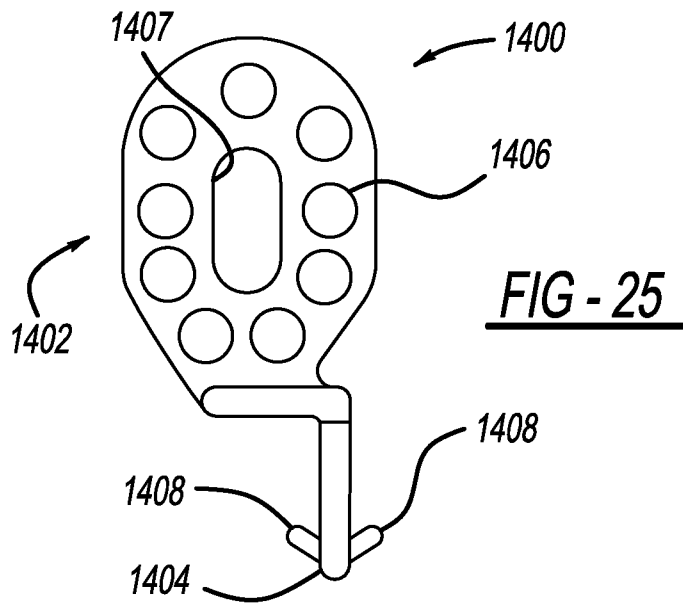
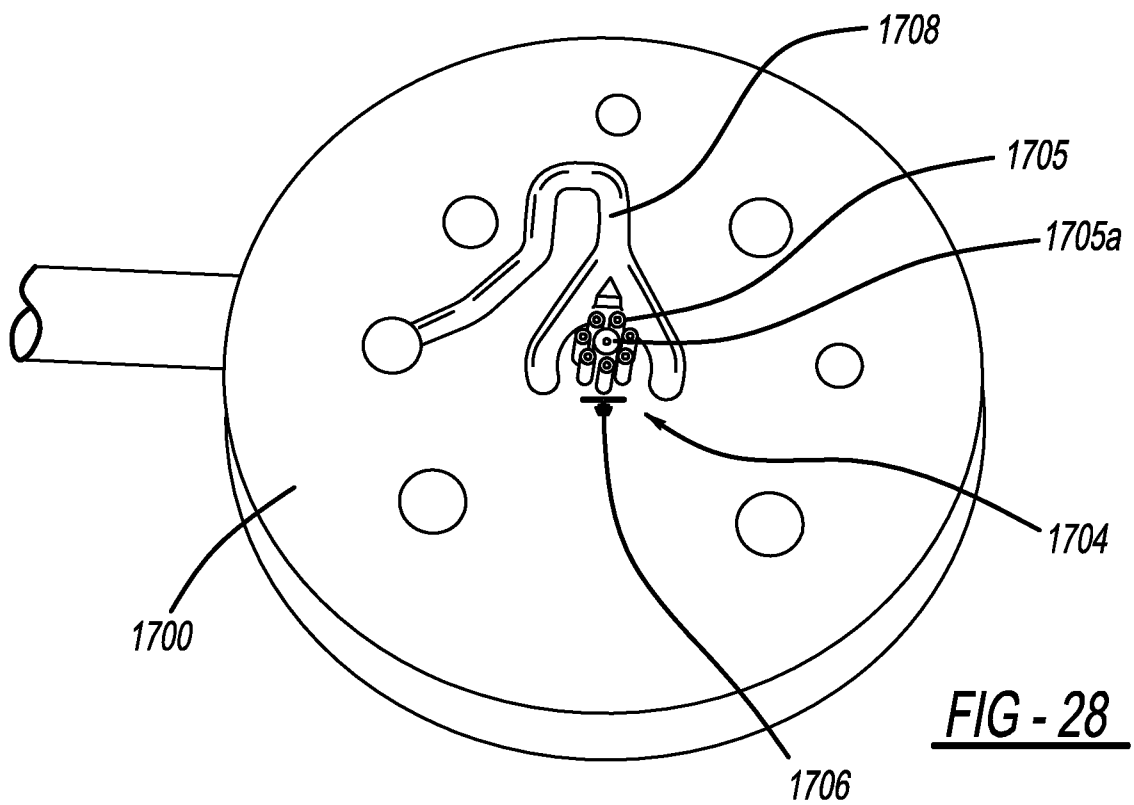
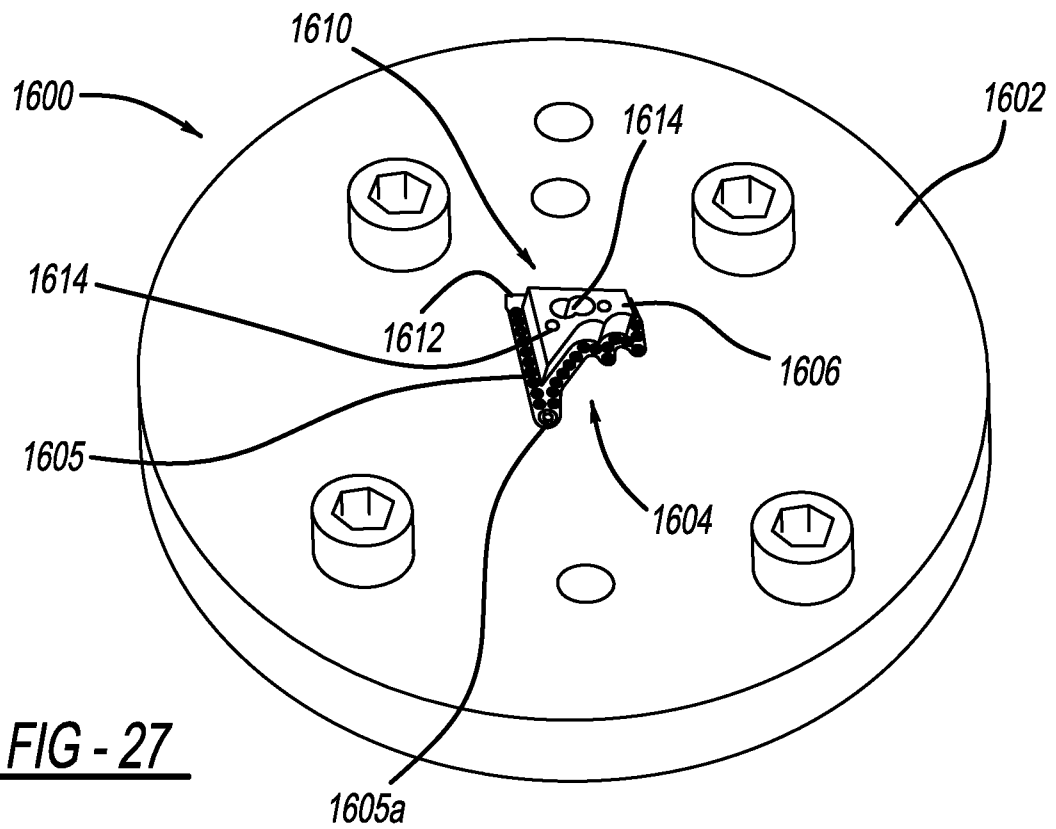
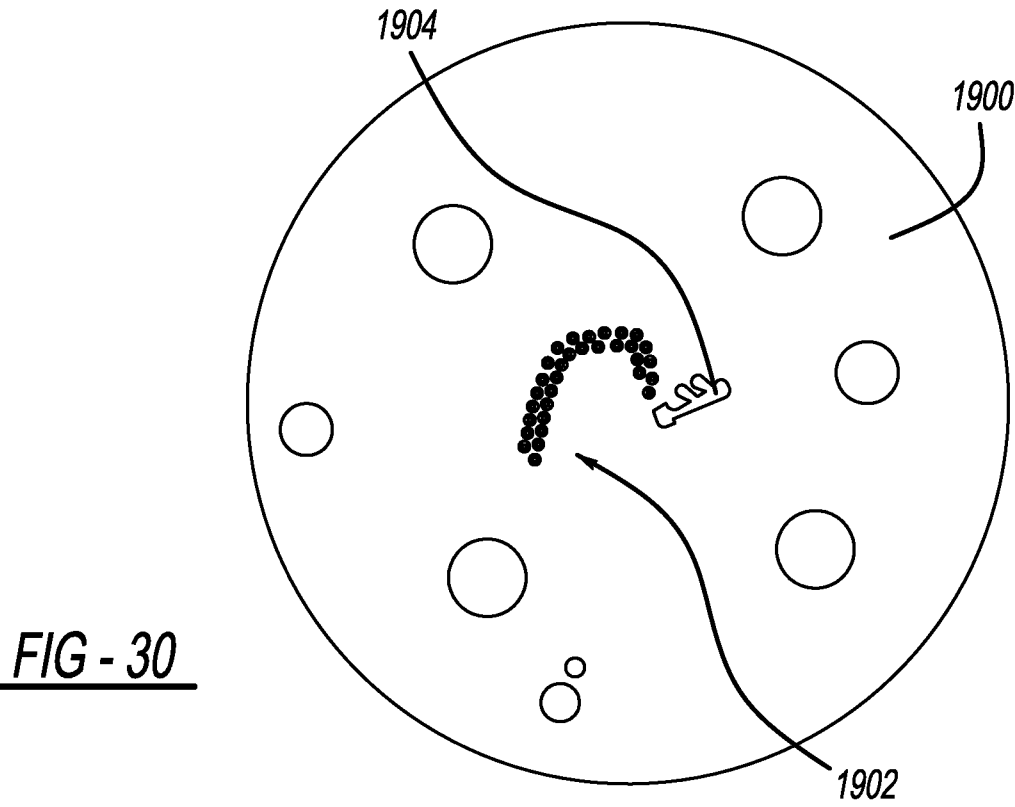
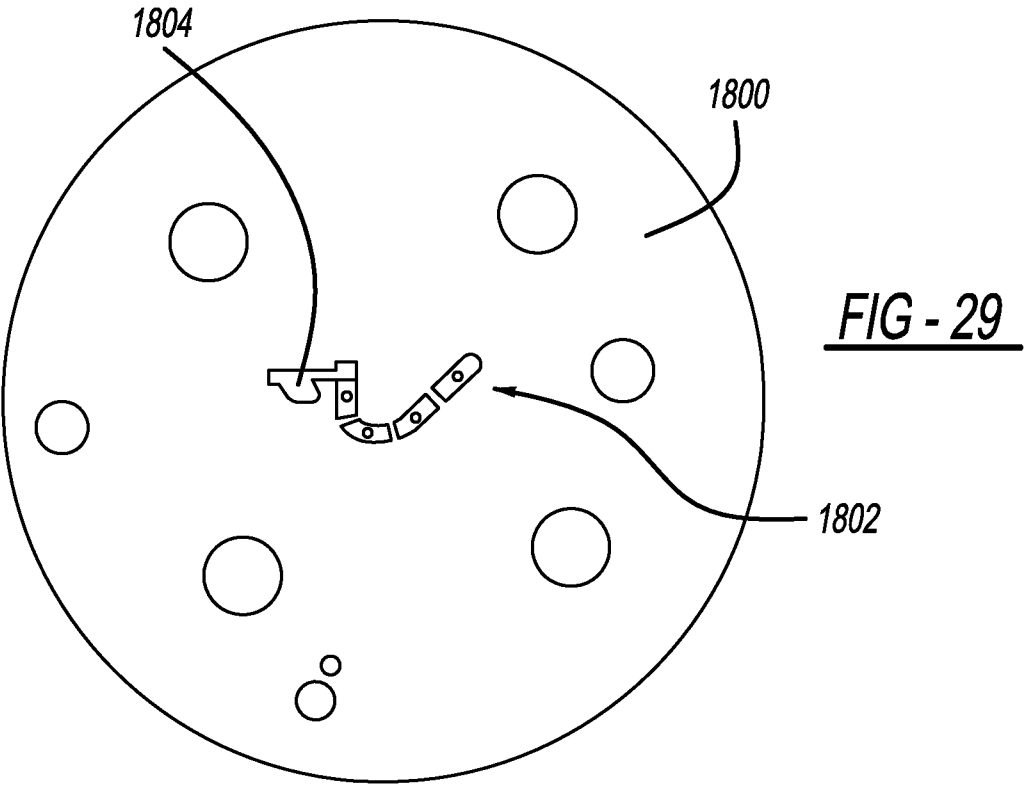


FIG - 24







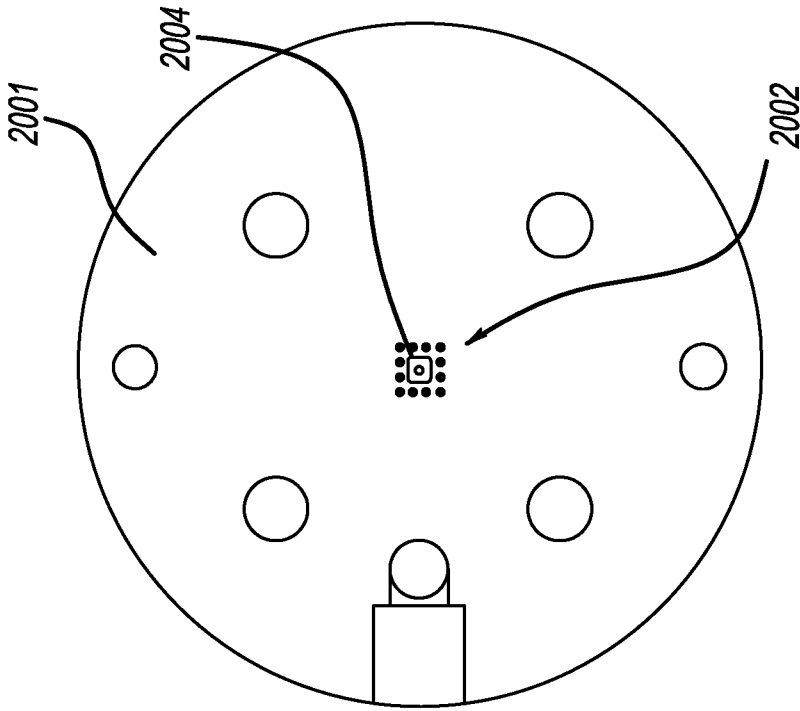


FIG - 31B

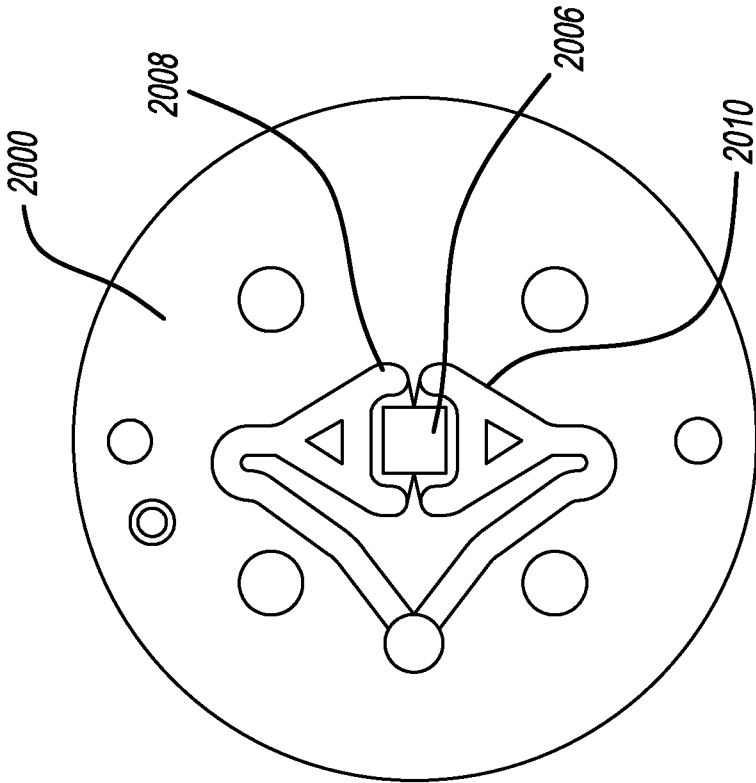


FIG - 31A

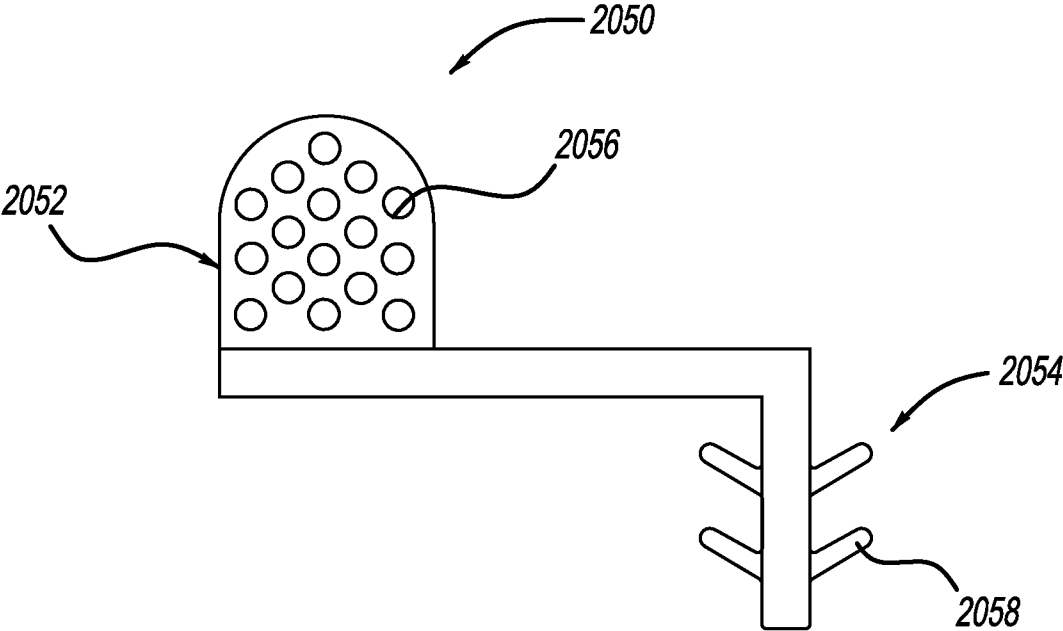


FIG - 32

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2017/033333

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C47/12 B29C47/08
 ADD. B60J10/80

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)

B29C B29L B60J

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 458 301 B1 (HENDRIX RAYMOND E [US]) 1 October 2002 (2002-10-01)	1,2,4-16
Y	abstract column 7, lines 18-50 claims 1-41 figures 12-17	19-21
X	US 2 137 887 A (ABBOTT CHARLES W) 22 November 1938 (1938-11-22) figures 4-6	1-3,5,6, 8-13
X	JP 2013 107607 A (TOYOTA MOTOR CORP) 6 June 2013 (2013-06-06)	17,18, 20,22
Y	figures 3-4	19,21
X	US 2012/038117 A1 (KNAPP MARK [US]) 16 February 2012 (2012-02-16)	17,18,22
Y	figures 1-1A	19-21
	-/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

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PCT/US2017/033333

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2015 214037 A (MITSUBA CORP) 3 December 2015 (2015-12-03) abstract figure 5 -----	1-22

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/033333

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6458301	B1	01-10-2002	CN 1547525 A 17-11-2004
			EP 1420932 A1 26-05-2004
			US 6458301 B1 01-10-2002
			WO 03018289 A1 06-03-2003

US 2137887	A	22-11-1938	NONE

JP 2013107607	A	06-06-2013	JP 5760977 B2 12-08-2015
			JP 2013107607 A 06-06-2013

US 2012038117	A1	16-02-2012	NONE

JP 2015214037	A	03-12-2015	NONE
