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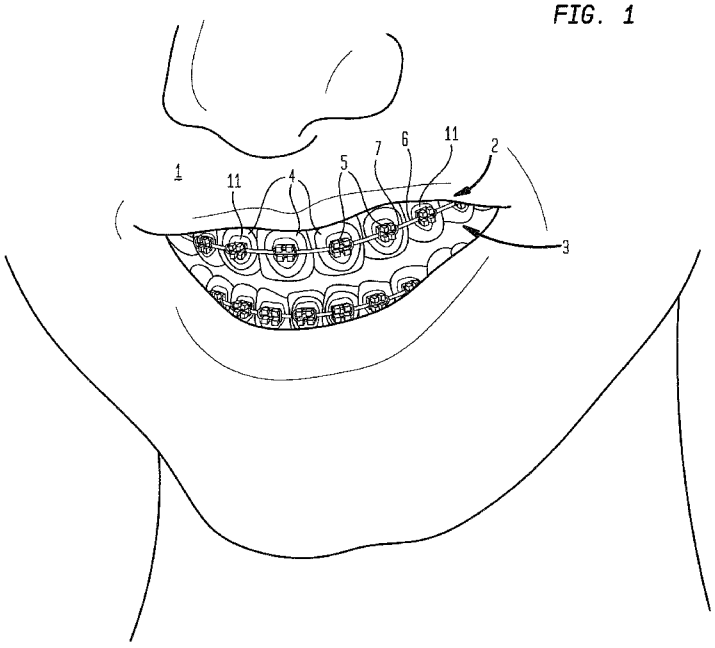
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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[Continued on next page]

(54) Title: BRACKET EXTENSION SYSTEM

FIG. 1



(57) Abstract: An orthodontic bracket extension system for orthodontic braces, the orthodontic bracket extension system including a plurality of bracket base extensions adapted for coupling one each to a corresponding plurality of brackets to increase a bracket bonding surface area for greater securement of each of the plurality of brackets to each of a corresponding plurality of teeth.

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BRACKET EXTENSION SYSTEM

This International Patent Cooperation Treaty Patent Application is a continuation of United States Non-Provisional Patent Application No. 14/504,325, filed October 1, 2014, which claims the benefit of United States Provisional Patent Application No. 61/886,461, filed October 3, 2013, each hereby incorporated by reference herein.

I. TECHNICAL FIELD

An orthodontic bracket extension system for orthodontic braces, the orthodontic bracket extension system including a plurality of bracket base extensions adapted for coupling one each to a corresponding plurality of brackets to increase a bracket bonding surface area for greater securement of each of the plurality of brackets to each of a corresponding plurality of teeth.

II. BACKGROUND

Conventional orthodontic brackets have bracket bases which are configured to directly bond to the surface of a tooth. However, particular prescriptions for forces or pressures which transfer from an archwire disposed within the bracket to the bracket can be sufficient to cause the bracket base to detach from the surface of the corresponding tooth.

Accordingly, a need exists for a system which can provide greater adherent forces between the bracket and the tooth surface to eliminate or reduce the occurrence of detachment of the bracket base from the surface of the corresponding tooth.

III. DISCLOSURE OF THE INVENTION

A broad object of a particular embodiment of the invention can be to provide an orthodontic bracket extension system including a plurality of brackets of an orthodontic appliance, each of the brackets including a bracket base having opposed bracket base first and second surfaces delimited by a bracket base periphery which defines a bracket base surface area of the bracket base first and second surfaces, and a bracket body having a bracket body length disposed between bracket body first and second ends, the bracket body first end coupled to the bracket base second surface, the bracket body second end terminating in an archwire slot configured to receive an archwire of the orthodontic appliance; and a plurality of bracket base extensions each having opposed bracket base extension first and second surfaces delimited by a bracket base extension periphery which defines a bracket base extension

surface area of the bracket base extension first and second surfaces, the bracket base extension first surface configured to fixedly mount to a corresponding one of a plurality of teeth in a dental arch, the bracket base extension second surface configured to fixedly couple to the bracket base first surface; whereby the bracket base extension surface area of the bracket base extension first surface is substantially greater than the bracket base surface area of the bracket base first surface.

Another broad object of a particular embodiment of the invention can be to provide a method of producing an orthodontic bracket extension system, the method including providing a bracket for an orthodontic appliance, the bracket including a bracket base having opposed bracket base first and second surfaces delimited by a bracket base periphery which defines a bracket base surface area of the bracket base first and second surfaces and a bracket body (16) having a bracket body length disposed between bracket body first and second ends, the bracket body first end coupled to the bracket base second surface, the bracket body second end terminating in an archwire slot configured to receive an archwire of the orthodontic appliance; providing a bracket base extension having opposed bracket base extension first and second surfaces delimited by a bracket base extension periphery which defines a bracket base extension surface area of the bracket base extension first and second surfaces, the bracket base extension first surface configured to fixedly mount to a tooth in a dental arch, whereby the bracket base extension surface area of the bracket base extension first surface is substantially greater than the bracket base surface area of the bracket base first surface; and coupling the bracket base first surface to the bracket base extension second surface, whereby the bracket can fixedly mount to the tooth in the dental arch via the bracket base extension first surface.

Another broad object of a particular embodiment of the invention can be to provide a method of using an orthodontic bracket extension system, the method including selecting a bracket for an orthodontic appliance, the bracket including a bracket base having opposed bracket base first and second surfaces delimited by a bracket base periphery which defines a bracket base surface area of the bracket base first and second surfaces and a bracket body having a bracket body length disposed between bracket body first and second ends, the bracket body first end coupled to the bracket base second surface, the bracket body second end terminating in an archwire slot configured to receive an archwire of the orthodontic appliance; selecting a bracket base extension having opposed bracket base extension first and second surfaces delimited by a bracket base extension periphery which defines a bracket base extension surface area of the bracket base extension first and second surfaces, the bracket base

extension first surface configured to fixedly mount to a tooth in a dental arch, whereby the bracket base extension surface area of the bracket base extension first surface is substantially greater than the bracket base surface area of the bracket base first surface; coupling the bracket base first surface to the bracket base extension second surface; and fixedly mounting the bracket base extension first surface to the tooth in the dental arch.

Naturally, further objects of the invention are disclosed throughout other areas of the specification, drawings, and claims.

IV. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an illustration of a particular embodiment of the orthodontic bracket extension system.

Figure 2A is an illustration a particular embodiment of the orthodontic bracket extension system mounted to lingual surfaces of a plurality of teeth.

Figure 2B is an illustration a particular embodiment of the orthodontic bracket extension system mounted to facial surfaces of a plurality of teeth.

Figure 3A is an incisal view of an incisor having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the incisor.

Figure 3B is a lingual view of an incisor having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the incisor.

Figure 3C is a perspective view of a particular embodiment of the orthodontic bracket extension system.

Figure 3D is a back view of a particular embodiment of a bracket base extension of the orthodontic bracket extension system, the back view showing a bracket base extension first surface.

Figure 3E is a back view of a particular embodiment of a bracket base of the orthodontic bracket extension system, the back view showing a bracket base first surface.

Figure 4A is a lingual view of a bicuspid (premolar) having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the bicuspid (premolar).

Figure 4B is a distal view of a bicuspid (premolar) having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the bicuspid (premolar), whereby the bracket base extension includes a partial band.

Figure 5A is an incisal view of a molar having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the molar, whereby the bracket base extension includes a mesial-distal band, the bracket base coupled to the mesial-distal band proximate a mesial-distal band lingual portion.

Figure 5B is a mesiofacial view of a molar having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the molar, whereby the bracket base extension includes a mesial-distal band, the bracket base coupled to the mesial-distal band proximate a mesial-distal band lingual portion.

Figure 5C is distoligual view of a molar having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the molar, whereby the bracket base extension includes a mesial-distal band, the bracket base coupled to the mesial-distal band proximate a mesial-distal band lingual portion.

Figure 6A is an incisal view of a molar having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the molar, whereby the bracket base extension includes a coronal band, the bracket base coupled to the coronal band proximate a coronal band lingual portion.

Figure 6B is meisofacial view of a molar having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the molar, whereby the bracket base extension includes a coronal band, the bracket base coupled to the coronal band proximate a coronal band lingual portion.

Figure 6C is distolingual view of a molar having a particular embodiment of the orthodontic bracket extension system mounted to the lingual surface of the molar, whereby the bracket base extension includes a coronal band, the bracket base coupled to the coronal band proximate a coronal band lingual portion.

V. MODE(S) FOR CARRYING OUT THE INVENTION

Now referring primarily to Figure 1, embodiments of the orthodontic bracket extension system (1) can be utilized for orthodontic treatment performed by fixing an orthodontic

appliance (2) to a plurality of teeth (3). Typically, but not necessarily, the orthodontic bracket extension system (1) can include one or more bracket base extensions (4), a plurality of brackets (5), an archwire (6), and a ligature (7). One or more of the plurality of brackets (5) can be secured in fixed relation to corresponding one or more bracket base extensions (4) which can be mounted to the surfaces of respective teeth (3). The plurality of brackets (5) can be intercoupled by the archwire (6), whereby the ligature (7) can be used to retain the archwire (6) in association with the plurality of brackets (5). The archwire (6) can generate external forces to urge the teeth (3) toward a targeted position or orientation over a period of time. Accordingly, the orthodontic appliance (2) can be utilized to correct malocclused teeth (3).

Now referring primarily to Figure 2A, as to particular embodiments, the orthodontic bracket extension system (1) can include one or more bracket base extensions (4) which can be mounted to the lingual surfaces (8) of respective teeth (3) around a dental arch (9), whereby the archwire (6) intercoupling the plurality of brackets (5) secured in fixed relation to the corresponding one or more bracket base extensions (4) extends around the lingual surfaces (8) of the teeth (3).

Now referring primarily to Figure 2B, as to particular embodiments, the orthodontic bracket extension system (1) can include one or more bracket base extensions (4) which can be mounted to the facial surfaces (10) of respective teeth (3) around the dental arch (10), whereby the archwire (6) intercoupling the plurality of brackets (5) secured in fixed relation to the corresponding one more bracket base extensions (4) extends around the facial surfaces (10) of the teeth (3).

Now referring primarily to Figure 1 through Figure 6C, the orthodontic bracket extension system (1) can include a plurality of brackets (5) of an orthodontic appliance (2) and a plurality of bracket base extensions (4).

Each of the brackets (5) can include a bracket base (11) having opposed bracket base first and second surfaces (12)(13) delimited by a bracket base periphery (14) which defines a bracket base surface area (15) of the bracket base first and second surfaces (12)(13). Each of the brackets (5) can further include a bracket body (16) having a bracket body length disposed between bracket body first and second ends (17)(18). The bracket body first end (17) can be coupled to the bracket base second surface (13). The bracket body second end (18) can terminate in an archwire slot (19) configured to receive an archwire (6) of the orthodontic appliance (2).

Each of the bracket base extensions (4) can have opposed bracket base extension first and second surfaces (20)(21) delimited by a bracket base extension periphery (22) which defines a bracket base extension surface area (23) of the bracket base extension first and second surfaces (20)(21). The bracket base extension first surface (20) can be configured to fixedly mount to a corresponding one of the plurality of teeth (3) in the dental arch (10). The bracket base extension second surface (21) can be configured to fixedly couple to the bracket base first surface (12).

As shown in Figure 3C through Figure 3E, the bracket base extension periphery (22) can define a bracket base extension surface area (23) of the bracket base extension first surface (20) which can be substantially greater than the bracket base surface area (15) of the bracket base first surface (12). Accordingly, a bracket base extension bonding surface area (24), which corresponds to at least a portion of the bracket base extension surface area (23) of the bracket base extension first surface (20), can be substantially greater than a bracket base bonding surface area (25), which corresponds to at least a portion of the bracket base surface area (15) of the bracket base first surface (12), whereby the relatively greater bracket base extension bonding surface area (24) can provide greater adherent forces between the orthodontic bracket extension system (1) and the corresponding teeth (3).

As used herein, the term "substantially greater" means greater than 5%. As an illustrative example, a bracket base extension surface area (23) is substantially greater than a bracket base surface area (15) when the bracket base extension surface area (23) is 5% greater than the bracket base surface area (15). As an additional illustrative example, a bracket base extension surface area (23) of at least 10.5 mm^2 is substantially greater than a bracket base surface area (15) of 10 mm^2, as 10.5 mm^2 is at least 5% greater than 10 mm^2.

In the use of conventional forces and pressures to move the teeth (3) toward targeted positions or orientations over a period of time, greater adherent forces between the orthodontic bracket extension system (1) and the corresponding teeth (3) can eliminate or reduce the occurrence of detachment of one or more bracket base extensions (4) from the corresponding one or more teeth (3). Additionally, greater adherent forces can allow an orthodontic practitioner to prescribe one or more tipping force moments, in-out force moments, or torqueing force moments which can be substantially outside of the conventional range of orthodontic mechanics to move one or more teeth (3) in relation to the plurality of teeth (3) of a patient with an elimination or reduction in the occurrence of detachment of one or more bracket base extensions (4) from the corresponding one or more teeth (3).

Embodiments of the bracket base extension (4) can have various configurations adapted for increasing the bracket base extension surface area (23) of the bracket base extension first surface (20), which can be directly bonded to or engaged with the lingual or facial surface (8)(10) of a corresponding tooth (3). As to particular embodiments, the bracket base extension first surface (20) can be configured as a generally planar bracket base extension first surface (20). As to other particular embodiments, the bracket base extension first surface (20) can be configured as an arcuate bracket base extension first surface (20), which can have a concave or convex contour configured to conform to a corresponding convex or concave contour of a mountable tooth surface (8)(10) of a corresponding tooth (3).

Now referring primarily to Figure 3A and Figure 3B, as to particular embodiments, the bracket base extension first surface (20) can have a configuration adapted for directly bonding to the lingual surface (8) of a tooth (3), for example an incisor (26), whereby the bracket base extension first surface (20) can have a convex contour configured to conform to a corresponding concave contour of the lingual surface (8) of the incisor (26).

Now referring primarily Figure 4A and Figure 4B, as to particular embodiments, the bracket base extension first surface (20) can have a configuration adapted for directly bonding to the lingual surface (8) of a tooth (3), for example a bicuspid (premolar) (27), whereby the bracket base extension first surface (20) can have a concave contour configured to conform to a corresponding convex contour of the lingual surface (8) of the bicuspid (premolar) (27).

Again referring primarily to Figure 4A and Figure 4B, as to particular embodiments, the bracket base extension (4) can further include a partial band (28) having at least one partial band element (29) adapted to extend, whether mesially or distally, about at least a portion of the tooth (3), for example the bicuspid (premolar) (27), to which the bracket base extension (4) affixes.

As to other particular embodiments, the bracket base extension (4) can further include a partial band (28) having at least one partial band element (29) adapted to extend about at least a portion of the occlusal surface of the tooth (3) to which the bracket base extension (4) affixes.

Now referring primarily to Figure 5A through Figure 5C, as to particular embodiments, the bracket base extension (4) can have a configuration adapted for directly bonding to both the lingual and facial surfaces (8)(10) of a tooth (3), for example a molar (30), whereby the

bracket base extension (4) can further include a mesial-distal band (31) having at least one mesial-distal band medial portion (32) disposed between mesial-distal band lingual and facial portions (33)(34). The mesial-distal band (31) can be adapted to extend mesially-distally about the molar (30). As to the particular embodiment shown in Figure 5A through Figure 5C, the bracket base extension (4) and corresponding bracket base (11) can be coupled to the mesial-distal band (31) proximate the mesial-distal band lingual portion (33). As to other particular embodiments, the bracket base extension (4) and corresponding bracket base (11) can be coupled to the mesial-distal band (31) proximate the mesial-distal band facial portion (34).

Now referring primarily Figure 6A through Figure 6C, as to particular embodiments, the bracket base extension (4) can have a configuration adapted for directly bonding to both the lingual and facial surfaces (8)(10) of a tooth (3), for example a molar (30), whereby the bracket base extension (4) can further include a coronal band (35) having a coronal band medial portion (36) disposed between coronal band lingual and facial portions (37)(38). The coronal band (35) can be adapted to extend over a coronal portion (39) of the molar (30). As to the particular embodiment shown in Figure 6A through Figure 6C, the bracket base extension (4) and corresponding bracket base (11) can be coupled to coronal band (35) proximate the coronal band lingual portion (37). As to other particular embodiments, the bracket base extension (4) and corresponding bracket base (11) can be coupled to coronal band (35) proximate the coronal band facial portion (38).

The bracket base (11) can be secured in fixed relation to the bracket base extension (4), whereby the bracket base first surface (12) fixedly couples to the bracket base extension second surface (21). As to particular embodiments, any of a wide variety of bonding adhesives (40) can be used to fixedly couple the bracket base first surface (12) to the bracket base extension second surface (21). Non-limiting examples of bonding adhesives (40) can include methacrylate ester monomers (CAS No: 109-16-0); polyacetal (CAS No: 9002-81-7); bisphenol A epichlorhydrin resin (CAS No: 25068-38-6); AbsoLute™ Self-Adhesive Resin Cement, which can be obtained from Centrix, Inc., 770 River Road, Shelton, Connecticut 06484, USA; Scotchbond™ Universal Adhesive, which can be obtained from 3M, 3M Center, St. Paul, Minnesota 55144, USA; or the like, or combinations thereof.

As to particular embodiments in which bonding adhesive (40) fixedly couples the bracket base first surface (12) to the bracket base extension second surface (21), an amount of bonding adhesive (40) can be provided between the bracket base first surface (12) and the

bracket base extension second surface (21). Following, the bonding adhesive (40) can be cured in accordance with the manufacturer's specifications to secure the bracket base (11) in fixed relation to the bracket base extension (4).

As to other particular embodiments, the bracket base (11) and the bracket base extension (4) can both be formed from a weldable metal (41), such as carbon steel, high-strength low-alloy steel, stainless steel, aluminum, titanium, or the like, or combinations thereof. The bracket base first surface (12) can be fixedly coupled to the bracket base extension second surface (21) by any method of welding which joins materials, such as soldering, arc welding, gas welding, resistance welding, energy beam welding, sold-state welding, or any method of welding which joins materials by causing coalescence.

As an illustrative example, the bracket base first surface (12) can be fixedly coupled to the bracket base extension second surface (21) by laser beam welding (as shown in the example of Figure 3B) incorporating a laser (42) having a high power density (on the order of 1 MW/cm^2) which results in relatively small heat-affected zones and relatively high heating and cooling rates. A spot size (43) of the laser (42) can vary in a range of between about 0.2 millimeters to about 1.0 millimeter; however, the invention need not be so limited, as the spot size (43) can be of lesser or greater size, depending upon the application. The depth of penetration of a laser beam (44) generated by the laser (42) in the bracket base extension (4) can not only be proportional to the amount of power supplied but can also be dependent upon the location of the focal point of the laser beam (44), whereby penetration can be enhanced when the focal point is slightly below the bracket base extension second surface (21). As to particular embodiments, a continuous or pulsed laser beam (44) can be used, depending upon the application.

As to particular embodiments in which laser beam welding fixedly couples the bracket base first surface (12) to the bracket base extension second surface (21), the bracket base (11) can be positioned on the bracket base extension (4) and millisecond-long pulses of the laser beam (44) can generate a weld (45) by moving the laser beam (44) to follow the bracket base periphery (14) to secure the bracket base (11) in fixed relation to the bracket base extension (4). As to particular embodiments, this can be achieved by manually moving the laser beam (44) along the bracket base periphery (14). As to other particular embodiments, movement of the laser beam (44) along the bracket base periphery (14) can be achieved with a mechanical movement apparatus (46), which can be guided in response to input from a laser scanner (47).

Embodiments of the bracket base extension (4) can be fixedly mounted to one of the plurality of teeth (3) by application of an amount of bonding adhesive (40), as above described, on the bracket base extension bonding surface area (24). Subsequently, the bracket base extension (4) can be fixedly mounted to the surface (8)(10) of a tooth (3) in a predetermined position or with a predetermined orientation, after which excess bonding adhesive (40) can be removed. As to particular embodiments, the bonding adhesive (40) can be cured, for example by using a high-intensity light, to secure the bracket base extension (4) to the surface (8)(10) of the tooth (3). Upon fixed securement, the archwire (6) can be disposed within the archwire slot (19) of the bracket body (16).

As to particular embodiments, the bracket base extension (4) can be provided with bond enhancement elements (48) to increase adherent forces between the bracket base extension (4) and the respective tooth surface (8)(10). Bond enhancement elements (48) can include chemical bond enhancement elements, mechanical bond enhancement elements, or a combination thereof. For example, suitable chemical bond enhancement elements can include silane treatment such as described in United States Patent No. 4,948,366. Suitable mechanical bond enhancement elements can include ridges, pegs, grooves, particles (such as regularly-shaped particles including spheres, rods, or cones, or irregularly-shaped particles such as shards of ceramic material).

A method of producing an orthodontic bracket extension system (1) can include: providing a bracket (5) for an orthodontic appliance (2), the bracket (5) including a bracket base (11) having opposed bracket base first and second surfaces (12)(13) delimited by a bracket base periphery (14) which defines a bracket base surface area (15) of the bracket base first and second surfaces (12)(13) and a bracket body (16) having a bracket body length disposed between bracket body first and second ends (17)(18), the bracket body first end (17) coupled to the bracket base second surface (13), the bracket body second end (18) terminating in an archwire slot (19) configured to receive an archwire (6) of the orthodontic appliance (2). The method can further include providing a bracket base extension (4) having opposed bracket base extension first and second surfaces (20)(21) delimited by a bracket base extension periphery (22) which defines a bracket base extension surface area (23) of the bracket base extension first and second surfaces (20)(21), the bracket base extension first surface (20) configured to fixedly mount to a tooth (3) in a dental arch (10), whereby the bracket base extension surface area (23) of the bracket base extension first surface (20) is substantially greater than the bracket base surface area (15) of the bracket base first surface (12). The

method can further include coupling the bracket base first surface (12) to the bracket base extension second surface (21). The bracket (5) fixedly mounts to the tooth (3) in the dental arch (10) by the bracket base extension first surface (20).

As to particular embodiments, the method can further include configuring the bracket base extension first surface (20) to directly bond to a lingual surface (8) of one of the plurality of teeth (3). As to other particular embodiments, the method can further include configuring the bracket base extension first surface (20) to directly bond to a facial surface (10) of one of the plurality of teeth (3).

As to particular embodiments, the method can further include coupling a partial band (28) to the bracket base extension (4), the partial band (28) having at least one partial band element (29) configured to extend about at least a portion of a tooth (3) to which the bracket base extension (4) fixedly mounts.

As to particular embodiments, the method can further include coupling a mesial-distal band (31) to the bracket base extension (4), the mesial-distal band (31) configured to extend mesially-distally about a tooth (3) to which the bracket base extension (4) fixedly mounts.

As to particular embodiments, the method can further include coupling a coronal band (35) to the bracket base extension (4), the coronal band (35) configured to extend over a coronal portion (39) of a tooth (3) to which the bracket base extension (4) fixedly mounts.

As to particular embodiments, the method can further include fixedly coupling the bracket base extension second surface (21) to the bracket base first surface (12) with a bonding adhesive (40). As to other particular embodiments, the method can further include forming the bracket base (11) and the bracket base extension (4) from a weldable metal (41) and fixedly coupling the bracket base extension second surface (21) to the bracket base first surface (12) by welding.

As to particular embodiments, the method can further include providing the bracket base extension (4) with a chemical bond enhancement element (48). As to other particular embodiments, the method can further include providing the bracket base extension (4) with a mechanical bond enhancement element (48).

As to particular embodiments, components of the orthodontic bracket extension system (1), including the bracket (5) and bracket base extension (4), can each be entirely formed of

the same material, or alternatively, can be formed from different materials. As to particular embodiments, components of the orthodontic bracket extension system (1) can be produced from any of a wide variety of materials which can be coupled to a tooth (3) and withstand forces or pressures which transfer from the archwire (6) disposed within the bracket (5). By way of non-limiting example, the material can include or consist of: metal, wood, plastic, plastic-like material, acrylic, polyamide, polyester, polypropylene, polyvinyl chloride-based materials, silicone-based materials, or the like, or combinations thereof. (Brandon, should we add any additional materials?)

As to particular embodiments, components of the orthodontic bracket extension system (1) can be produced from any of a wide variety of processes depending upon the application, such as press molding, injection molding, fabrication, machining, printing, three-dimensional printing, or the like, or combinations thereof, as one piece or assembled from a plurality of pieces into an embodiment of a component of the orthodontic bracket extension system (1) or provided as a plurality of pieces for assembly into an embodiment of a component of the orthodontic bracket extension system (1).

A method of using an orthodontic bracket base extension system (1) can include selecting a bracket (5) for an orthodontic appliance (2), the bracket (5) including a bracket base (11) having opposed bracket base first and second surfaces (12)(13) delimited by a bracket base periphery (14) which defines a bracket base surface area (15) of the bracket base first and second surfaces (12)(13) and a bracket body (16) having a bracket body length disposed between bracket body first and second ends (17)(18), the bracket body first end (17) coupled to the bracket base second surface (13), the bracket body second end (18) terminating in an archwire slot (19) configured to receive an archwire (6) of the orthodontic appliance (2). The method can further include selecting a bracket base extension (4) having opposed bracket base extension first and second surfaces (20)(21) delimited by a bracket base extension periphery (22) which defines a bracket base extension surface area (23) of the bracket base extension first and second surfaces (20)(21), the bracket base extension first surface (20) configured to fixedly mount to a tooth (3) in a dental arch (10), whereby the bracket base extension surface area (23) of the bracket base extension first surface (20) is substantially greater than the bracket base surface area (15) of the bracket base first surface (12). The method can further include coupling the bracket base first surface (12) to the bracket base extension second surface (21). The method can further include fixedly mounting the bracket base extension first surface (20) to the tooth (3) in the dental arch (10).

As can be easily understood from the foregoing, the basic concepts of the present invention may be embodied in a variety of ways. The invention involves numerous and varied embodiments of a bracket extension system and methods for making and using such bracket extension systems, including the best mode.

As such, the particular embodiments or elements of the invention disclosed by the description or shown in the figures or tables accompanying this application are not intended to be limiting, but rather exemplary of the numerous and varied embodiments generically encompassed by the invention or equivalents encompassed with respect to any particular element thereof. In addition, the specific description of a single embodiment or element of the invention may not explicitly describe all embodiments or elements possible; many alternatives are implicitly disclosed by the description and figures.

It should be understood that each element of an apparatus or each step of a method may be described by an apparatus term or method term. Such terms can be substituted where desired to make explicit the implicitly broad coverage to which this invention is entitled. As but one example, it should be understood that all steps of a method may be disclosed as an action, a means for taking that action, or as an element which causes that action. Similarly, each element of an apparatus may be disclosed as the physical element or the action which that physical element facilitates. As but one example, the disclosure of a "door stop" should be understood to encompass disclosure of the act of "a torque" -- whether explicitly discussed or not -- and, conversely, were there effectively disclosure of the act of "torquing", such a disclosure should be understood to encompass disclosure of a "a torque" and even a "means for torquing." Such alternative terms for each element or step are to be understood to be explicitly included in the description.

In addition, as to each term used it should be understood that unless its utilization in this application is inconsistent with such interpretation, common dictionary definitions should be understood to included in the description for each term as contained in the Random House Webster's Unabridged Dictionary, second edition, each definition hereby incorporated by reference.

All numeric values herein are assumed to be modified by the term "about", whether or not explicitly indicated. For the purposes of the present invention, ranges may be expressed as from "about" one particular value to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value to the other particular

value. The recitation of numerical ranges by endpoints includes all the numeric values subsumed within that range. A numerical range of one to five includes for example the numeric values 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, and so forth. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint. When a value is expressed as an approximation by use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term “about” generally refers to a range of numeric values that one of skill in the art would consider equivalent to the recited numeric value or having the same function or result. Similarly, the antecedent “substantially” means largely, but not wholly, the same form, manner or degree and the particular element will have a range of configurations as a person of ordinary skill in the art would consider as having the same function or result. When a particular element is expressed as an approximation by use of the antecedent "substantially," it will be understood that the particular element forms another embodiment.

Moreover, for the purposes of the present invention, the term “a” or “an” entity refers to one or more of that entity unless otherwise limited. As such, the terms “a” or “an”, “one or more” and “at least one” can be used interchangeably herein.

Thus, the applicant(s) should be understood to claim at least: i) each of the bracket extension systems herein disclosed and described, ii) the related methods disclosed and described, iii) similar, equivalent, and even implicit variations of each of these devices and methods, iv) those alternative embodiments which accomplish each of the functions shown, disclosed, or described, v) those alternative designs and methods which accomplish each of the functions shown as are implicit to accomplish that which is disclosed and described, vi) each feature, component, and step shown as separate and independent inventions, vii) the applications enhanced by the various systems or components disclosed, viii) the resulting products produced by such systems or components, ix) methods and apparatuses substantially as described hereinbefore and with reference to any of the accompanying examples, x) the various combinations and permutations of each of the previous elements disclosed.

The background section of this patent application provides a statement of the field of endeavor to which the invention pertains. This section may also incorporate or contain paraphrasing of certain United States patents, patent applications, publications, or subject matter of the claimed invention useful in relating information, problems, or concerns about the state of technology to which the invention is drawn toward. It is not intended that any United States patent, patent application, publication, statement or other information cited or

incorporated herein be interpreted, construed or deemed to be admitted as prior art with respect to the invention.

The claims set forth in this specification, if any, are hereby incorporated by reference as part of this description of the invention, and the applicant expressly reserves the right to use all of or a portion of such incorporated content of such claims as additional description to support any of or all of the claims or any element or component thereof, and the applicant further expressly reserves the right to move any portion of or all of the incorporated content of such claims or any element or component thereof from the description into the claims or vice-versa as necessary to define the matter for which protection is sought by this application or by any subsequent application or continuation, division, or continuation-in-part application thereof, or to obtain any benefit of, reduction in fees pursuant to, or to comply with the patent laws, rules, or regulations of any country or treaty, and such content incorporated by reference shall survive during the entire pendency of this application including any subsequent continuation, division, or continuation-in-part application thereof or any reissue or extension thereon.

Additionally, the claims set forth in this specification, if any, are further intended to describe the metes and bounds of a limited number of the preferred embodiments of the invention and are not to be construed as the broadest embodiment of the invention or a complete listing of embodiments of the invention that may be claimed. The applicant does not waive any right to develop further claims based upon the description set forth above as a part of any continuation, division, or continuation-in-part, or similar application.

VI. CLAIMS

I claim:

1. An orthodontic bracket extension system comprising:

a) a plurality of brackets of an orthodontic appliance, each of said brackets including:

i) a bracket base having opposed bracket base first and second surfaces delimited by a bracket base periphery which defines a bracket base surface area of said bracket base first and second surfaces; and

ii) a bracket body having a bracket body length disposed between bracket body first and second ends, said bracket body first end coupled to said bracket base second surface, said bracket body second end terminating in an archwire slot configured to receive an archwire of said orthodontic appliance; and

b) a plurality of bracket base extensions each having opposed bracket base extension first and second surfaces delimited by a bracket base extension periphery which defines a bracket base extension surface area of said bracket base extension first and second surfaces, said bracket base extension first surface configured to fixedly mount to a corresponding one of a plurality of teeth in a dental arch, said bracket base extension second surface configured to fixedly couple to said bracket base first surface;

wherein said bracket base extension surface area of said bracket base extension first surface substantially greater than said bracket base surface area of said bracket base first surface.

2. The system of claim 1, said bracket base extension first surface configured to directly bond to a lingual surface of one of said plurality of teeth.

3. The system of claim 1, said bracket base extension first surface configured to directly bond to a facial surface of one of said plurality of teeth.

4. The system of claim 1, said bracket base extension further including a partial band having at least one partial band element configured to extend about at least a portion of a tooth to which said bracket base extension fixedly mounts.

5. The system of claim 1, said bracket base extension further including a mesial-distal band configured to extend mesially-distally about a tooth to which said bracket base extension fixedly mounts.

6. The system of claim 1, said bracket base extension further including a coronal band configured to extend over a coronal portion of a tooth to which said bracket base extension fixedly mounts.

7. The system of claim 1, wherein a bonding adhesive fixedly couples said bracket base extension second surface to said bracket base first surface.

8. The system of claim 1, said bracket base and said bracket base extension formed from a weldable metal, wherein said bracket base extension second surface fixedly couples to said bracket base first surface by welding.

9. The system of claim 1, said bracket base extension further comprising a chemical bond enhancement element.

10. The system of claim 1, said bracket base extension further comprising a mechanical bond enhancement element.

11. A method of producing an orthodontic bracket extension system, said method comprising:

a) providing a bracket for an orthodontic appliance, said bracket including:

i) a bracket base having opposed bracket base first and second surfaces delimited by a bracket base periphery which defines a bracket base surface area of said bracket base first and second surfaces; and

ii) a bracket body having a bracket body length disposed between bracket body first and second ends, said bracket body first end coupled to said bracket base second surface, said bracket body second end terminating in an archwire slot configured to receive an archwire of said orthodontic appliance;

b) providing a bracket base extension having opposed bracket base extension first and second surfaces delimited by a bracket base extension periphery which defines a bracket base extension surface area of said bracket base extension first and second surfaces, said bracket base extension first surface configured to fixedly mount to a tooth in a dental arch, said bracket base extension surface area of said bracket base extension first surface substantially greater than said bracket base surface area of said bracket base first surface; and

c) coupling said bracket base first surface to said bracket base extension second surface;

whereby said bracket fixedly mounts to said tooth in said dental arch by said bracket base extension first surface.

12. The method of claim 11, further comprising configuring said bracket base extension first surface to directly bond to a lingual surface of one of said plurality of teeth.

13. The method of claim 11, further comprising configuring said bracket base extension first surface to directly bond to a facial surface of one of said plurality of teeth.

14. The method of claim 11, further comprising coupling a partial band to said bracket base extension, said partial band having at least one partial band element configured to extend about at least a portion of a tooth to which said bracket base extension fixedly mounts.

15. The method of claim 11, further comprising coupling a mesial-distal band to said bracket base extension, said mesial-distal band configured to extend mesially-distally about a tooth to which said bracket base extension fixedly mounts.

16. The method of claim 11, further comprising coupling a coronal band to said bracket base extension, said coronal band configured to extend over a coronal portion of a tooth to which said bracket base extension fixedly mounts.

17. The method of claim 11, further comprising fixedly coupling said bracket base extension second surface to said bracket base first surface with a bonding adhesive.

18. The method of claim 11, further comprising forming said bracket base and said bracket base extension from a weldable metal, further comprising fixedly coupling said bracket base extension second surface to said bracket base first surface by welding.

19. The method of claim 11, further comprising providing said bracket base extension with a chemical bond enhancement element.

20. The method of claim 11, further comprising providing said bracket base extension with a mechanical bond enhancement element.

21. A method of using an orthodontic bracket base extension system, said method comprising:

a) selecting a bracket for an orthodontic appliance, said bracket including:

i) a bracket base having opposed bracket base first and second surfaces delimited by a bracket base periphery which defines a bracket base surface area of said bracket base first and second surfaces; and

ii) a bracket body having a bracket body length disposed between bracket body first and second ends, said bracket body first end coupled to said bracket base second surface, said bracket body second end terminating in an archwire slot configured to receive an archwire of said orthodontic appliance;

b) selecting a bracket base extension having opposed bracket base extension first and second surfaces delimited by a bracket base extension periphery which defines a bracket base extension surface area of said bracket base extension first and second surfaces, said bracket base extension first surface configured to fixedly mount to a tooth in a dental arch, said bracket base extension surface area of said bracket base extension first surface substantially greater than said bracket base surface area of said bracket base first surface; and

c) coupling said bracket base first surface to said bracket base extension second surface; and

d) fixedly mounting said bracket base extension first surface to said tooth in said dental arch.

FIG. 1

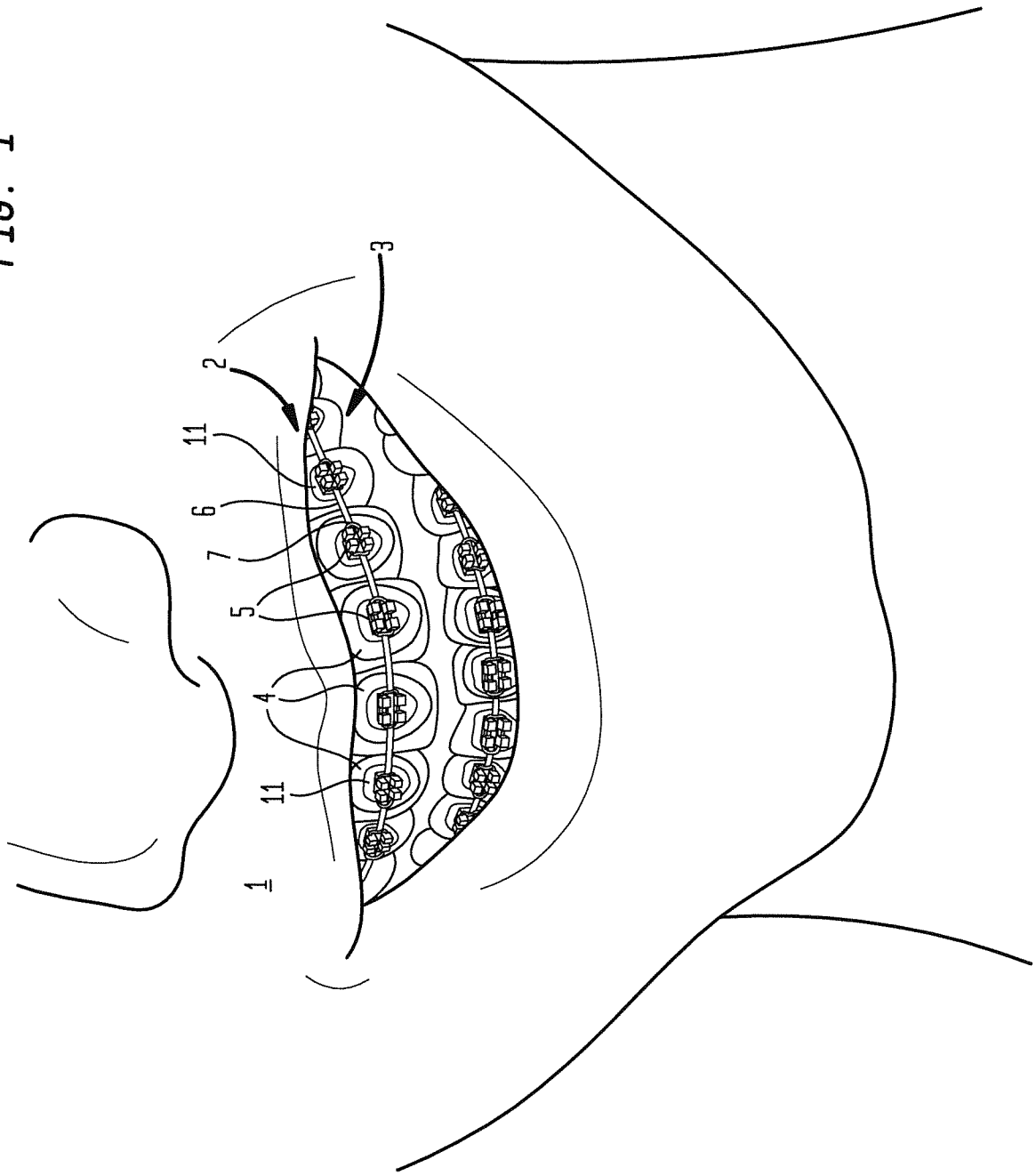


FIG. 2A

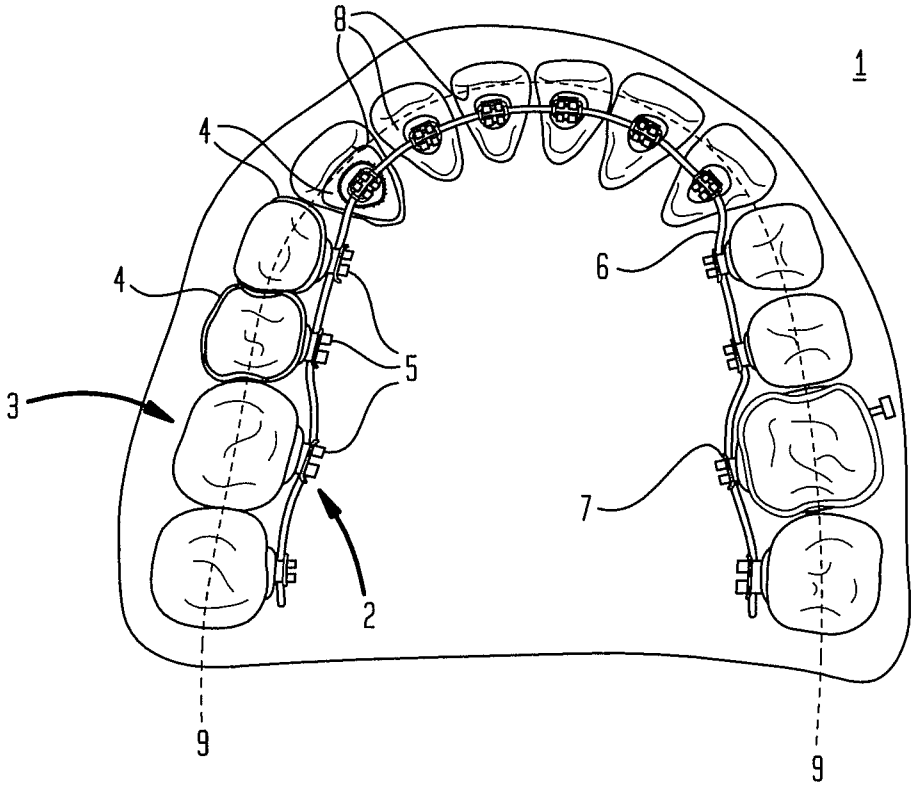


FIG. 2B

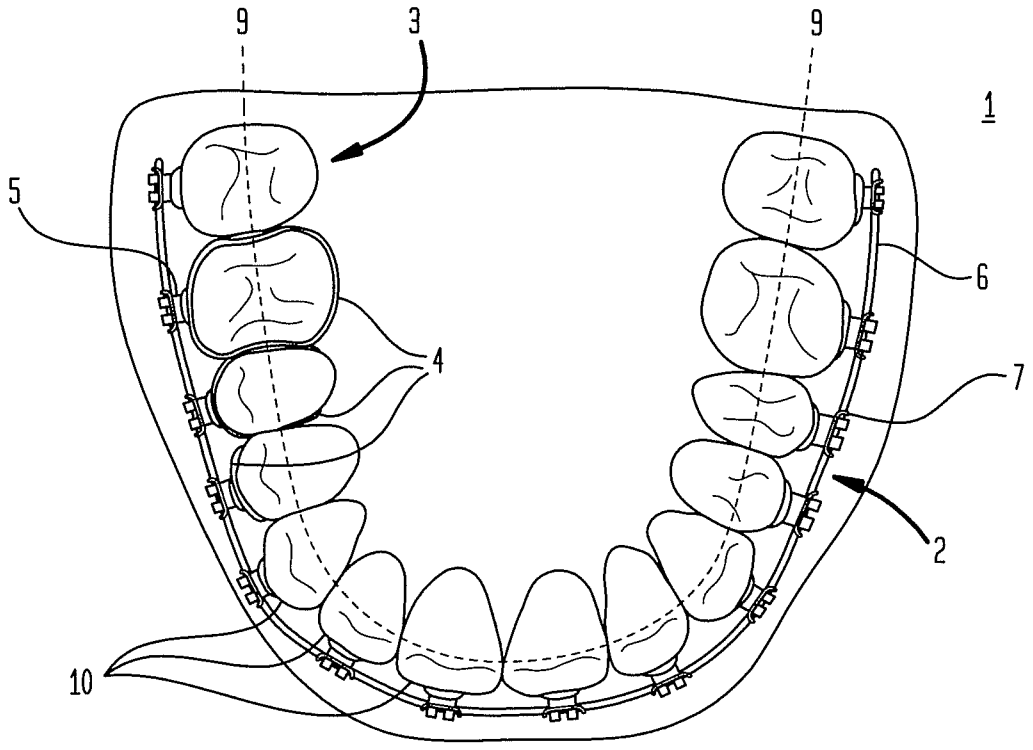


FIG. 3A

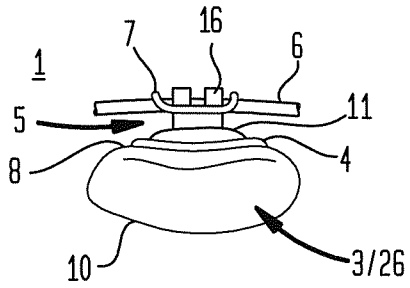


FIG. 3B

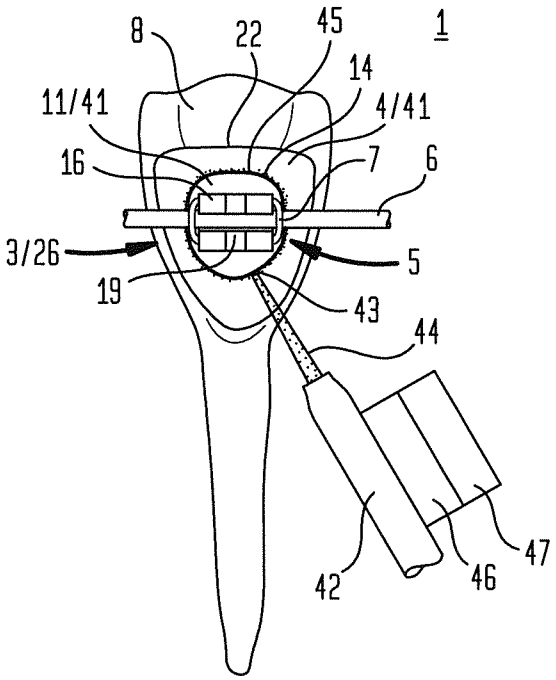


FIG. 3C

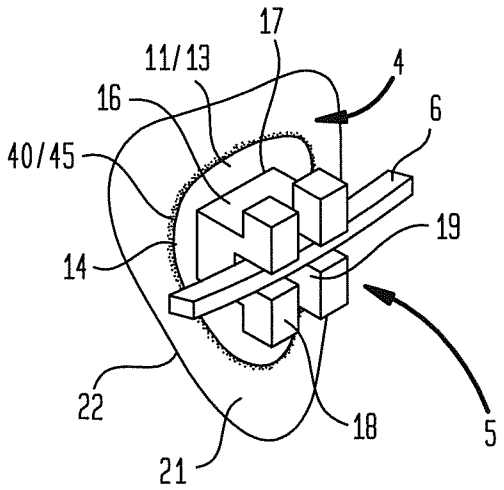


FIG. 3D

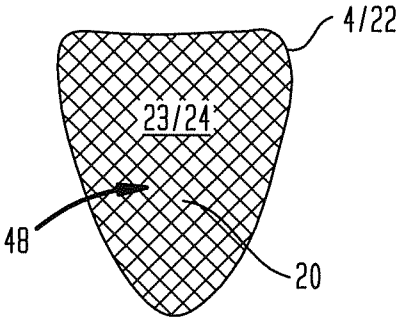


FIG. 3E

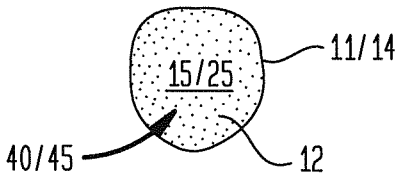


FIG. 4A

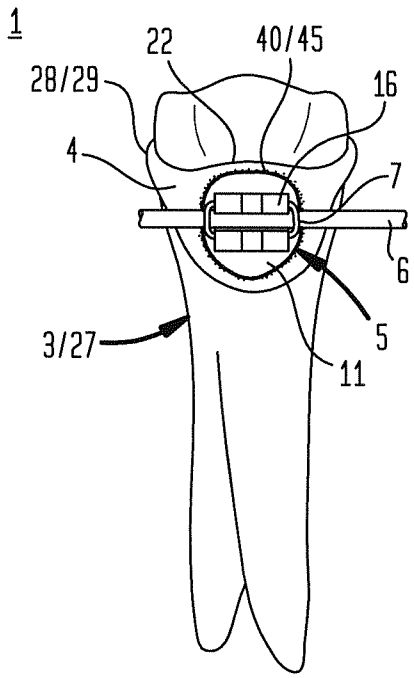


FIG. 4B

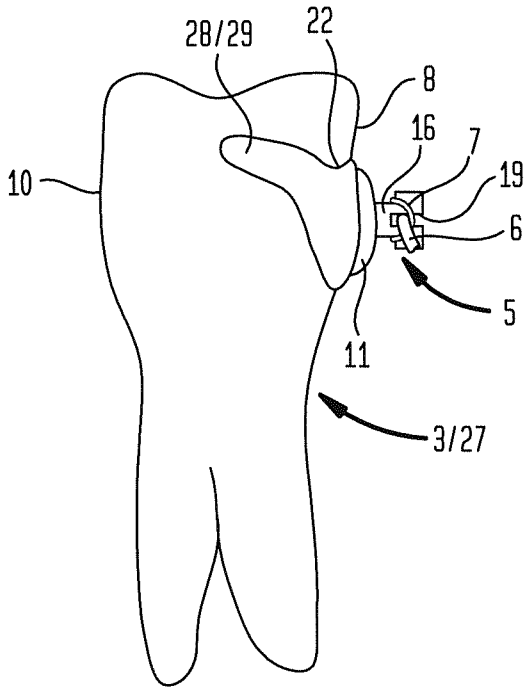


FIG. 5A

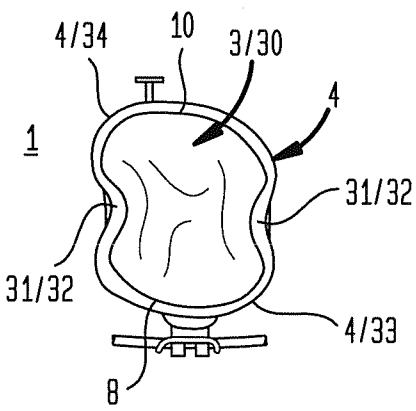


FIG. 5B

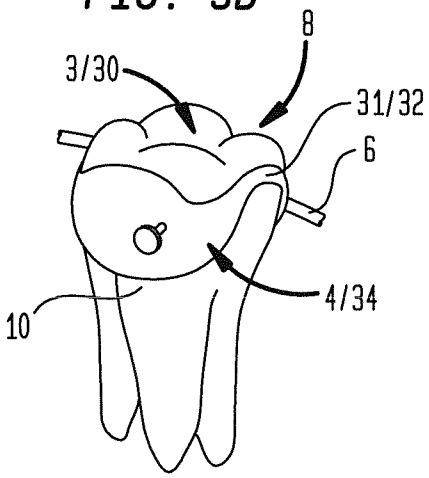


FIG. 5C

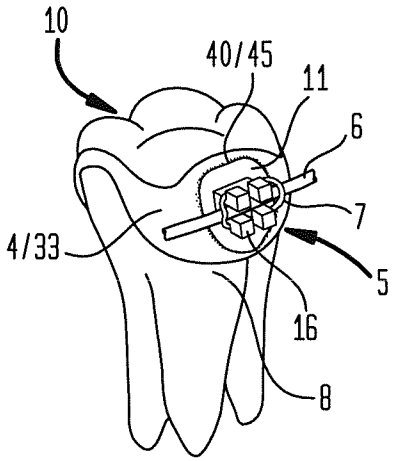


FIG. 6A

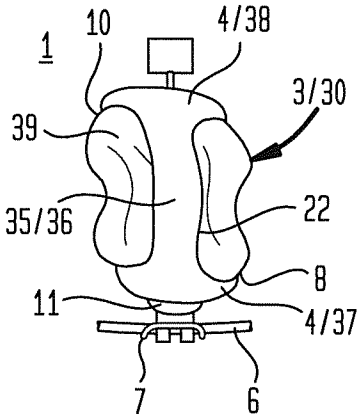


FIG. 6B

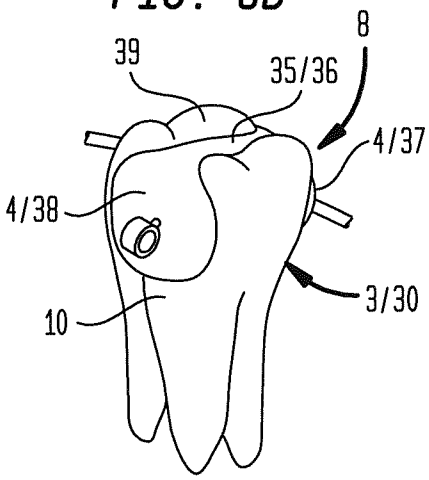
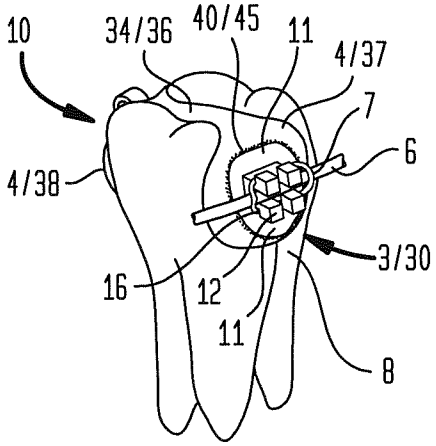


FIG. 6C



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/058982

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61C 7/12 (2014.01)
CPC - A61C 7/12 (2014.12)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A61C 3/00, 7/00, 7/02, 7/12 (2014.01)
CPC - A61C 3/00, 7/00, 7/02, 7/12 (2014.12)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 433/3, 8, 9, 10, 11 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Orbit, Google Patents, Google Scholar
Search terms used: orthodontic bracket; pad, extension, archwire, band, partial band

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,098,288 A (KESLING) 24 March 1992 (24.03.1992) entire document	1-3, 7, 9, 11-13, 17, 19, 21
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Y		4-6, 8, 10, 14-16, 18, 20
Y	US 2,716,283 A (ATKINSON) 30 August 1955 (30.08.1955) entire document	4-6, 14-16
Y	US 4,494,931 A (WILDMAN) 22 January 1985 (22.01.1985) entire document	8, 10, 18, 20
A	US 6,247,923 B1 (VASHI) 19 June 2001 (19.06.2001) entire document	1-21

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

* 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
19 December 2014	14 JAN 2015

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774