(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 December 2016 (15.12.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/200944 A1

(51) International Patent Classification:
A61C 3/00 (2006.01)

(21) International Application Number:
PCT/US2016/036452

(22) International Filing Date:
8 June 2016 (08.06.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

62/172,548	8 June 2015 (08.06.2015)	US
15/176,777	8 June 2016 (08.06.2016)	US

(71) Applicant: **AMERICAN ORTHODONTICS CORPORATION** [US/US]; 3524 Washington Avenue, Sheboygan, WI 53081 (US).

(72) Inventors: **SOMMER, Jay, S.**; 1117 Bluebird Road, Howards Grove, WI 53083 (US). **NIMMER, Eric, W.**; W6025 Whispering Lane, Plymouth, WI 53073 (US). **PIETZNER, Andrew, R.**; 2226 N. 22nd Street, Sheboygan, WI 53083 (US).

(74) Agents: **IMHOFF, Benjamin R.** et al.; Andrus Intellectual Property Law, LLP, 100 E. Wisconsin Avenue, Suite 1100, Milwaukee, WI 53202 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: SELF-LIGATING BRACKET

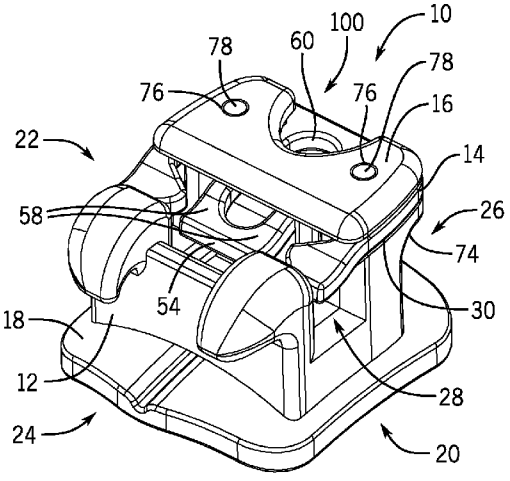


FIG. 1B

(57) Abstract: A self-ligating bracket 10 includes a bracket body 12 and a spring clip 14. The bracket body 12 includes a mesial channel 86, a distal channel 84, a center channel 92, and an arch wire slot 28. The spring clip 14 includes a distal arm 30, mesial arm 32, and a center arm 34 which are moveably within the mesial channel 86, distal channel 84, and center channel 92 between an open position and a closed position to occlude the arch wire slot 28.

WO 2016/200944 A1

SELF-LIGATING BRACKET

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority of U.S. Provisional Patent Application No. 62/172,548, filed on June 8, 2015 and U.S. Patent Application No. 15/176,777, filed June 8, 2016, the contents of which are hereby incorporated herein by reference in their entireties.

BACKGROUND

[0002] The present disclosure relates to the field of orthodontics. More specifically, the present disclosure relates to self-ligating brackets.

[0003] Orthodontic treatment often involves at least a combination of an arch wire and brackets and/or buccal tubes that are used to secure the arch wire to the teeth of the patient. The arch wire is made of a resilient material that, if bent or deformed, will return to its previous shape. Dental malocclusions are treated by securing the arch wire to the patient teeth which are brought into a post-treatment alignment as the arch wire returns to its original shape. The corrective forces are transferred from the interactions between the arch wire and the arch wire slot of the bracket, through the bracket to the tooth.

[0004] Traditionally, brackets are secured to the teeth of a patient and the brackets have an arch wire slot within which the arch wire is received. Elastomeric ligatures secure the arch wire within the arch wire slot of the bracket. Self-ligating brackets include a built in mechanical ligature which eliminates the need for separate elastomeric ligatures to secure the arch wire to the bracket. Self-ligating brackets typically use a sliding and/or rotating clip or door that moves relative to the bracket body to occlude the arch wire slot.

[0005] Self-ligating brackets are available as “active” brackets or “passive” brackets, which describe the way in which the arch wire may interact with the clip. Active self-ligating brackets include a clip in which an end or portion extends into an edgewise slot and resiliently applies a seating force against an arch wire in the facial-lingual dimension. The active self-ligating bracket retains the arch wire in the slot due to the mechanical strength of the clip itself. Active self-ligating brackets provide more control of the interactive forces between the clip and

the arch wire, but can increase friction between the arch wire and the clip, which may reduce the transfer of this force to the tooth.

[0006] Passive self-ligating brackets include a clip that extends across and beyond the arch wire slot and is fixed or restrained against movement in the facial-lingual dimension. The passive self-ligating bracket, when closed, effectively forms a tube defined by the slot and the clip within which an arch wire with a diameter smaller than a diameter of the formed tube can slide. For this reason, in some applications, the clip of a passive self-ligating bracket is called a door.

BRIEF DISCLOSURE

[0007] An exemplary embodiment of a self-ligating bracket includes a bracket body. The bracket body includes a mesial side and a distal side. The bracket body includes an arch wire slot that extends from the mesial side to the distal side of the bracket body. A mesial channel extends into the bracket body. A center channel extends into the bracket body between the mesial channel and the distal channel. A spring clip includes a distal arm which includes a distal arm body and a distal finger. The spring clip includes a mesial arm which includes a mesial arm body and a mesial finger. The spring clip includes a center arm which includes a first center arm body and a second arm center body. The first center arm body and the second arm body are connected by a center arm bar. The spring clip is movable between an open position and a closed position. In the open position, the arch wire slot is unobstructed and in the closed position the distal finger, the mesial finger, and the center arm bar extend into and across the arch wire slot to occlude the arch wire slot.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1A is a top view of an exemplary embodiment of a self-ligating bracket in a closed configuration.

[0009] Figure 1B is a perspective view of an exemplary embodiment of a self-ligating bracket in a closed configuration.

[0010] Figure 1C is a side view of an exemplary embodiment of a self-ligating bracket in a closed configuration.

[0011] Figure 2A is a top view of an exemplary embodiment of a self-ligating bracket in an open configuration.

[0012] Figure 2B is a perspective view of an exemplary embodiment of a self-ligating bracket in an open configuration.

[0013] Figure 2C is a side view of an exemplary embodiment of a self-ligating bracket in an open configuration.

[0014] Figure 3 is a side sectional view of the self-ligating bracket taken along line 3-3 of Figure 1A.

[0015] Figure 4A is a top view of an exemplary embodiment of a spring clip.

[0016] Figure 4B is a perspective view of an exemplary embodiment of a spring clip.

[0017] Figure 5 is a perspective view of an exemplary embodiment of a bracket cap.

[0018] Figure 6 is a top view of an exemplary embodiment of a bracket body.

[0019] Figure 7 depicts a perspective view of a second exemplary embodiment of a self-ligating bracket in an open configuration.

[0020] Figure 8 depicts a perspective view of the second exemplary embodiment of the self-ligating bracket in a closed configuration.

[0021] Figure 9 is a cut away view of the second exemplary embodiment of the self-ligating bracket taken along the line 9-9 in Figure 7.

[0022] Figure 10 is a top sectional view of the second exemplary embodiment of the self-ligating bracket as taken along line 10-10 of Figure 8.

[0023] Figure 11 is a perspective sectional view taken along line 11-11 of Figure 8.

DETAILED DISCLOSURE

[0024] Figures. 1-6 all depict various views of a first exemplary embodiment of a self-ligating bracket 10. The self-ligating bracket 10 generally includes a bracket body 12, a spring clip 14, and a bracket cap 16. In embodiments, a bonding pad 18 is secured to the bracket body 12. The bonding pad 18 may be exemplarily secured to the bracket body 12 by braising or welding. In alternative embodiments, the bonding pad 18 may be secured to the bracket body 12 by being integral to one another and being exemplarily formed by casting or milling, although it

will be understood that alternative techniques of manufacturing the bracket body 12 and bonding pad 18 may be used. In embodiments, the bonding pad 18 may be formed or contoured such as to be secured to a tooth of a patient's dentition. Applicant's co-pending U.S. Patent Application No. 14/212,616 filed on March 14, 2014 further described aspects of self-ligating brackets and is hereby incorporated by reference in its entirety.

[0025] The self-ligating bracket 10 exemplarily includes a distal side 20, a mesial side 22, a gingival side 24, and an occlusal side 26. It will be recognized that these designations are relative and informational and alternative embodiments may be positioned in other orientations within the mouth of the patient while remaining within the scope of the embodiments as disclosed herein.

[0026] Figures 1A-C depict various views of the first exemplary embodiment of the self-ligating bracket 10 in a closed configuration in which the spring clip 14 is moved to a closed position that occludes an arch wire slot 28. Figures 2A-C depict various views of the first exemplary embodiment of the self-ligating bracket 10 in an open configuration in which the spring clip 14 is moved to a position in which the arch wire slot 28 is accessible to receive an arch wire (not depicted). When the self-ligating bracket 10 is in the open configuration, the spring clip 14 is in the open position away from the arch wire slot 28 and the arch wire slot 28 is able to receive an arch wire. When the self-ligating bracket 10 is in the closed configuration, the spring clip 14 is in a closed position extending across and into the arch wire slot 28 in a manner that operates to retain the arch wire during use to orthodontically treat the dentition of a patient. Specific features and interaction within the embodiment will be described in further detail herein with respect to Figs. 4-6.

[0027] Figure 4A is a top view of a spring clip 14. Figure 4B is a perspective view of the spring clip 14. The spring clip 14 includes a distal arm 30, a mesial arm 32, and a center arm 34. The distal arm 30 further includes a distal arm body 36 and a distal finger 38. The distal arm 30 terminates in a distal arm end 39. The distal finger 38 is connected to the distal arm body 36 by a distal transition portion 40. In an exemplary embodiment, the distal transition portion 40 is formed as an S-curve between the distal arm body 36 and the distal finger 38, although it will be recognized that the distal transition portion 40 may take a variety of other shapes or forms while staying within the scope of the present disclosure. In embodiments, at least a portion of the distal

finger 38 is planar and extends in a different plane than the distal arm body 36. In some embodiments, the distal finger 38 may extend parallel to the distal arm body 36. In other embodiments, the distal finger 38 may extend at another angle or curvature. The mesial arm 32 similarly includes a mesial arm body 42 connected to a mesial finger 44 by a mesial transition portion 46. The mesial arm 32 terminates in a mesial arm end 45. In an embodiment, the mesial arm 32 is constructed in similar manners as described above with respect to the distal arm 30.

[0028] In still further embodiments as described herein, the distal arm 30 includes a distal projection 48. In an embodiment, the distal projection 48 extends interior to the self-ligating bracket 14 from the distal finger 38. Similarly, the mesial arm 32 further includes a mesial projection 50 that extends into the self-ligating bracket 14 exemplarily from the mesial finger 44.

[0029] The center arm 34 is exemplarily constructed of two generally opposed center arm bars 52 connected by an end bar 54. The center arm 34 terminates in a center arm end 55. The end bar 54 exemplarily extends across and connects gingival ends 56 of the respective center arm bars 52. The end bar 54 exemplarily extends in the same plane as the distal finger 38 and mesial finger 44. In still further exemplary embodiments, the end bar 54 extends in the same plane as the distal projection 48 and the mesial projection 50. The center arm bars 52 exemplarily further include center transition portions 58, which are exemplarily S-curves. In exemplary embodiments, similar components respectively between the distal arm 30, mesial arm 32 and center arm 34 extend in a same plane when viewed looking mesially-distally, as like components across these structures. The spring clip 14 further includes a base bar 60 that may generally extend along a length of the spring clip 14 in the mesial-distal dimension. The distal arm 30, mesial arm 32, and center arm 34 all exemplarily extend away from the base bar 60.

[0030] As best depicted by way of reference to Figs. 1A and 4A, a total width W_1 of the spring clip 14 between the distal arm 30 and the mesial arm 32 exemplarily coincides with the bracket body 12 in total width in the mesial-distal dimension. More specifically, a distal edge 37 of the distal arm 30, and particularly the distal finger 38 is aligned with a distal side 31 of the bracket body 12 and a mesial edge of the mesial arm 32, and particularly the mesial finger 44 is aligned with a mesial side 33 of the bracket body 12. Thus, when the spring clip 14 is in the closed position, the distal arm 30 and mesial arm 32 apply their restraining forces on an arch wire starting at the respective distal and mesial ends of the arch wire slot 28. Additionally, the center

arm 34, more specifically, the center arm bar 54 provides the restraining force on an arch wire at the center of the arch wire slot 28, and similarly the center of the bracket 12.

[0031] The distal finger 38 has a width W_2, the center bar 54 has a width W_3, and the mesial finger 44 has a width W_4. These widths represent the portion of the spring clip 14 that are configured to engage an arch wire in the slot 28. Thus a combined width (W_2+W_3+W_4), while necessarily less than or equal to W_1, represents the amount of the arch wire slot 28 that is occluded when the clip 14 is in the closed position. In an embodiment, the combined width is 60% or more of W_1. In still further embodiments, the distal projection 48 increases W_2 beyond the width of the distal arm body 36 and the mesial projection 50 increases W_4 beyond the width of the mesial arm body 42 and the combined width is a greater percentage of W_1. In one exemplary embodiment the distal and mesial projections are at least twice as wide as the respective widths of the distal arm body 36 and the mesial arm body 42 and the combined width is 80% or more of W_1. In a still further exemplary embodiment, for example as depicted in Figs. 1-6, the combined width is 85% or more of W_1. In a still further embodiment, by enlargement of one or more of the center bar 54, distal finger 38, and mesial finger 44 the combined width is 90% or more of W_1. It will be understood that these embodiments are merely exemplary and additional configurations of components making up W_2, W_3, and W_4 will be recognized while being within the scope of the present disclosure. Therefore, embodiments exhibit the advantage of separate engagement forces, applied at the distal, mesial, and center of the bracket across a great portion of the arch wire slot.

[0032] The center arm bars 52 and end bar 54 exemplarily define a center opening 62. The center opening 62 exemplarily includes a first end 64, which may be generally flat as defined by the end bar 54 and a second end 66 that may be rounded in shape and defined by a curve formed into the center arm bars 52 and base bar 60. It will be recognized that the center opening 62 may exemplarily take other shapes while still remaining within the scope of the present disclosure.

[0033] Figure 5 is a perspective view of an exemplary embodiment of a bracket cap 16 as will be described in further detail herein. The bracket cap 16 has a generally planar top surface 68. At an exemplary gingival side, the bracket cap 16 includes an arch wire slot side 70. Opposite the arch wire slot side 70, the bracket cap ends in two tie wing caps 72. The bracket cap 16 is

configured to matingly engage the bracket body 12 in the manners as depicted in Figures 1-3. In such engagement, the arch wire slot side 70 is aligned with an occlusal wall 27 of the arch wire slot 28 in the bracket body 12 and each of the tie wing caps 72 align with respective tie wings 74 of the bracket body 12.

[0034] The bracket cap 16 further includes post holes 76 that extend through the bracket caps 16 and are configured to engage posts 78 on the bracket body 12 as described in further detail herein.

[0035] Figure 6 depicts various views of an exemplary embodiment of a bracket body 12. The bracket body 12 further includes a plurality of stop projections, exemplarily gingival stop projections 80 and occlusal stop projections 82 that respectively extend into a distal channel 84 within which the distal arm (not depicted) of the spring clip slides and the mesial channel 86 within which the mesial arm (not depicted) of the spring clip slides. The stop projections 80, 82 resiliently engage the distal projection 48 and the mesial projection 50 of the spring clip 14 (Fig. 4). In addition to other features as described in further detail herein, the engagement of the spring clip distal projection and mesial projection with the stop projection 80 and 82 of the bracket body 12 defines and open position of the spring clip. On the other hand, engagement of the distal finger 38 and mesial finger 44 with respective gingival sides 88 of the arch wire slot 28 as well as engagement of the base bar 60 with occlusal end 90 of the occlusal stop projections 82 define the closed position of the spring clip.

[0036] The bracket body 12 further includes a center channel 92 within which the center arm 34 of the spring clip slides, as depicted in Figs. 1-3. A stop projection 94 is located within the center channel 92 and exemplarily extends upwards from a center channel floor 96 which is the surface that the center arm 34 of the spring clip slidingly engages. The stop projection 94 is exemplarily dimensioned such that it is can be slidingly received within the center opening 62 of the spring clip. When the center opening 62 of the spring clip 14 is arranged over the stop projection 94, the center arm 34 is slidably received within the center channel 92. The stop projection 94 extends through the center opening 62 where when the spring clip 14 is in the open position, the stop projection 94 engages the first end 64 of the center opening 62, which may be embodied by the end bar 54 of the center arm 34. Thus, the engagement of the stop projection 94

with the end bar 54 further defines the open position of the spring clip and prevents complete removal of the spring clip beyond the defined open position.

[0037] The bracket body 12 further includes shoulders 98 on the occlusal wall 27 of the arch wire slot 28 which effectively transition each of the distal channel 84, mesial channel 86, and center channel 92 into the ach wire slot 28. In embodiments, the respective transition portions 40, 46, and 58 of the distal arm 30, mesial arm 32, and center arm 34 are exemplarily shaped as S-curves which, due to the resilient material from which the spring clip is constructed, generally flatten as the spring clip is moved into the open position and withdrawn into the respective distal channel 84, mesial channel 86, or center channel 92. It will be further recognized that the distal channel 84, mesial channel 86, and center channel 92 are further defined on the labial side by the bracket cap 16 secured to the bracket body. As the spring clip is moved into the closed position, the S-curves of the transition portions return to their normal configuration and create a biasing force against the shoulders to retain the spring clip in the closed position.

[0038] Additionally, in exemplary embodiments, at least some of the arms are further reinforced against the arch wire escaping the arch wire slot when the clip is in the closed position. This may achieve improved ligating strength and robustness of embodiments of the bracket. In the exemplary embodiment depicted in Figures 1-6, the cap 16 provides a resilient force against each of the arms 30, 32, 34 in the facial-lingual dimension. This creates a short moment arm about which any force in the facial-lingual dimension from the arch wire against any arms 30, 32, 34 is resisted. The short moment arm increases the strength of the arms to resist this force. Additionally, in some embodiments, the arch wire slot side 70 of the cap16 may be in alignment with the occlusal wall 27 of the arch wire slot 28 which further minimizes this moment arm. A similar configuration and embodiment with similar advantages may be implemented in the embodiment of the bracket shown and described with respect to Figs. 7-11, although in such embodiment, the caps 114 engage the mesial arm 30 and distal arm 32.

[0039] The bracket cap 16 further includes a tool cut out 100 that extends between the tie wing cap 72. The tool cut out 100 may exemplarily be defined as a complex curve defined by three curved sections comprising at least two radii. When the spring clip is in the closed position, the second end 66 of the center opening 62 of the spring clip 14 is aligned with the tool cut out

100 to facilitate access by an orthodontist's tool tip (not depicted) with the second end 66 of the center opening 62 such that the orthodontist can apply an opening force with the orthodontic tool tip to overcome the exemplary biasing forces, of the transition portion of the spring clip arms against the shoulders of the bracket body as well as the distal and mesial projections against the respective gingival stop projections of the base, to move the spring clip into the open position.

[0040] In an exemplary embodiment, the orthodontic tool creates a lever between the bracket body and the spring clip to move the spring clip from the closed position to the open position. The tool tip extends through the center opening and engages the bracket body through the center opening 62. The orthodontist uses a twisting or rotating movement to place a force in the gingival direction against the bracket body and a force in the occlusal direction against the spring clip. These forces overcome the biasing forces of the spring clip in the closed position to move the spring clip into the open position. However, this may provide improved patient comfort as the forces from the tool generally oppose one another creating less force felt by the patient in contrast to an embodiment wherein the tool tip only engages the spring clip with the force in the occlusal direction.

[0041] The above described structural features of the first embodiment of the self-ligating bracket 10 achieve the desirable feature of providing a self-ligating bracket 10 which includes a spring clip 14 that is captured between the bracket body 12 and the bracket cap 16. In assembly, the spring clip 14 is positioned on the bracket body 12, exemplarily in the closed position with the distal, mesial, and center arms positioned respectively in the distal, mesial, and center channels. The bracket cap 16 is secured to the bracket body 12, securing the spring clip 14 moveably between the bracket body 12 and the bracket cap 16. When the post holes 76 of the bracket cap engage the posts 78 of the bracket body, the bracket cap 16 can be secured, exemplarily by welding or braising to the bracket body 12. This is depicted in Fig. 3 which shows the bracket cap 16 secured to the bracket body 12 and in contact with the top of the stop projection 94. As can also be seen in Fig. 3, the distal channel, center channel, (and mesial channel) are exemplarily the same height as the thickness of the spring clip 14 such that the spring clip is slidable within the respective channels. Once secured, the bracket cap 16 traps the spring clip 14 in slidable engagement between the bracket cap 16 and bracket body 12. The spring clip 14 cannot be removed from the joined bracket body 12 and the bracket cap 16

because of the engagement of the end bar 54 with the stop projection 94 when the spring clip 14 is moved into the open position and the securement of the bracket cap 16 over the center channel 92.

[0042] Figure 3 is a side sectional view taken along line 3-3 of Figure 1A depicting an exemplary embodiment of the self-ligating bracket 10 in the closed configuration. As depicted in Figures 1C, 2C, and 3, the arch wire slot 28 is defined by an occlusal wall 27, a gingival wall 29, and a bottom wall 31. In an exemplary embodiment, the arch wire slot 28 has a width of 0.022 inches for which coincides with a larger diameter of a standard rectangular arch wire; however, it will be recognized that other dimensions or configurations of the arch wire slot 28 may be used as disclosed in embodiments herein.

[0043] As described above, when the spring clip 14 is in the closed position, the respective distal arm 30, mesial arm 32, and center arm 34 bend at respective distal transition portion 40, mesial transition portion 46, and center transition portions 58 such that the distal finger 38, mesial finger 44, and center finger 54 is located into the arch wire slot at a position closer to the bottom 31 of the arch wire slot 28 than the rest of the spring clip 14. A distance D1 between the bottom of the respective fingers 38, 44, 54 of the spring clip 14 and the bottom 31 of the arch wire slot 28 defines a minimum diameter of arch wire required for active engagement of the arch wire by the spring clip 14. Thus, if an arch wire with a diameter smaller than D1 is used, the spring clip 14 will only actively engage the arch wire should the arch wire already be being forced out of seating in the arch wire slot 28, for example by a force labially away from the tooth.

[0044] Taking a hypothetical example where the wire is in alignment in the arch wire slot and seated at the bottom of the slot so that there are no corrective/interactive forces between the wire and the bracket, possible interactions between the clip and the wire will be explained. When an active self-ligating bracket is used with an arch wire with a smaller diameter than a distance (D1) between the bottom of the arch wire slot and the portion of the clip that extends into the slot, the active self-ligating bracket effectively operates as a passive bracket. However, when used with an arch wire of a diameter greater than the distance (D1) between the bottom of the arch wire slot and the clip, then clip engages the arch wire and applies the seating force. Thus, an active self-ligating bracket may be one in which a cross-sectional dimension of a lumen defined

by the arch wire slot and the clip in the closed position is smaller than a cross-sectional dimension of at least one arch wire for which the arch wire slot is configured to receive.

[0045] A passive self-ligating bracket may be one in which a cross-sectional dimension of the lumen defined by the arch wire slot and the clip in the closed position is greater than a cross-sectional dimension of a largest arch wire for which the arch wire slot is configured to receive. The clip of the passive self-ligating bracket therefore does not engage any size of arch wire during treatment. Passive self-ligating brackets provide less control over bracket arch wire interaction, but do so with minimal friction (all else being equal) compared to elastomeric ligations and active clips which may improve transfer of the corrective force to the tooth. In some embodiments, the lumen of a passive self-ligating bracket may further be defined by a rigid ledge or other portion of the bracket body that engages the clip to define the minimum distance between the bottom of the arch wire slot and the clip in the closed position. The engagement of the clip with this structure of the bracket body may limit this minimum distance independent of the shape or other physical properties of the clip itself.

[0046] By way of example, a bracket may be designed for use with arch wires having a diameter in the facial-lingual dimension of 0.018 inch and with arch wires having a diameter in the facial-lingual dimension of 0.022 inch. In such an example, an active self-ligating bracket embodiment may be one with the aforementioned distance (D1) in the lumen is less than or equal to 0.022, while the clip in the closed position is capable of flexing to a distance (D1) of at least 0.022 inch while a passive self-ligating bracket is one in which the aforementioned distance (D1) in the lumen is greater than 0.022 inch, independent of the flexibility or rigidity of the clip.

[0047] Additionally, in an embodiment at least one of the end 39 of the distal arm 30, the end 45 of the mesial arm 32, and the end 55 of the center arm 54 engages the gingival wall 29 of the arch wire slot 28 when the spring clip is in the closed position and when the spring clip 14 is in the open position, the ends 39, 45, 55 are retracted into the bracket body occlusally of the occlusal wall 27 of the arch wire slot 28. In another embodiment, at least one of the end 39 of the distal arm 30, the end 45 of the mesial arm 32, and the end 55 of the center arm extend gingivally past a plane of the gingival wall 29, or end occlusally of the gingival wall 29. In either case, when the clip is in the open position, the respective ends 39, 45, 55 of the arms are retracted occlusally of the occlusal wall 27.

[0048] Some embodiments of the features described present additional advantages in that self-ligating bracket clips are typically tiny pieces of metal that if removed from engagement with the rest of the bracket, may become lost in a patient's mouth, swallowed by a patient, or cause abrasion to the inside of the patient's mouth. Therefore, a bracket that securely retains the spring clip when the clip is in the open position is beneficial. Additionally, retention of the spring clip in engagement with the rest of the bracket can minimize the risk of damage to the spring clip as the spring clip cannot be moved out of position.

[0049] Figures 7-11 depict a second exemplary embodiment of a self-ligating bracket 110. It will be recognized that in Figures 7-11 similar reference numerals as used and described above with respect to Figures 1-6 are further used herein to identify similar structures.

[0050] The self-ligating bracket 110 includes a bracket body 112 a spring clip 14 and a bonding pad 18. The bracket body 112 includes an arch wire slot 28 and tie wings 74. The arch wire slot 28 is defined by an occlusal wall 27, a gingival wall 29, and a bottom wall 31. The occlusal wall 27, gingival wall 29, and bottom wall 31 define a largest diameter or arch wire that can be accepted into the bracket 110.

[0051] As best depicted in Figures 9 and 10, which are cut away views of self-ligating bracket 110, the bracket body 112 includes gingival stop projections 80 and occlusal stop projections 82. The gingival stop projections 80 and occlusal stop projections 82 respectively extend labially for at least the thickness of the spring clip 14 to define the distal channel 84 and mesial channel 86 in the labial dimension. The gingival stop projections 80 and occlusal stop projections 82 extend into the distal channel 84 within which the distal arm 30 of the spring clip 40 is slidingly received and the mesial channel 86 from which the mesial arm 32 of the spring clip 14 is slidably received. The bracket body 112 further includes a center channel 92 within which the center arm 34 of the spring clip 14 slidingly moves.

[0052] As previously described, the center arm 34 includes center arm bars 52 which terminate at an end bar 54 connecting gingival ends 56 of respective center arm bars 52. The spring clip further defines a center opening 62 bounded by the center arm bars 52, end bar 54 and base bar 60 of the spring clip 14. The center opening 62 is exemplarily defined between a first end 64 and a second end 66. As will be described in further detail herein, the first end 64 and

second end 66 of the center opening 62 are exemplarily curved shaped. It will be recognized, however, that other shapes of the first end 64 and second end 66 may be used in this embodiment and in other embodiments while remaining within the scope of the present disclosure.

[0053] The distal arm 30 includes a distal transition portion 40, the mesial arm 32 includes a mesial transition portion 46, and the center arm 34 includes center transition portions 58. Each of the transition portions 40, 46, and 58 are exemplarily shaped as S-curves while other configurations will be recognized from the present disclosure.

[0054] Referring back to Figures 7 and 8, the bracket body 112 includes tie wing caps 114 that are integral components of the bracket body 112. The tie wing caps 114 exemplarily extend from the gingival stop projections 80 and the occlusal stop projections 82 and cover above the respective distal channel 84 and mesial channel 86, while leaving the center channel 92 exemplarily exposed.

[0055] The bracket body 112 further includes a stop projection 116 that extends from a channel floor 96 of the center channel 92. The stop projection 116 further includes a gingival shoulder 118 and an occlusal ramp 120.

[0056] In operation, the self-ligating bracket 110 is assembled by inserting the spring clip 14 into the occlusal side of the bracket body 112 and slide the distal arm 30 and mesial arm 32 within the respective distal channel 84 and mesial channel 86 of the bracket body 112. As the spring clip 14 is inserted, the distal arm 30 and mesial arm 32 deform in the mesial-distal dimension so that the respective distal projection 48 and mesial projection 50 can pass around first the occlusal stop projection 82 and later the gingival stop projection 80, when the spring clip is moved into the closed position.

[0057] As the spring clip 14 is advanced in the gingival direction, the end bar 54 engages the occlusal ramp 120 of the stop projection 116. The occlusal ramp 120 deforms the center arm 34 outward in an exemplary facial direction until the first end 64 of the center opening 62 passes over the gingival shoulder 118 of the stop projection 116.

[0058] As mentioned above, if the spring clip 14 advances further in the exemplary gingival direction, the respective transition portions 40, 58, and 46 of the spring clip arms pass over the shoulders 98 and the distal finger 38, end bar 54, and mesial finger 44 extend into and

across the arch wire slot 28 as the transition portions 40, 46, and 58 return to their normal position. In this position, the distal finger end 39 and mesial finger end 45 engage the gingival wall 29 of the arch wire slot 28.

[0059] As best depicted in Figures 7, 9, and 11, when the spring clip 14 is moved from the closed position to the open position, the distal arm 30 and mesial arm 32 operate in the same manner as described above with respect to Figures 1-6. The center arm 34 operates in an alternative manner as the center arm 34 is not retained in engagement with the bracket body 112 by the bracket cap 16 as in the first embodiment (Figs. 1-6). Rather, as the transition portions 58 of the center arm 34 are deformed to move past the shoulder 98 from the closed position to the open position, an inward or exemplarily lingual force is placed on the end bar 54 in conjunction with the engagement of the gingival shoulder 118 against the first end 64 of the center opening 62. These two engagements combine to prevent the end bar 54 from being able to move past the gingival shoulder 118 of the stop projection 116. The engagement of the gingival shoulder 1189 of the stop projection 116 with the first end 64 of the center opening 62 prevents further occlusal movement of the clip 14. The force of the transition portions 58 pressing the end bar 55 against the top of shoulder 98 and/or the channel floor 96 gingival of the stop projection 92 keeps the center bar 54 from moving facially to move over the stop projection 92. As such, when the spring clip 14 is in the open position as exemplarily depicted in Figures 7 and 9, the spring clip 14 is held from any further movement in the exemplary occlusal direction as such movement would require additional deforming forces both against the end bar 54 in the facial direction to move past the stop projection 116 and against the distal arm 30 and mesial arm 32 outwardly in the mesial-distal dimension to respectively move the distal projection 48 and mesial projection 50 out of respective engagement with the occlusal stop projections 82. As such combination of forces cannot be practically applied to the spring clip in the open position, the spring clip 14 is effectively locked into engagement with the bracket body 112 and is not removable without damaging one or more components of the self-ligating bracket 110.

[0060] The self-ligating bracket as described herein present advantages over current self-ligating bracket solutions by providing a clip that is moveably secured to the bracket body in a manner that prevents its removal.

[0061] Self-ligating brackets as described herein may further provide improved active ligation by separately engaging an arch wire positioned in the arch wire slot at at least two, and in some embodiments three, locations: the distal end of the slot, the mesial end of the slot, and at the center of the slot. During use, the arch wire necessarily experiences uneven interaction with the arch wire slot and the clip. This imbalance in interactions direct the tooth to the desired corrected position. Only after the tooth is in the corrected position (as can be achieved with a particular arch wire dimension) and can freely move within the arch wire slot. Therefore, the spring clips as disclosed herein are able to individually provide active force against the arch wire with each slot when torque on the tooth/bracket causes the arch wire to unevenly interact with the clip. The separate arms engage the wire independently and therefore maintain engagement by each arm during treatment.

[0062] Self-ligating brackets as described herein provide the above-mentioned at least two and in some embodiments, three independent areas of active force, but also, with the center bar, and distal and mesial projections of the distal and mesial fingers, engage the arch wire across a substantial width of the total arch wire slot width. Embodiments as disclosed herein may engage the arch wire across greater than 60%, 80%, 85%, or greater than 90% of the arch wire slot width. Thus, while the brackets disclosed herein may provide three independent areas of active ligating force, such forces are also applied across a substantial portion of the width of the arch wire slot and bracket. The distal projections and mesial projections serve multiple functions of retaining the spring clip in the open position (by engagement with the gingival projections), retaining the spring clip to the bracket body (by engagement with the occlusal projections), and increasing the area of engagement with the arch wire.

[0063] While the present disclosure uses the specific example of a bracket such as one configured for use on an incisor or canine, it will be recognized that as used herein, self-ligating brackets may similarly exemplarily refer to buccal tubes, convertible orthodontic appliances, and/or other orthodontic appliances which may include a self-ligating clip as described herein.

[0064] Certain relative directional terms including, but not limited to occlusal, gingival, mesial, distal, buccal, labial, lingual, facial have been used within the present description in reference to a particular exemplary orientation on a patient's body. It will be recognized that

these are merely exemplary and that a bracket having the same features may be oriented differently on any particular patient.

[0065] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to make and use the invention. It will be recognized that features described herein with respect to one embodiment may be combined with features disclosed with respect to other embodiments herein while remaining within the scope of the disclosed invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

CLAIMS

1. A self-ligating bracket comprising:

a bracket body having a mesial side and a distal side, the bracket body comprising an arch wire slot that extends from the mesial side to the distal side of the bracket body, a mesial channel that extends into the bracket body, a distal channel that extends into the bracket body, and a center channel extending into the bracket body between the mesial channel and the distal channel;

a spring clip comprising a distal arm comprising a distal arm body and a distal finger, a mesial arm comprising a mesial arm body and a mesial finger, and a center arm comprising a first center arm body and a second center arm body connected by a center arm bar; and

wherein the spring clip is movable between an open position and a closed position wherein in the open position, the arch wire slot is unobstructed and in the closed position, the distal finger, the mesial finger and the center arm bar extend into and across the arch wire slot to occlude the arch wire slot.

2. The self-ligating bracket of claim 1, further comprising:

at least one bracket cap secured over the bracket body and at least partially defining the distal channel and the mesial channel.

3. The self-ligating bracket of claim 2, wherein the at least one bracket cap comprises a distal bracket cap integrally formed with the bracket body and at least partially defining the distal channel and a mesial bracket cap integrally formed with the bracket body and at least partially defining the mesial channel.

4. The self-ligating bracket of claim 2, wherein the at least one bracket cap is a single bracket cap secured to the bracket body across the distal channel, center channel, and mesial channel.

5. The self-ligating bracket of any of claims 1-4, further comprising a stop projection extending from the center channel and received within a center opening of the spring clip, the center opening being defined by the first center arm body, the second center arm body, and the center arm bar.

6. The self-ligating bracket of claim 5, wherein the spring clip is movably trapped within the distal channel, mesial channel, and center channel by the stop projection extending through the center opening and the bracket cap secured over the center channel.

7. The self-ligating bracket of any of claims 1-5, wherein a combined width in the mesial-distal dimension of the distal finger, mesial finger, and center arm bar is at least 60% of a width of the arch wire slot in the mesial-distal dimension.

8. The self-ligating bracket of any of claims 1-7, wherein the distal finger comprises a distal projection that extends in the mesial direction and the mesial finger comprises a mesial projection that extends in the distal direction.

9. The self-ligating bracket of any of claims 1-8, wherein the bracket body further comprises:

a first gingival projection that extends distally within the distal channel;

a second gingival projection that extends mesially within the mesial channel;

a first occlusal projection that extends distally within the distal channel; and

a second occlusal projection that extends mesially within the mesial channel;

wherein the distal projection of the distal arm engages the first gingival projection and the first occlusal projection and the mesial projection of the mesial arm engages the second gingival projection and the second occlusal projection to restrain the spring clip in the open position.

10. The self-ligating bracket of any of claims 1-9, wherein the combined width in the mesial-distal dimension of the distal finger, mesial finger, and center arm bar is at least 85% of the width of the arch wire slot in the mesial-distal dimension.

11. The self-ligating bracket of any of claims 1-10, wherein when the spring clip is in the closed position, the distal finger, the mesial finger, and the center arm bar extend into the arch wire slot to a position such that a distance between the distal finger, mesial finger, and the center arm bar and a bottom wall of the arch wire slot is smaller than a similar dimension of at least one arch wire configured to be received in the arch wire slot.

12. The self-ligating bracket of any of claims 1-11, wherein the spring clip further comprises:

a distal transition portion between the distal arm body and the distal finger;

a mesial transition portion between the mesial arm body and the mesial finger;

a first center transition portion between the first center arm body and the center arm bar; and

a second center transition portion between the second center arm body and the center arm bar;

wherein the distal arm body, mesial arm body, first center arm body, and second center arm body are all co-planar in a first plane and the distal finger, mesial finger and the center arm bar are all co-planar in a second plane and the first plane is different from the second plane.

13. The self-ligating bracket of claim 12, further comprising:

a distal shoulder between the distal channel and the arch wire slot;

a mesial shoulder between the mesial channel and the arch wire slot; and

a center shoulder between the center channel and the arch wire slot; and

wherein when the spring clip is in the closed position, the distal transition portion resiliently engages the distal shoulder, the mesial transition portion resiliently engages the mesial shoulder and the first and second center transition portions resiliently engage the center shoulder to bias the spring clip in the closed position.

14. The self-ligating bracket of any of claims 1-4 and 6-13, further comprising a stop projection extending from the center channel and received within a center opening of the spring

clip, the center opening being defined by the first center arm body, the second center arm body, and the center arm bar.

15. The self-ligating bracket of claim 14, wherein the stop projection comprises a ramp portion oriented away from the arch wire slot, the ramp portion configured to engage the center arm bar to move the center arm bar over the stop projection to position the stop projection within the center opening of the spring clip.

16. The self-ligating bracket of claim 14, further comprising:

wherein the center opening comprises a first end defined by the arm bar and a second end opposite the first end, the second end configured to be engaged by an orthodontic tool to move the spring clip from the closed position to the open position; and

wherein when the spring clip is in the open position, the first end engages the stop projection and the second end is free from engagement with the stop projection and when the spring clip is in the closed position the first end and the second end are both free from engagement with the stop projection.

17. The self-ligating bracket of claim 16, further comprising:

a first gingival projection that extends distally within the distal channel;

a second gingival projection that extends mesially within the mesial channel;

a first occlusal projection that extends distally within the distal channel; and

a second occlusal projection that extends mesially within the mesial channel;

wherein the distal projection of the distal arm engages the first gingival projection and the first occlusal projection and the mesial projection of the mesial arm engages the second gingival projection and the second occlusal projection to restrain the spring clip in the open position.

18. The self-ligating bracket of claim 14, further comprising:

a distal transition portion between the distal arm body and the distal finger;

a mesial transition portion between the mesial arm body and the mesial finger;

a first center transition portion between the first center arm body and the center arm bar; and

a second center transition portion between the second center arm body and the center arm bar;

wherein when the spring clip is in the closed position, the distal arm body, mesial arm body, first center arm body, and second center arm body are all co-planar in a first plane and the distal finger, mesial finger and the center arm bar are all co-planar in a second plane and the first plane is different from the second plane; and

wherein when the spring clip is in the open position, a first end of the center opening defined by the center arm bar engages the stop projection and the first and second transition portions bias the center arm bar into engagement with a channel floor or the center channel.

19. The self-ligating bracket of claim 18, further comprising:

wherein when the spring clip is in the open position, the distal finger is retracted into the distal channel and the mesial finger is retracted into the mesial channel; and

wherein the distal channel engages the distal arm to flatten the distal arm such that the distal arm body and the distal finger are co-planar within the distal channel and the mesial channel engages the mesial arm to flatten the mesial arm such that the mesial arm body and the mesial finger are co-planar within the mesial channel.

20. The self-ligating bracket of any of claims 1-19, wherein the bracket body comprises a distal tie wing on the distal side and a mesial tie wing on the mesial side, the distal channel extends into the distal tie wing from the distal side of the bracket body, the mesial channel extends into the mesial tie wing from the mesial side of the body, and the center channel extends into the bracket body between the distal tie wing and the mesial tie wing.

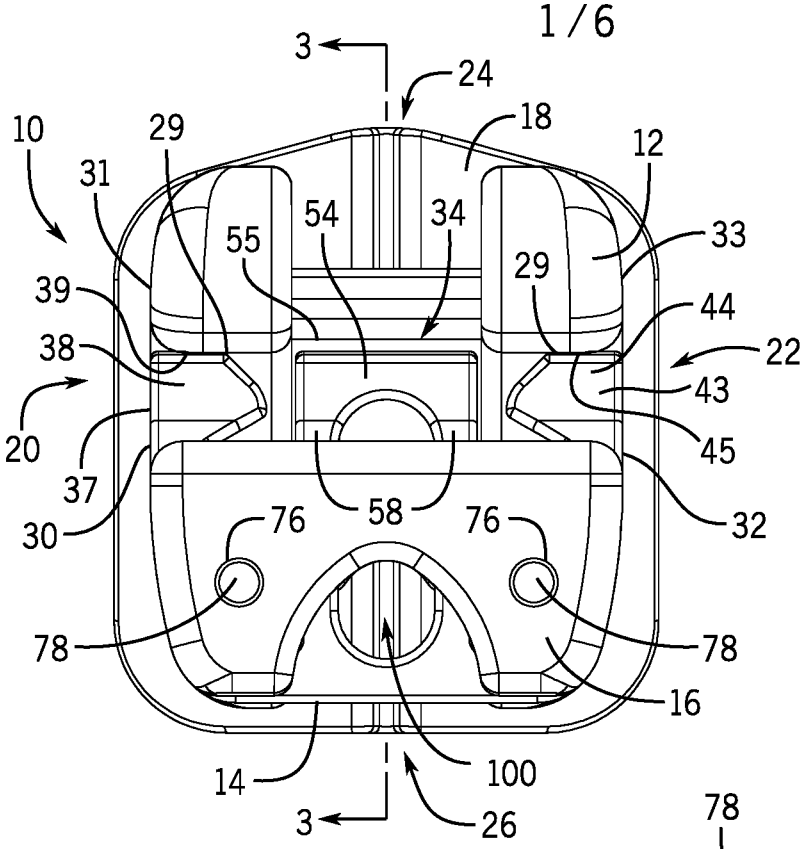


FIG. 1A

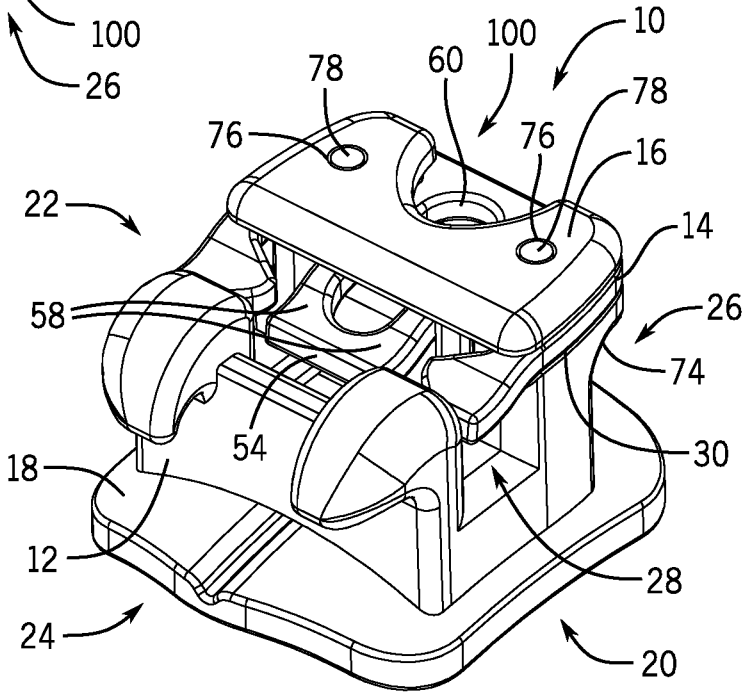


FIG. 1B

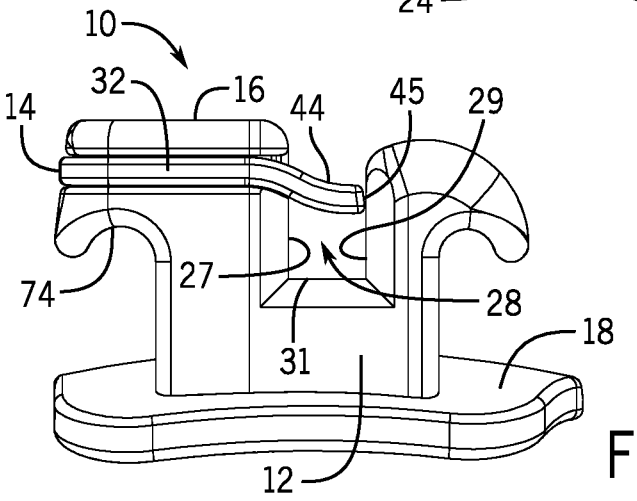


FIG. 1C

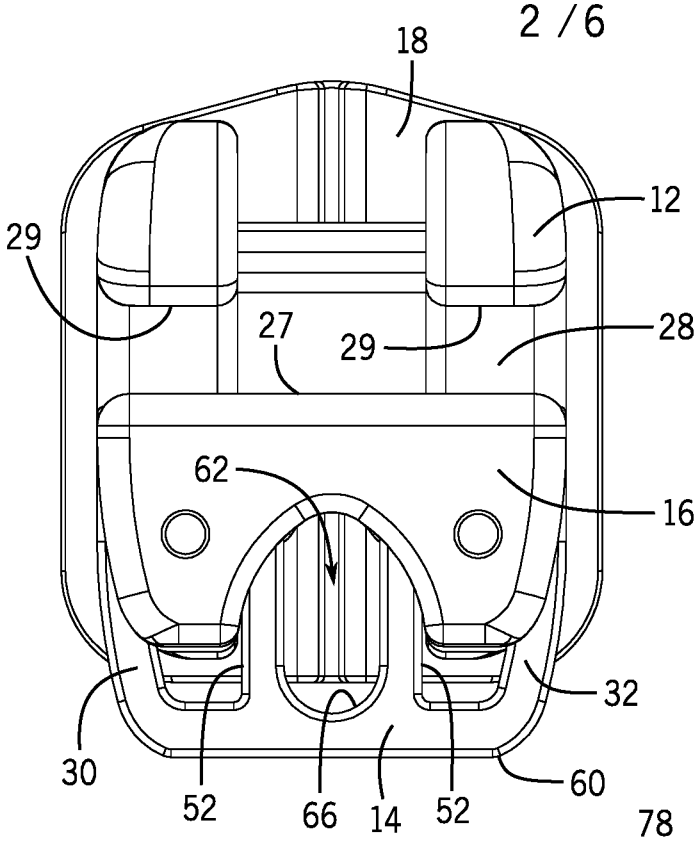


FIG. 2A

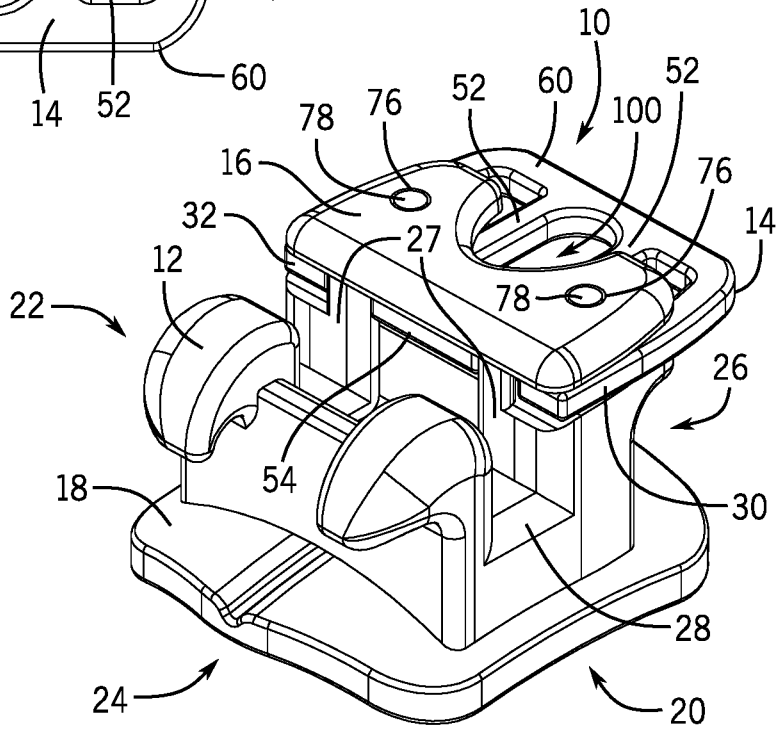


FIG. 2B

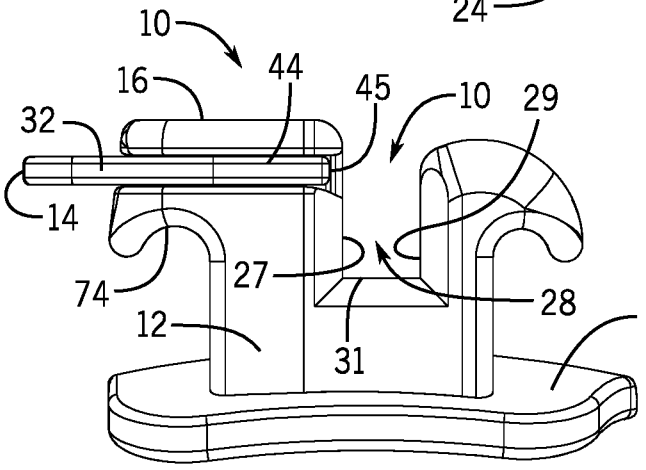


FIG. 2C

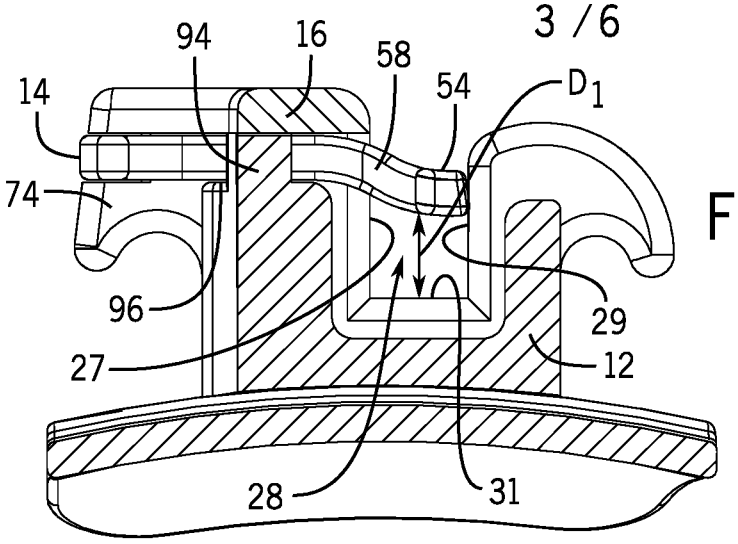


FIG. 3

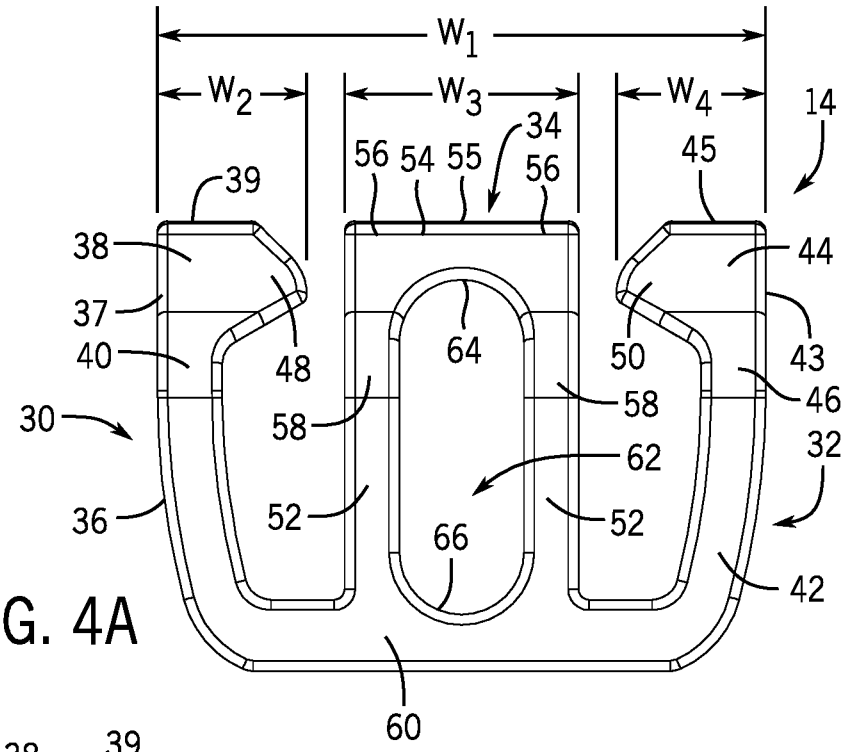


FIG. 4A

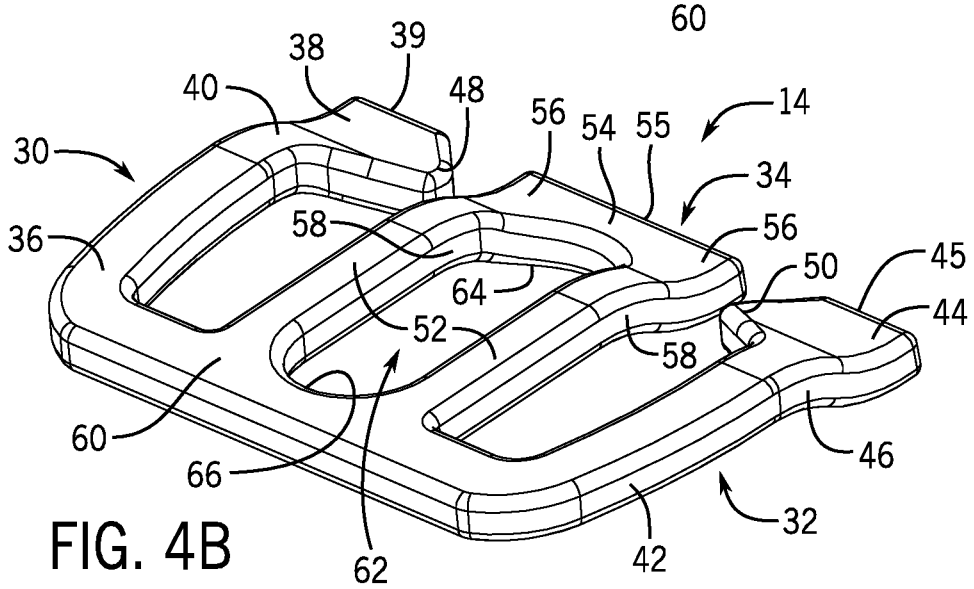


FIG. 4B

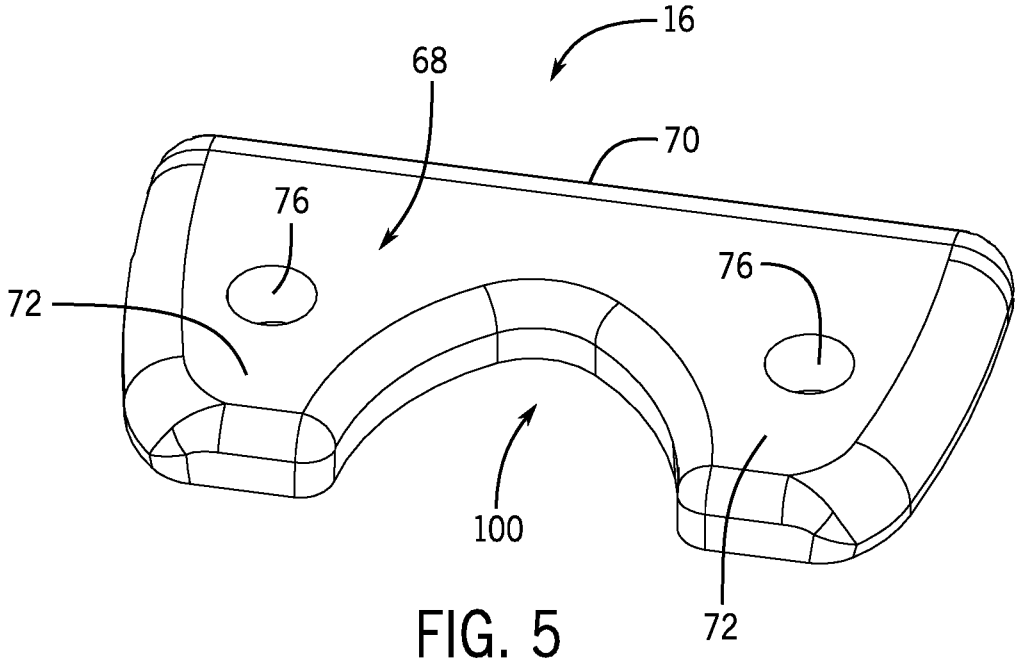

16
68
70
76
76
72
100
72

FIG. 5

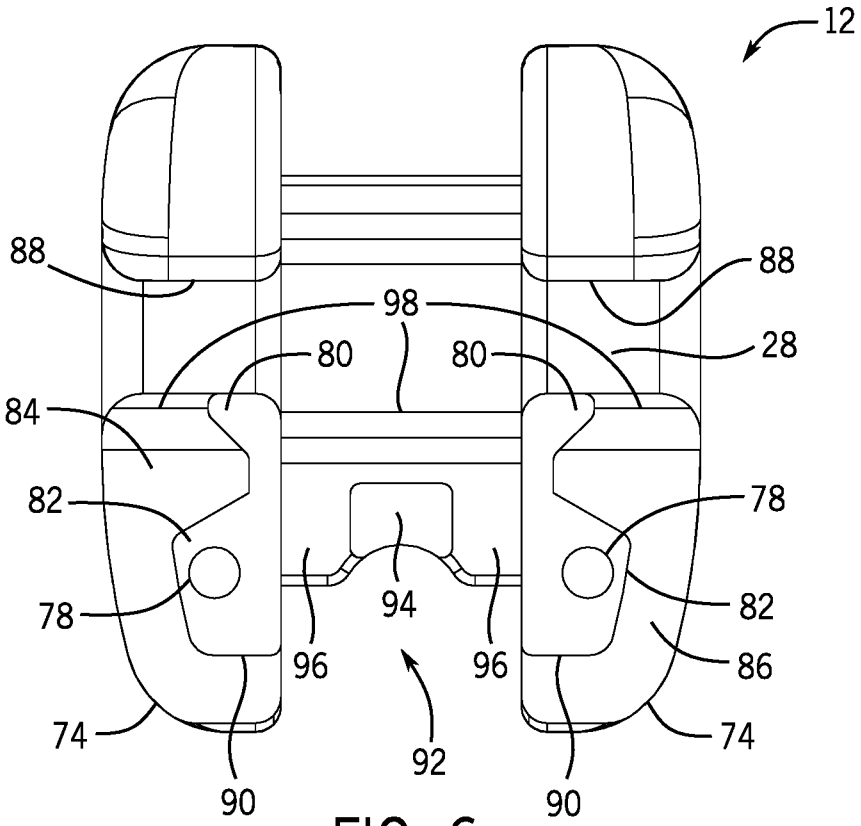

12
88
88
98
80
80
28
84
82
78
78
82
94
96
96
86
74
74
92
90
90

FIG. 6

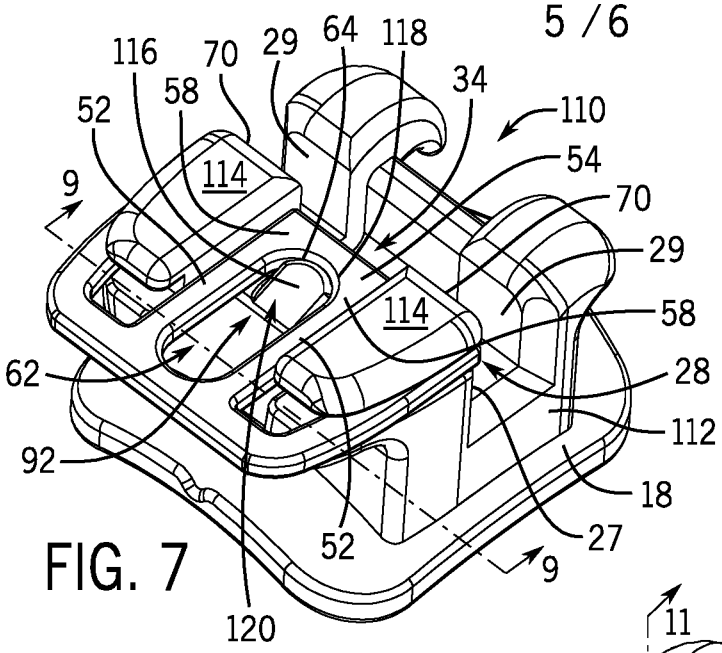


FIG. 7

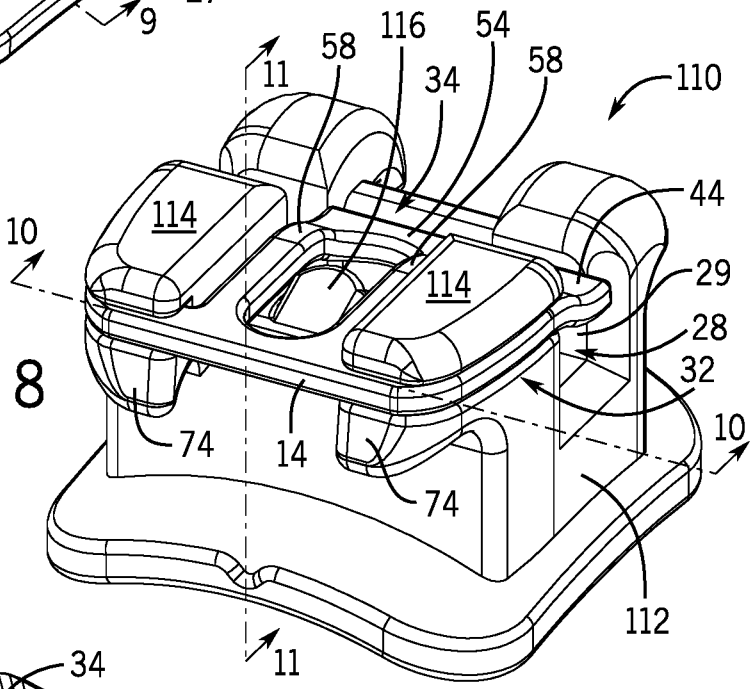


FIG. 8

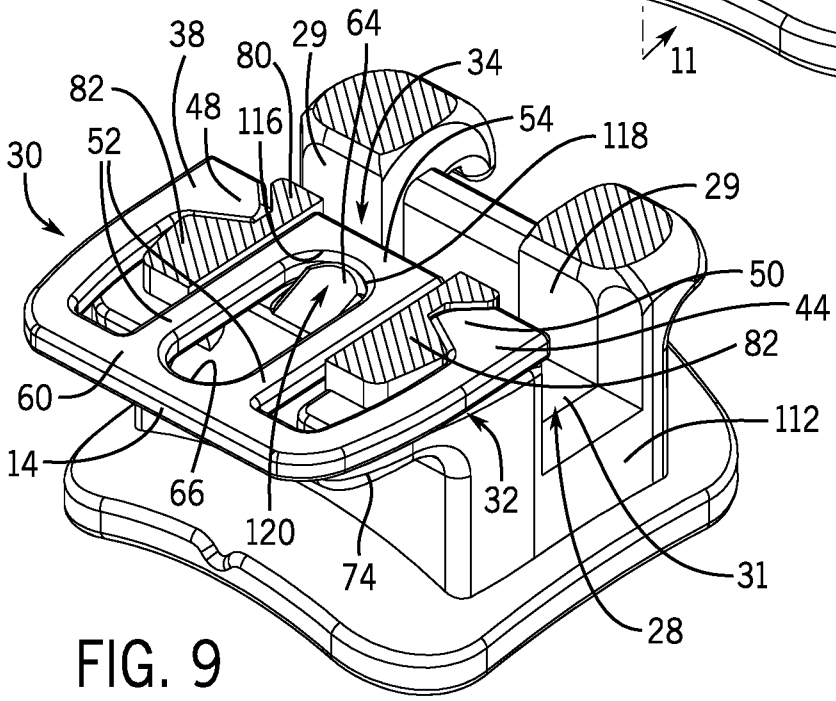


FIG. 9

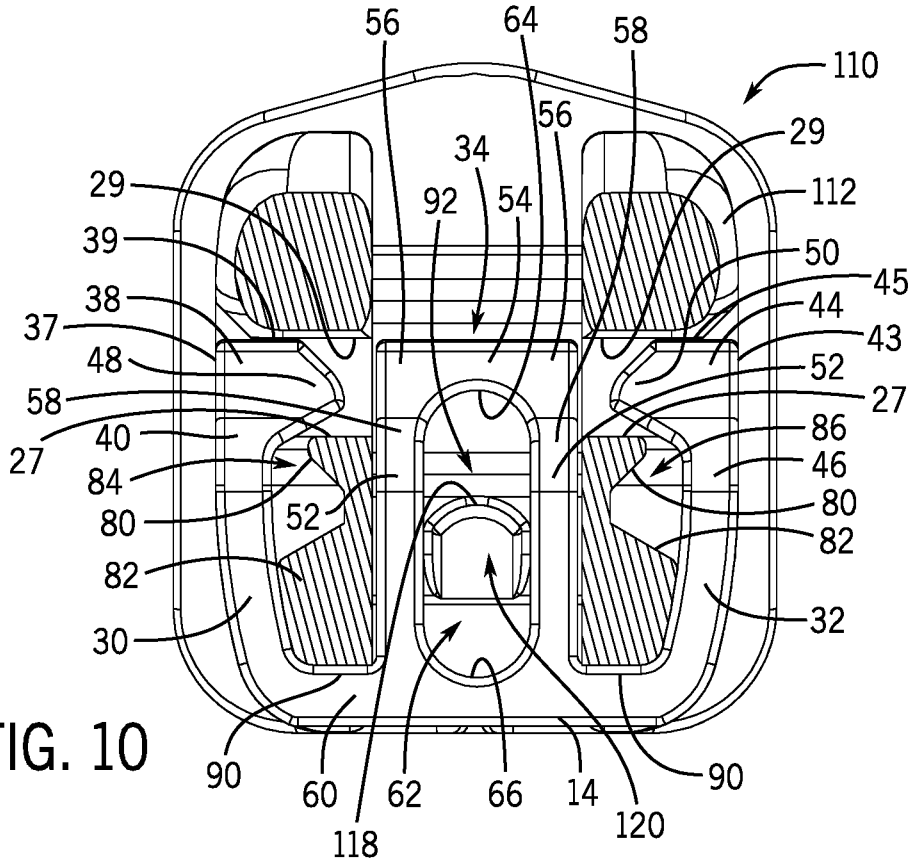

56
64
58
110
56
29
34
29
92
54
112
39
50
45
38
44
37
43
48
52
58
27
27
40
86
84
46
52
80
80
82
82
30
32
90
60
62
66
14
90
118
120

FIG. 10

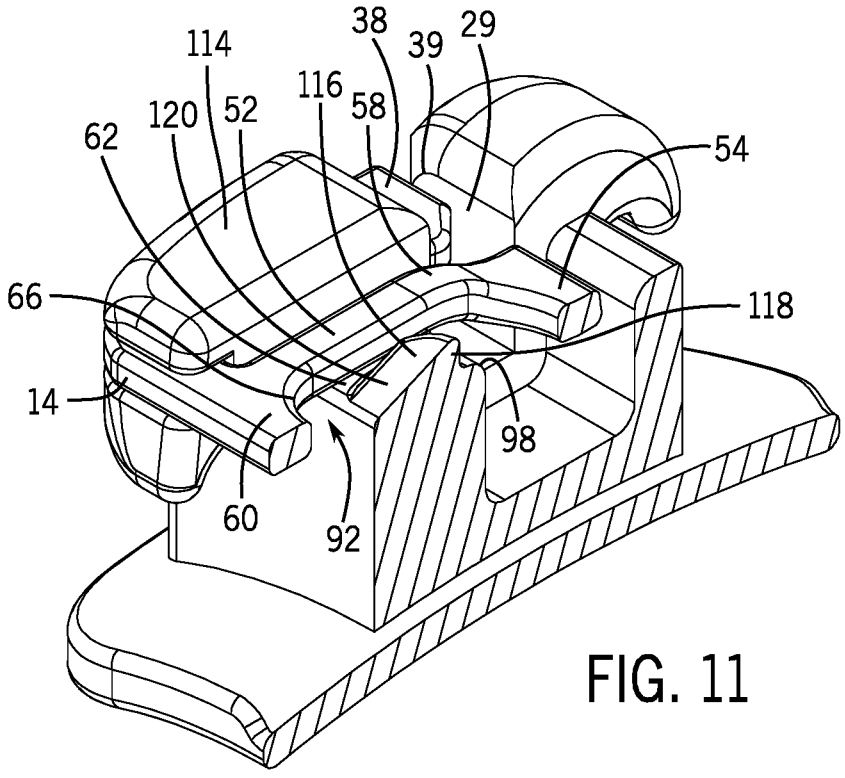

38
39
29
114
116
120
52
58
62
54
66
118
14
98
60
92

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/36452

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61C 3/00 (2016.01)
CPC - A61C 7/12, A61C 7/148, A61C 7/28, A61C 7/30, A61C 7/34, A61C 7/287
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)
CPC: A61C 7/12, A61C 7/148, A61C 7/28, A61C 7/30, A61C 7/34, A61C 7/287
IPC(8): A61C 3/00 (2016.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 433/8, 11, 13, 14 (keyword limited; terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase; Google Patents; Google
Search Terms Used: self, lock*, ligat*, spring, clip, orthodont*, bracket, archwire, closure, cover, cap, retaining

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0272753 A1 (SOMMER et al) 18 September 2014 (18.09.2014) fig 2A, 2B, 4, 6, 8A-12, para [0027], [0029], [0041]-[0043], [0045]-[0046], [0049], [0060]	1-4
Y		(5-6)/(1-4)
Y	US 2014/0272750 A1 (LAI) 18 September 2014 (18.09.2014) fig 6, 7, 11-13, para [0053]	(5-6)/(1-4)
A	US 2005/0239012 A1 (BATHEN et al) 27 October 2005 (27.10.2005) entire document	1-6
A	US 2011/0076633 A1 (BRYANT et al) 31 March 2011 (31.03.2011) entire document	1-6

☐ 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
28 JULY 2016	07 SEP 2016

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. 571-273-8300	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/36452

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

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

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

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

3. ☒ Claims Nos.: 7-20
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

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

This International Searching Authority found multiple inventions in this international application, as follows:

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

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

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

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

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

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

☐ No protest accompanied the payment of additional search fees.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 107847294 A
(43)申请公布日 2018.03.27

(21)申请号 201680033612.8

(22)申请日 2016.06.08

(30)优先权数据
62/172,548 2015.06.08 US

(85)PCT国际申请进入国家阶段日
2017.12.08

(86)PCT国际申请的申请数据
PCT/US2016/036452 2016.06.08

(87)PCT国际申请的公布数据
WO2016/200944 EN 2016.12.15

(71)申请人 美国正畸公司
地址 美国威斯康星州

(72)发明人 杰伊·S·萨默 埃里克·W·尼默 安德鲁·R·皮茨内尔

(74)专利代理机构 北京品源专利代理有限公司 11332
代理人 王瑞朋 杨生平

(51)Int.Cl.
A61C 3/00(2006.01)

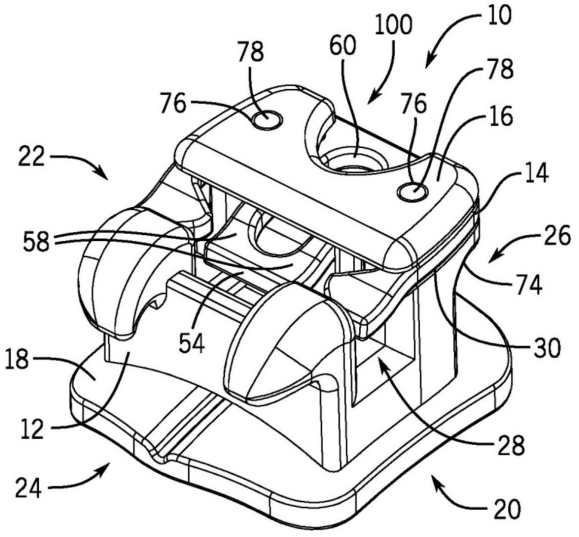
权利要求书3页 说明书9页 附图8页

(54)发明名称

自锁托架

(57)摘要

自锁托架(10)包括托架本体(12)与弹簧夹(14)。托架本体(12)包括近端通道(86)、远端通道(84)、中间通道(92)与弓丝狭槽(28)。弹簧夹(14)包括远端臂(30)、近端臂(32)与中间臂(34),其在近端通道(86)、远端通道(84)和中间通道(92)内在打开位置与闭合位置之间可移动以咬合弓丝狭槽(28)。



CN 107847294 A

1.一种自锁托架,包括:

托架本体,其具有近端侧与远端侧,所述托架本体包括从所述托架本体的近端侧延伸到远端侧的弓丝狭槽、延伸到所述托架本体中的近端通道、延伸到所述托架本体中的远端通道、以及延伸到所述托架本体中并且位于所述近端通道与所述远端通道之间的中间通道;

弹簧夹,其包括具有远端臂本体和远端指部的远端臂、具有近端臂本体和近端指部的近端臂、以及具有通过中间臂杆连接的第一中间臂本体和第二中间臂本体的中间臂;并且

其中所述弹簧夹能够在打开位置和闭合位置之间移动,其中在所述打开位置中,所述弓丝狭槽不被阻挡,并且在所述闭合位置中,所述远端指部、所述近端指部与所述中间臂杆延伸到并且横跨所述弓丝狭槽以咬合所述弓丝狭槽。

2.根据权利要求1所述的自锁托架,还包括:

至少一个托架盖,其固定在所述托架本体上方并且至少部分地限定所述远端通道与所述近端通道。

3.根据权利要求2所述的自锁托架,其中,所述至少一个托架盖包括:远端托架盖,其与所述托架本体一体形成并且至少部分地限定所述远端通道;以及近端托架盖,其与所述托架本体一体形成并且至少部分地限定所述近端通道。

4.根据权利要求2所述的自锁托架,其中所述至少一个托架盖是横跨所述远端通道、中间通道与近端通道固定到所述托架本体的单一托架盖。

5.根据权利要求1-4中任一项所述的自锁托架,还包括止动突出部,其从所述中间通道延伸并且接收在所述弹簧夹的中间开口内,所述中间开口由所述第一中间臂本体、所述第二中间臂本体与所述中间臂杆限定。

6.根据权利要求5所述的自锁托架,其中,所述弹簧夹由延伸通过所述中间开口的所述止动突出部以及固定在所述中间通道上方的所述托架盖可移动地捕获在所述远端通道、近端通道与中间通道内。

7.根据权利要求1-5中任一项所述的自锁托架,其中在所述远端指部、近端指部和中间臂杆的近端-远端维度上的组合宽度至少是所述弓丝狭槽在近端-远端维度上的宽度的60%。

8.根据权利要求1-7中任一项所述的自锁托架,其中所述远端指部包括沿着近端方向延伸的远端突出部,并且所述近端指部包括沿着远端方向延伸的近端突出部。

9.根据权利要求1-8中任一项所述的自锁托架,其中所述托架本体还包括:

第一齿龈突出部,其在所述远端通道内向远端延伸;

第二齿龈突出部,其在所述近端通道内向近端延伸;

第一咬合突出部,其在所述远端通道内向远端延伸;以及

第二咬合突出部,其在所述近端通道内向近端延伸;

其中所述远端臂的远端突出部与所述第一齿龈突出部和所述第一咬合突出部接合,并且所述近端臂的近端突出部与所述第二齿龈突出部和所述第二咬合突出部接合,以将所述弹簧夹限定在所述打开位置中。

10.根据权利要求1-9中任一项所述的自锁托架,其中在所述远端指部、近端指部和中间臂杆的近端-远端维度上的组合宽度至少是所述弓丝狭槽在所述近端-远端维度上的宽

度的85％。

11.根据权利要求1-10中任一项所述的自锁托架，其中当所述弹簧夹在所述闭合位置中时，所述远端指部、近端指部与中间臂杆在所述弓丝狭槽中延伸到一定位置处，使得所述远端指部、近端指部以及中间臂杆与所述弓丝狭槽的底壁之间的距离小于构造为接收在所述弓丝狭槽中的至少一个弓丝的类似尺寸。

12.根据权利要求1-11中任一项所述的自锁托架，其中，所述弹簧夹还包括：

在所述远端臂本体与所述远端指部之间的远端过渡部分；

在所述近端臂本体与所述近端指部之间的近端过渡部分；

在所述第一中间臂本体与所述中间臂杆之间的第一中间过渡部分；以及

在所述第二中间臂本体与所述中间臂杆之间的第二中间过渡部分；

其中所述远端臂本体、近端臂本体、第一中间臂本体和第二中间臂本体全部在第一平面中是共面的，并且所述远端指部、近端指部和所述中间臂杆全部在第二平面中是共面的，并且所述第一平面与所述第二平面不同。

13.根据权利要求12所述的自锁托架，还包括：

在所述远端通道与所述弓丝狭槽之间的远端肩部；

在所述近端通道与所述弓丝狭槽之间的近端肩部；以及

在所述中间通道与所述弓丝狭槽之间的中间肩部；并且

其中当所述弹簧夹位于所述闭合位置中时，所述远端过渡部分与所述远端肩部弹性地接合，所述近端过渡部分与所述近端肩部弹性地接合，并且所述第一中间过渡部分和第二中间过渡部分与所述中间肩部弹性地接合，以将所述弹簧夹偏置到所述闭合位置中。

14.根据权利要求1-4以及6-13中任一项所述的自锁托架，还包括从所述中间通道延伸并且接收在所述弹簧夹的中间开口内的止动突出部，所述中间开口通过所述第一中间臂本体、所述第二中间臂本体与所述中间臂杆限定。

15.根据权利要求14所述的自锁托架，其中所述止动突出部包括远离所述弓丝狭槽定向的斜面部分，所述斜面部分构造为与所述中间臂杆接合以使所述中间臂杆在所述止动突出部上方移动，从而将所述止动突出部定位在所述弹簧夹的中间开口内。

16.根据权利要求14所述的自锁托架，还包括：

其中所述中间开口包括通过所述臂杆限定的第一端以及与所述第一端相对的第二端，所述第二端构造为通过齿列矫正工具接合以使所述弹簧夹从所述闭合位置移动到所述打开位置；并且

其中当所述弹簧夹位于所述打开位置中时，所述第一端与所述止动突出部接合，并且所述第二端与所述止动突出部脱离接合，并且当所述弹簧夹位于所述闭合位置中时，所述第一端与所述第二端都与所述止动突出部脱离接合。

17.根据权利要求16所述的自锁托架，还包括：

第一齿龈突出部，其在所述远端通道内向远端延伸；

第二齿龈突出部，其在所述近端通道内向近端延伸；

第一咬合突出部，其在所述远端通道内向远端延伸；以及

第二咬合突出部，其在所述近端通道内向近端延伸；

其中所述远端臂的远端突出部与所述第一齿龈突出部和第一咬合突出部接合，并且所

述近端臂的近端突出部与所述第二齿龈突出部和第二咬合突出部接合，以将所述弹簧夹限制在所述打开位置中。

18.根据权利要求14所述的自锁托架，还包括：

在所述远端臂本体与所述远端指部之间的远端过渡部分；

所述近端臂本体与所述近端指部之间的近端过渡部分；

在所述第一中间臂本体与所述中间臂杆之间的第一中间过渡部分；以及

在所述第二中间臂本体与所述中间臂杆之间的第二中间过渡部分；

其中当所述弹簧夹位于所述闭合位置中时，所述远端臂本体、近端臂本体、第一中间臂本体与第二中间臂本体全部在第一平面中是共面的，并且所述远端指部、近端指部和中间臂杆全部在第二平面中是共面的，并且所述第一平面与所述第二平面不同；并且

其中当所述弹簧夹位于打开位置中时，由所述中间臂杆限定的中间开口的第一端与所述止动突出部接合，并且所述第一过渡部分与第二过渡部分使所述中间臂杆偏置成与通道底面或所述中间通道接合。

19.根据权利要求18所述的自锁托架，还包括：

其中当所述弹簧夹位于所述打开位置中时，所述远端指部收回到所述远端通道中，并且所述近端指部收回到所述近端通道中；并且

其中所述远端通道与所述远端臂接合以使所述远端臂变平，使得所述远端臂本体与所述远端指部在所述远端通道内是共面的，并且所述近端通道与所述近端臂接合以使所述近端臂变平，使得所述近端臂本体与所述近端指部在所述近端通道内是共面的。

20.根据权利要求1-19中任一项所述的自锁托架，其中所述托架本体包括在所述远端侧上的远端连结翼及在所述近端侧上的近端连结翼，所述远端通道从所述托架本体的远端侧延伸到所述远端连结翼中，所述近端通道从所述本体的近端侧延伸到所述近端连结翼中，并且所述中间通道在所述远端连结翼与所述近端连结翼之间延伸到所述托架本体中。

自锁托架

[0001] 相关申请的交叉引用

[0002] 本申请要求2015年6月8日提交的美国临时专利申请No.62/172,548以及2016年6月8日提交的美国专利申请No.15/176,777的优先权,其内容通过它们整体引用的方式包含于此。

技术领域

[0003] 本公开涉及牙齿矫正领域。更具体地说,本公开涉及自锁托架。

背景技术

[0004] 牙齿矫正治疗通常至少涉及弓丝与用于将弓丝固定到患者的牙齿的托架和/或颊管的组合。弓丝由弹性材料制成,如果弯曲或变形,其将恢复到其先前形状。通过将弓丝固定到患者牙齿来治疗牙齿咬合不正,当弓丝恢复到其初始形状时,牙齿达到后治疗对齐。矫正力从弓丝和托架的弓丝狭槽之间的交互处通过托架传递到牙齿。

[0005] 传统地,托架固定到患者的牙齿并且托架具有弓丝接收在其内的弓丝狭槽。弹性绑带将弓丝固定在托架的弓丝狭槽内。自锁托架包括内置的机械绑带,其消除了针对用于将弓丝固定到托架的单独弹性绑带的需要。自锁托架通常使用滑动和/或旋转夹具或门,其相对于托架本体移动以咬合弓丝狭槽。

[0006] 自锁托架作为“主动”托架或“被动”托架可获得,其描述了其中弓丝可以与夹具相互作用的方式。主动自锁托架包括夹具,该夹具端部或一部分延伸到方丝弓(edgewise)狭槽中并且沿着面部-舌部维度抵靠弓丝弹性地施加定位力。由于夹具自身的机械强度,主动自锁托架将弓丝保持在狭槽中。主动自锁托架提供了夹具与弓丝之间的相互作用力的更多控制,但是可以增大弓丝与夹具之间的摩擦,这可以减小该力传递到牙齿。

[0007] 被动自锁托架包括夹具,该夹具延伸横跨并且超过弓丝狭槽并且被固定或约束为抵抗沿着面部-舌部维度的运动。被动自锁托架,当闭合时有效地形成通过狭槽与夹具限定的管子,具有比所形成管子的直径更小的直径的弓丝可以在该管子内滑动。为此原因,在一些应用中,被动自锁托架的夹具称为门。

发明内容

[0008] 自锁托架的示例性实施方式包括托架本体。托架本体包括近端侧(mesial side)与远端侧。托架本体包括弓丝狭槽,其从托架本体的近端侧延伸到远端侧。近端通道延伸到托架本体中。中间通道在近端通道与远端通道之间延伸到托架本体中。弹簧夹包括远端臂,其包括远端臂本体与远端指部。弹簧夹包括包含近端臂本体与近端指部的近端臂。弹簧夹包括包含第一中间臂本体与第二中间臂本体的中间臂。第一中间臂本体与第二臂本体通过中间臂杆连接。弹簧夹在打开位置与闭合位置之间可移动。在打开位置中,弓丝狭槽不被阻挡,并且在闭合位置中,远端指部、近端指部与中间臂杆延伸进入并且跨越弓丝狭槽以咬合弓丝狭槽。

附图说明

[0009] 图1A是处于闭合构造中的自锁托架的示例性实施方式的俯视图。

[0010] 图1B是处于闭合构造中的自锁托架的示例性实施方式的立体图。

[0011] 图1C是处于闭合构造中的自锁托架的示例性实施方式的侧视图。

[0012] 图2A是处于打开构造中的自锁托架的示例性实施方式的俯视图。

[0013] 图2B是处于打开构造中的自锁托架的示例性实施方式的立体图。

[0014] 图2C是处于打开构造中的自锁托架的示例性实施方式的侧视图。

[0015] 图3是沿着图1A的线3-3所截取的自锁托架的侧面剖视图。

[0016] 图4A是弹簧夹的示例性实施方式的俯视图。

[0017] 图4B是弹簧夹的示例性实施方式的立体图。

[0018] 图5是托架盖的示例性实施方式的立体图。

[0019] 图6是托架本体的示例性实施方式的俯视图。

[0020] 图7描述了处于打开构造中的自锁托架的第二示例性实施方式的立体图。

[0021] 图8描述了处于闭合构造中的自锁托架的第二示例性实施方式的立体图。

[0022] 图9是沿着图7的线9-9所截取的自锁托架的第二示例性实施方式的剖视图。

[0023] 图10是沿着图8的线10-10所截取的自锁托架的第二示例性实施方式的俯视剖面图。

[0024] 图11是沿着图8的线11-11所截取的立体剖面图。

具体实施方式

[0025] 图1-图6全部描述了自锁托架10的第一示例性实施方式的各种视图。自锁托架10大体上包括托架本体12、弹簧夹14与托架盖16。在实施方式中，结合垫18固定到托架本体12。结合垫18可以通过硬钎焊(braising)或焊接示例性地固定到托架本体12。在另选实施方式中，结合垫18可以通过彼此一体形成并且通过铸造或铣削示例性地形成而固定到托架本体12，但应该理解的是可以使用制造托架本体12与结合垫18的另选技术。在实施方式中，结合垫18可以形成或成形为以便固定到患者齿列的牙齿。申请人于2014年3月14日提交的共同未决美国专利申请No.14/212,616还描述了自锁托架的各方面并且由此通过整体引用的方式包含于此。

[0026] 自锁托架10示例性地包括远端侧20、近端侧22、齿龈侧24与咬合侧26。将会认识到，这些名称是相对的和报告性的，并且另选实施方式可以沿着其它定向定位在患者的口中，同时保持在如这里公开的实施方式的范围内。

[0027] 图1A-图1C描述了处于闭合构造中的自锁托架10的第一示例性实施方式的各种视图，在闭合构造中，弹簧夹14移动到咬合弓丝狭槽28的闭合位置。图2A-图2C描述了处于打开构造中的自锁托架10的第一示例性实施方式的各种视图，在打开构造中，弹簧夹14移动到其中弓丝狭槽28是可进入的以接收弓丝(未示出)的位置。当自锁托架10位于打开构造中时，弹簧夹14远离弓丝狭槽28处于打开位置中，并且弓丝狭槽28能够接收弓丝。当自锁托架10处于闭合构造中时，弹簧夹14处于闭合位置中，其在使用过程中以操作进而保持弓丝的方式延伸横跨并且进入到弓丝狭槽28中，以矫正地治疗患者的齿列。这里将参照图4-图6进

一步详细地描述实施方式内的特定特征与相互作用。

[0028] 图4A是弹簧夹14的俯视图。图4B是弹簧夹14的立体图。弹簧夹14包括远端臂30、近端臂32与中间臂34。远端臂30还包括远端臂本体36与远端指部38。远端臂30终止于远端臂端部39。远端指部38通过远端过渡部分40连接到远端臂本体36。在示例性实施方式中，远端过渡部分40在远端臂本体36与远端指部38之间形成为S曲线，但应该认识到的是，远端过渡部分40可以采用各种其它形状或形式，同时保持在本公开的范围内。在实施方式中，远端指部38的至少一部分是平坦的并且在与远端臂本体36不同的平面中延伸。在一些实施方式中，远端指部38可以平行于远端臂本体36延伸。在其它实施方式中，远端指部38可以以另一个角度或曲率延伸。近端臂32类似地包括近端臂本体42，其通过近端过渡部分46连接到近端指部44。近端臂32终止于近端臂端部45。在实施方式中，近端臂32相对于远端臂30以上面描述的类似方式构造。

[0029] 在本文所述的此外其它实施方式中，远端臂30包括远端突出部48。在实施方式中，远端突出部48从远端指部38向内延伸到自锁托架14。类似地，近端臂32还包括近端突出部50，其从近端指部44示例性地延伸到自锁托架14中。

[0030] 中间臂34示例性地构造有由端杆54连接的两个大体上相对的中间臂杆52。中间臂34终止于中间臂端部55。端杆54示例性地延伸跨越并且与相应的中间臂杆52的齿龈端56连接。端杆54示例性地在与远端指部38和近端指部44相同的平面中延伸。在此外其它示例性实施方式中，端杆54在与远端突出部48和近端突出部50相同的平面中延伸。中间臂杆52还示例性地包括示例性地为S曲线的中间过渡部分58。在示例性实施方式中，与跨越这些结构的同样部件类似，当从近端向远端观察时，相应地位于远端臂30、近端臂32与中间臂34之间的类似部件在相同平面中延伸。弹簧夹14还包括基部杆60，其可以大体上在从近端向远端的维度上沿着弹簧夹14的长度延伸。远端臂30、近端臂32与中间臂34全部示例性地远离基部杆60延伸。

[0031] 如通过参照图1A和图4A最佳描述的，弹簧夹14的介于远端臂30与近端臂32之间的总宽度W_1与托架本体12沿从近端向远端的维度的总宽度示例性地一致。更具体地说，远端臂30的远端边缘37(且特别地远端指部38)与托架本体12的远端侧31对准，并且近端臂32的近端边缘(且尤其是近端指部44)与托架本体12的近端侧33对准。由此，当弹簧夹14位于闭合位置中时，远端臂30与近端臂32将它们的约束力施加在起始于弓丝狭槽28的相应远端与近端处的弓丝上。此外，中间臂34(更具体地说，中间臂杆54)在弓丝狭槽28的中心处、以及类似地托架12的中心处将约束力施加在弓丝上。

[0032] 远端指部38具有宽度W_2，中间杆54具有宽度W_3，并且近端指部44具有宽度W_4。这些宽度代表弹簧夹14的、构造为与狭槽28中的弓丝接合的部分。由此组合宽度($W_2+W_3+W_4$)表示当夹具14位于闭合位置中时咬合的弓丝狭槽28的量，同时该组合宽度必要地小于或等于W_1。在实施方式中，组合宽度是W_1的60％或更多。在此外其它实施方式中，远端突出部48使W_2增加超过远端臂本体36的宽度，并且近端突出部50使W_4增加超过近端臂本体42的宽度，并且组合宽度是W_1的更大的百分比。在一个示例性实施方式中，远端突出部与近端突出部的宽度至少是相应的远端臂本体36和近端臂本体42的宽度的至少二倍，并且组合宽度是W_1的80％或更多。在此外其它示例性实施方式中，例如如图1-图6中描述的，组合宽度是W_1的85％或更多。在此外其它实施方式中，通过扩大中间杆54、远端指部38与近端指部44中的一

个或多个，组合宽度是W_1的90％或更多。应该理解的是，这些实施方式仅仅是示例性的，并且当在本公开的范围内时，构成W_2、W_3和W_4的部件的额外构造将被认可。由此，实施方式显示了横跨弓丝狭槽的大部分而施加在托架的远端、近端与中间的单独接合力的优点。

[0033] 中间臂杆52与端杆54示例性地限定中间开口62。中间开口62示例性地包括：第一端64，其可以大体上是如通过端杆54限定的大体上平坦的；以及第二端66，其可以是圆形形状并且通过形成到中间臂杆52与基部杆60中的曲线限定。应该认识到的是，当仍保持在本公开的范围内时，中间开口62可以示例性地采用其它形状。

[0034] 图5是如将在这里进一步详细描述的托架盖16的示例性实施方式的立体图。托架盖16具有大体上平坦的顶部表面68。在示例性齿龈侧处，托架盖16包括弓丝狭槽侧70。与弓丝狭槽侧70相对，托架盖终止于两个连结翼盖72。托架盖16构造为以图1-图3中所描述的方式与托架本体12匹配地接合。在该接合中，弓丝狭槽侧70与托架本体12中的弓丝狭槽28的咬合壁27对准，并且每个连结翼盖72与托架本体12的相应连结翼74对准。

[0035] 如这里更加详细描述的，托架盖16还包括柱孔76，其延伸通过托架盖16并且构造为与托架本体12上的柱78接合。

[0036] 图6描述了托架本体12的示例性实施方式的不同视图。托架本体12还包括多个止动突出部，即示例性的齿龈止动突出部80以及咬合止动突出部82，其相应地延伸到弹簧夹的远端臂(未示出)在其内滑动的远端通道84以及弹簧夹的近端臂(未示出)在其内滑动的近端通道86中。止动突出部80、82与弹簧夹14的远端突出部48和近端突出部50(图4)弹性地接合。除了如这里进一步详细描述的其它特征，弹簧夹的远端突出部和近端突出部与托架本体12的止动突出部80和82的接合限定弹簧夹的打开位置。在另一个方面，远端指部38和近端指部44与弓丝狭槽28的相应齿龈侧88的接合以及基部杆60与咬合止动突出部82的咬合端90的接合限定了弹簧夹的闭合位置。

[0037] 托架本体12还包括弹簧夹的中间臂34(如图1-图3中所示)在其内滑动的中间通道92。止动突出部94定位在中间通道92内并且从中间通道底面96示例性地向上延伸，其中该中间通道底面为与弹簧夹的中间臂34滑动地接合的表面。止动突出部94示例性地尺寸设计为使得其可以滑动地接收在弹簧夹的中间开口62内。当弹簧夹14的中间开口62布置在止动突出部94上方时，中间臂34可滑动地接收在中间通道92内。止动突出部94延伸通过中间开口62，其中当弹簧夹14处于打开位置时，止动突出部94与中间开口62的第一端64接合，这可以通过中间臂34的端杆54呈现。由此，止动突出部94与端杆54的接合进一步限定弹簧夹的打开位置并且防止弹簧夹超过限定打开位置的完全移除。

[0038] 托架本体12还包括在弓丝狭槽28的咬合壁27上的肩部98，其使远端通道84、近端通道86与中间通道92中的每个有效地过渡到弓丝狭槽28中。在实施方式中，当弹簧夹移动到打开位置中并且收回到相应远端通道84、近端通道86或中间通道92中时，远端臂30、近端臂32与中间臂34的相应过渡部分40、46和58示例性地成形为S曲线，其大体上是平坦的，这是由于弹簧夹由其构造的弹性材料造成的。将会进一步认识到的是，远端通道84、近端通道86与中间通道92由固定于托架本体的托架盖16进一步地限定在唇侧上。当弹簧夹移动到闭合位置中时，过渡部分的S曲线恢复到它们的正常构造并且抵靠肩部产生偏置力以使弹簧夹保持在闭合位置中。

[0039] 此外，在示例性实施方式中，至少一些臂被进一步加强以防备当夹具位于闭合位

置时弓丝离开弓丝狭槽。这可以实现托架实施方式的改进的锁紧强度与稳固性。在图1至图6中描述的示例性实施方式中，盖16沿着面部-舌部维度提供抵抗每个臂30、32、34的弹性力。这形成了短力矩臂，围绕其抵制沿面部-舌部维度的、来自弓丝的抵抗任何臂30、32、34的任何力。短力矩臂增加了用于抵制该力的臂的强度。此外，在一些实施方式中，盖16的弓丝狭槽侧70可以与弓丝狭槽28的咬合壁27对准，这进一步使该力矩臂最小化。可以在参照图7-图11中示出与描述的托架的实施方式中实施具有类似优点的类似构造与实施方式，尽管在此实施方式中盖114与近端臂30和远端臂32接合。

[0040] 托架盖16还包括在连结翼盖72之间延伸的工具切口100。工具切口100可以示例性地限定为由包括至少两个半径的三个弯曲部分限定的复合曲线。当弹簧夹在闭合位置中时，弹簧夹14的中间开口62的第二端66与工具切口100对准，以助于正牙医生的工具尖端(未示出)通过中间开口62的第二端66进入，使得正牙医生可以通过齿列矫正工具尖端施加打开力，以克服弹簧夹臂的过渡部分抵靠托架本体的肩部的示例性偏置力以及远端突出部和近端突出部抵靠基部的相应齿龈止动突出部的示例性偏置力，从而将弹簧夹移动到打开位置中。

[0041] 在示例性实施方式中，齿列矫正工具在托架本体与弹簧夹之间形成杠杆以将弹簧夹从闭合位置移动到打开位置。工具尖端延伸通过中间开口并且通过中间开口62与托架本体接合。正牙医生利用扭转或旋转运动抵靠托架本体布置沿齿龈方向的力并且抵靠弹簧夹布置沿咬合方向的力。这些力克服了弹簧夹在闭合位置中的偏置力，从而将弹簧夹移动到打开位置中。然而，与工具尖端仅通过沿咬合方向的力与弹簧夹接合的实施方式相比，由于来自工具的力大体上彼此相对以形成由患者感受的较小力，因此这可以提供改进的患者舒适度。

[0042] 自锁托架10的第一实施方式的上述特征结构实现了提供自锁托架10的期望特征，该自锁托架包括被捕获在托架本体12与托架盖16之间的弹簧夹14。在装配中，弹簧夹14定位在托架本体12上，示例性地在闭合位置中，使得远端臂、近端臂与中间臂分别定位在远端通道、近端通道与中间通道中。托架盖16固定到托架本体12，从而将弹簧夹14可移动地固定在托架本体12与托架盖16之间。当托架盖的柱孔76与托架本体的柱78接合时，可以示例性地通过焊接或硬钎焊将托架盖16固定到托架本体12。这在图3中进行了描述，图3示出了固定到托架本体12并且与止动突出部94的顶部接触的托架盖16。如还可以在图3中看到的，远端通道、中间通道(以及近端通道)示例性地具有与弹簧夹14的厚度相同的高度，使得弹簧夹能够在相应的通道内滑动。一旦固定，托架盖16将捕获可滑动地接合在托架盖16与托架本体12之间的弹簧夹14。由于在弹簧夹14移动到打开位置中时端杆54与止动突出部94的接合以及托架盖16在中间通道92上方的固定，因此不能从结合的托架本体12与托架盖16移除弹簧夹14。

[0043] 图3是沿着图1A的线3-3所截取的侧视剖面图，其描述了处于闭合构造中的自锁托架10的示例性实施方式。如在图1C、图2C和图3中描述的，弓丝狭槽28通过咬合壁27、齿龈壁29与底壁31限定。在示例性实施方式中，弓丝狭槽28具有0.022英寸的宽度，以便与标准矩形弓丝的较大直径一致；然而，应该认识到，可以使用如在本文实施方式中所公开的弓丝狭槽28的其它尺寸或构造。

[0044] 如上所述，当弹簧夹14在闭合位置中时，相应的远端臂30、近端臂32与中间臂34在

相应远端过渡部分40、近端过渡部分46与中间过渡部分58处弯折，使得远端指部38、近端指部44与中间指部54在比弹簧夹14的剩余部分更靠近弓丝狭槽28的底部31的位置处定位在弓丝狭槽中。弹簧夹14的相应指部38、44、54的底部与弓丝狭槽28的底部31之间的距离D1限定了由弹簧夹14主动接合弓丝所需的弓丝的最小直径。由此，如果使用具有小于D1的直径的弓丝，假如弓丝例如通过远离牙齿的唇侧力已经被迫定位到弓丝狭槽28的外部，则弹簧夹14仅与弓丝主动地接合。

[0045] 举一个假设例子，其中导丝在弓丝狭槽中对准并且定位在狭槽的底部使得在导丝与托架之间不存在矫正/相互作用力，夹具与导丝之间的可能的相互作用将被解释。当主动自锁托架与具有比弓丝狭槽的底部和夹具的延伸到狭槽中的部分之间的距离(D1)更小直径的弓丝一起使用时，主动自锁托架有效地作为被动托架操作。然而，当与具有比弓丝狭槽的底部和夹具之间的距离(D1)更大的直径的弓丝一起使用时，则夹具与弓丝接合并且施加定位力。由此，主动自锁托架可以是这样的一个自锁托架，其中，在闭合位置中通过弓丝狭槽与夹具限定的腔体的横截面尺寸小于弓丝狭槽构造为用于接收的至少一个弓丝的横截面尺寸。

[0046] 被动自锁托架可以是这样的一个自锁托架，其中，在闭合位置中通过弓丝狭槽与夹具限定的腔体的横截面尺寸大于弓丝狭槽构造为用于接收的最大弓丝的横截面尺寸。在治疗过程中被动自锁托架的夹具由此不与任何尺寸的弓丝接合。被动自锁托架提供了对于托架弓丝相互作用的较少控制，但是与可以改进矫正力到牙齿的传递的弹性绑带和主动夹具相比，这样做具有最小摩擦(其它全部都相同)。在一些实施方式中，被动自锁托架的腔体还可以进一步通过托架本体的刚性壁架或其它部分限定，其在闭合位置中与夹具接合以限定弓丝狭槽的底部与夹具之间的最小距离。夹具与托架本体的这种结构的接合可以独立于夹具自身的形状或其它物理特性来限定该最小距离。

[0047] 通过实例的方式，托架可以设计为与沿着面部-舌部维度具有0.018英寸的直径的弓丝以及与沿着面部-舌部维度具有0.022英寸直径的弓丝一起使用。在该实例中，主动自锁托架实施方式可以是在腔体中具有上述小于或等于0.022英寸的距离(D1)的实施方式，而在闭合位置中的夹具能够弯曲到具有至少0.022英寸的距离(D1)，而被动自锁托架是这样一种自锁托架，其中，独立于夹具的柔性或刚性，腔体中的上述距离(D1)大于0.022英寸。

[0048] 此外，在一实施方式中，当弹簧夹在闭合位置中时，远端臂30的端部39、近端臂32的端部45以及中间臂54的端部55中的至少一个与弓丝狭槽28的齿龈壁29接合，并且当弹簧夹14在打开位置中时，端部39、45、55在弓丝狭槽28的咬合壁27的咬合方向上收回到托架本体中。在另一个实施方式中，远端臂30的端部39、近端臂32的端部45以及中间臂的端部55中的至少一个在齿龈方向上延伸经过齿龈壁29的平面，或者在齿龈壁29的咬合方向上终止。在任一情形中，当夹具位于打开位置中时，臂的相应端部39、45、55在咬合壁27的咬合方向上收回。

[0049] 所描述特征的一些实施方式提出了其它优点，其中自锁托架夹具通常是微小的金属件，如果移除与托架的剩余部分的接合，其可能丢落在患者嘴中，被患者吞咽或者对患者的嘴的内部造成擦伤。由此，在夹具处于打开位置中时固定地保持弹簧夹的托架是有利的。此外，当弹簧夹不能移动离开位置时，使弹簧夹与托架的剩余部分保持接合可以使对弹簧夹的损害的风险最小化。

[0050] 图7-图11描述了自锁托架110的第二示例性实施方式。应该认识到在图7-图11中，如上面参照图1-图6使用与描述的类似附图标记还在这里使用以识别类似结构。

[0051] 自锁托架110包括托架本体112、弹簧夹14与结合垫18。托架本体112包括弓丝狭槽28与连结翼74。弓丝狭槽28由咬合壁27、齿龈壁29与底壁31限定。咬合壁27、齿龈壁29与底壁31限定可以被接收在托架110中的最大直径或弓丝。

[0052] 如在图9和图10中最佳描述的，其是自锁托架110的剖视图，托架本体112包括齿龈止动突出部80与咬合止动突出部82。齿龈止动突出部80与咬合止动突出部82相应地向唇侧延伸至少弹簧夹14的厚度，以沿着唇侧维度限定远端通道84与近端通道86。齿龈止动突出部80与咬合止动突出部82延伸到远端通道84和近端通道86中，弹簧夹40的远端臂30滑动地接收在该远端通道内，并且弹簧夹14的近端臂32从该近端通道被可滑动地接收。托架本体112还包括弹簧夹14的中间臂34在其内滑动地移动的中间通道92。

[0053] 如前面描述的，中间臂34包括中间臂杆52，该中间臂杆终止于连接相应中间臂杆52的齿龈端56的端杆54。弹簧夹进一步限定由弹簧夹14的中间臂杆52、端杆54与基部杆60界定的中间开口62。在第一端64与第二端66之间示例性地限定中间开口62。如将在这里进一步详细描述的，中间开口62的第一端64与第二端66示例性地是曲线状的。然而，应该认识到的是，当保持在本公开的范围内时，在本实施方式中以及其它实施方式中可以使用第一端64与第二端66的其它形状。

[0054] 远端臂30包括远端过渡部分40，近端臂32包括近端过渡部分46，并且中间臂34包括中间过渡部分58。过渡部分40、46和48中的每个都示例性地成形为S曲线，同时其它构造通过本公开也将是被认可的。

[0055] 返回参照图7和图8，托架本体112包括作为托架本体112的一体部件的连结翼盖114。连结翼盖114示例性地从齿龈止动突出部80与咬合止动突出部82延伸并且覆盖在相应远端通道84与近端通道86上方，同时使中间通道92示例性地暴露。

[0056] 托架本体112还包括从中间通道92的通道底面96延伸的止动突出部116。止动突出部116还包括齿龈肩部118与咬合斜面120。

[0057] 在操作中，通过将弹簧夹14插入到托架本体112的咬合侧中并且使远端臂30和近端臂32在托架本体112的相应远端通道84和近端通道86内滑动来装配自锁托架110。当弹簧夹14插入时，远端臂30与近端臂32沿着近端-远端维度变形，使得当弹簧夹移动到闭合位置中时，相应的远端突出部与近端突出部50可以绕过第一咬合止动突出部82以及随后齿龈止动突出部80。

[0058] 当弹簧夹14沿着齿龈方向前进时，端杆54与止动突出部116的咬合斜面120接合。咬合斜面120使中间臂34沿着示例性面部方向向外变形，直到中间开口62的第一端64越过止动突出部116的齿龈肩部118。

[0059] 如上所述，如果弹簧夹14进一步沿着示例性齿龈方向前进，那么弹簧夹臂的相应过渡部分40、58和60越过肩部98，并且当过渡部分40、46与58恢复到它们的正常位置时，远端指部38、端杆54与近端指部44延伸进入并且横跨弓丝狭槽28。在该位置中，远端指部端39与近端指部端45与弓丝狭槽28的齿龈壁29接合。

[0060] 如在图7、图9和图11中最佳描述的，当弹簧夹14从闭合位置移动到打开位置时，远端臂30与近端臂32以如上面参照图1-图6描述的相同方式操作。当中间臂34不像第一实施

方式中(图1-图6)那样通过托架盖16与托架本体112保持接合时，中间臂34以另选方式操作。相反，当中间臂34的过渡部分58变形以从闭合位置经过肩部98移动到打开位置时，连同齿龈肩部118的接合，向内或示例性舌部力布置在端杆54上抵靠中间开口62的第一端64。这两个接合组合以防止端杆54能够移动经过止动突出部116的齿龈肩部118。止动突出部116的齿龈肩部118与中间开口62的第一端64的接合防止了夹具14的进一步咬合移动。过渡部分58将端杆55压靠在肩部98的顶部和/或止动突出部92的齿龈方向上的通道底面96上的力阻止中间杆54在面部方向上移动以移动越过止动突出部92。如此，当弹簧夹14在如图7和图9中示例性描述的打开位置中时，弹簧夹14被阻止沿着示例性咬合方向任何进一步的移动，因为这种移动将要求额外变形力沿面部方向抵抗端杆54以移动经过止动突出部116以及沿着近端-远端维度向外地抵抗远端臂30与近端臂32以分别使远端突出部48和近端突出部50移动为脱离与咬合止动突出部82的相应接合。由于在打开位置中所述力的组合实际上不能施加到弹簧，因此弹簧夹14有效地锁定成与托架本体112接合并且在不损坏自锁托架110的一个或多个部分的情况下是不可移除的。

[0061] 如这里描述的自锁托架通过设置以防止其移除的方式可移动地固定到托架本体的夹具呈现超过当前自锁托架解决方案的优点。

[0062] 如这里描述的自锁托架还可以在至少两个并且在一些实施方式中三个位置(狭槽的远端、狭槽的近端以及狭槽的中间)处通过单独地接合定位在弓丝狭槽中的弓丝提供改进的主动绑带。在使用过程中，弓丝必要地经历与弓丝狭槽和夹具的非均匀的相互作用。在相互作用中的这种不平衡将牙齿引导到期望的矫正位置。之后牙齿才能处于矫正位置(如可以通过特定的弓丝尺寸实现)并且能够在弓丝狭槽内自由地移动。由此，当在牙齿/托架上的转矩致使弓丝与夹具不均匀地相互作用时，如这里公开的弹簧夹能够单独地抵抗各狭槽内的弓丝来提供主动力。在治疗过程中独立臂与导丝独立地接合并且由此通过各臂保持接合。

[0063] 如这里描述的自锁托架向中间杆提供了上述至少两个并且在一些实施方式中，三个独立的主动力的区域，而且，远端指部和近端指部的远端突出部和近端突出部跨越全部弓丝狭槽宽度的大部分宽度与弓丝接合。如这里公开的实施方式可以与跨越大于弓丝狭槽宽度的60％、80％、85％、或大于90％的弓丝接合。由此，尽管这里公开的托架可以提供三个独立的主动锁定力的区域，该力还跨越弓丝狭槽与托架的宽度的大部分施加。远端突出部与近端突出部提供将弹簧夹保持在打开位置中(通过与齿龈突出部接合)，将弹簧夹保持到托架本体(通过与咬合突出部接合)，以及增加与弓丝的接合的面积的多个功能。

[0064] 尽管本公开使用诸如构造为用于门牙或犬齿上的托架的特定实例，应该认识到如这里使用的，自锁托架可以类似地示例性地称作为颊管、可改变齿列矫正用具和/或可以包括如这里描述的自锁夹具的其它齿列矫正用具。

[0065] 一些相关方向术语包括但不限于，咬合方向上、齿龈方向上、近端、远端、面颊方向上、唇方向上、舌部方向上、面部方向上被参照患者身体上的特定示例性定向用于本说明书内。应该认识到这些仅仅是示例性的并且具有相同特征的托架可以不同地定向在任意特定患者上。

[0066] 本书面描述利用实例来公开本发明，包括最佳模式并且还使得本技术中的技术人员能够制造与使用本发明。应该认识到的是当保持在公开发明的范围内时，这里相对于一

个实施方式描述的特征可以与相对于这里其它实施方式公开的特征结合。通过权利要求来限定本发明的可授予专利权的范围，并且可以包括本领域中技术人员想到的其它实例。如果它们具有与权利要求的字面语言不同的结构元件，或者如果它们包括与权利要求的字面语言略微不同的等同的结构元件，这些其它实例旨在落入权利要求的范围内。

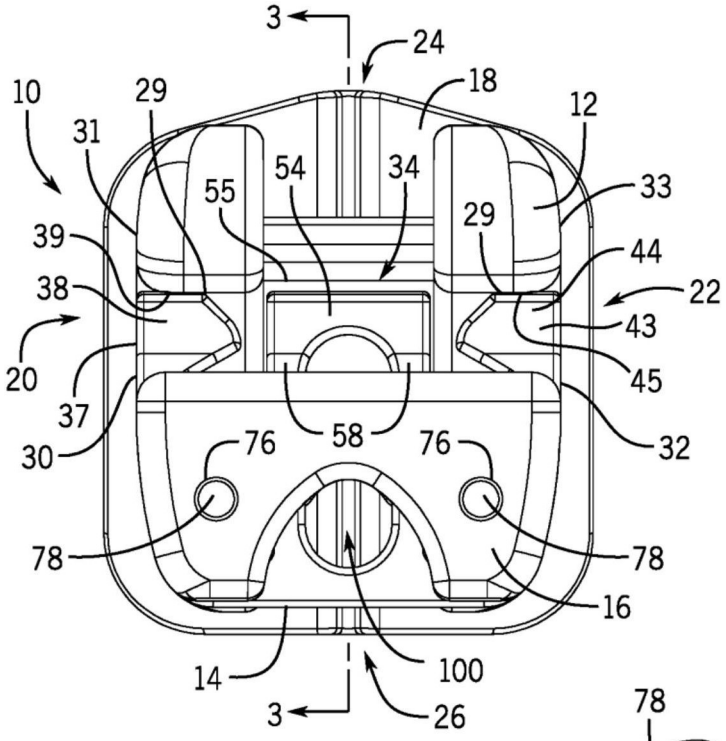

3
24
18
12
10
29
31
55
54
34
33
39
29
44
38
22
43
20
45
37
58
32
30
76
76
78
78
16
14
100
3
26

图 1A

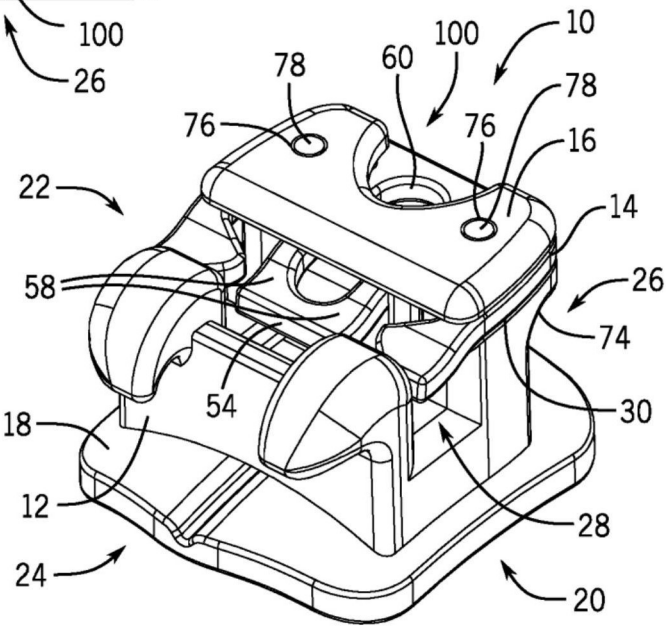

78
60
100
10
76
76
78
16
22
14
58
26
74
54
30
18
12
28
24
20

图 1B

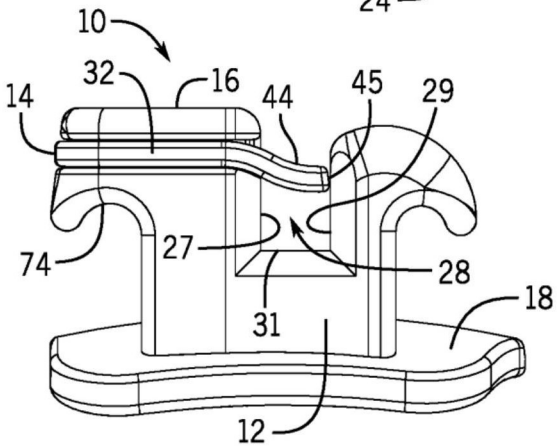

10
32
16
14
44
45
29
74
27
28
31
18
12

图 1C

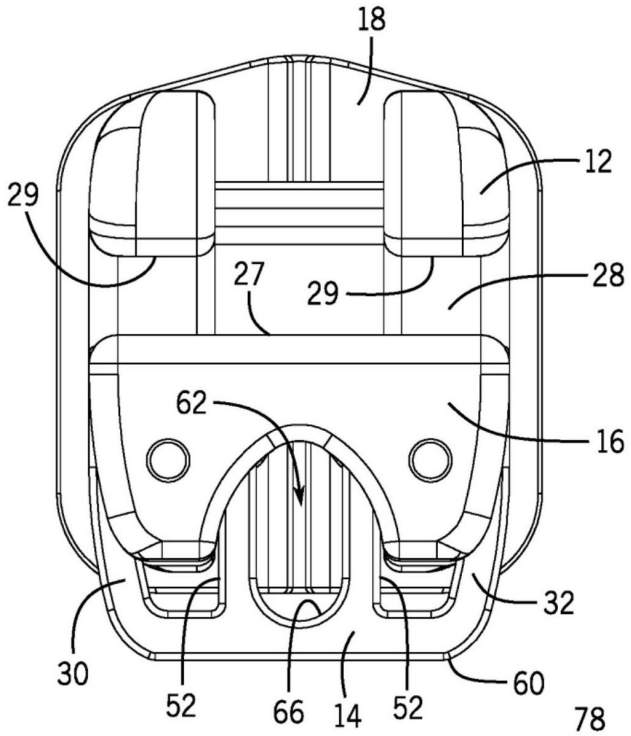

18
12
29
27
29
28
62
16
32
30
52
66
14
52
60

图 2A

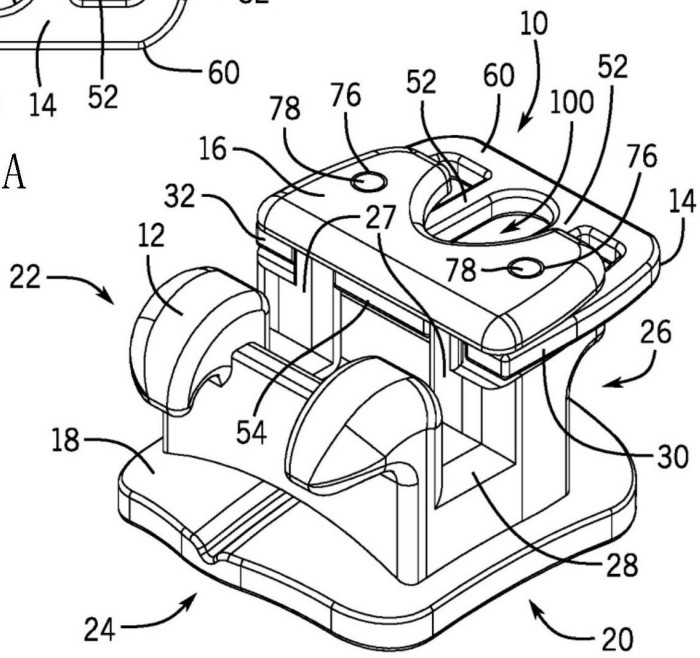

10
78
76
52
60
52
100
76
16
32
27
14
12
78
22
26
54
18
30
28
24
20

图 2B

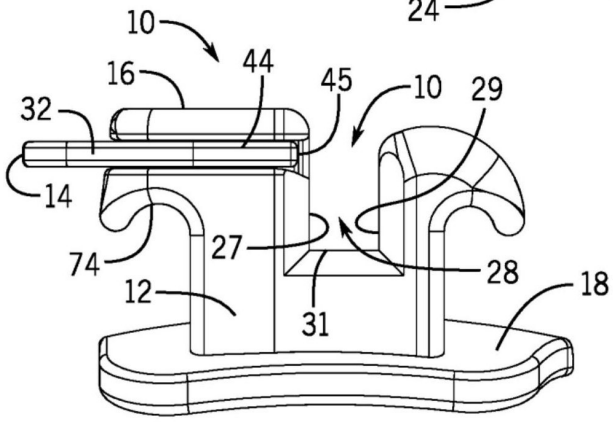

10
44
16
45
10
29
32
14
74
27
28
12
31
18

图 2C

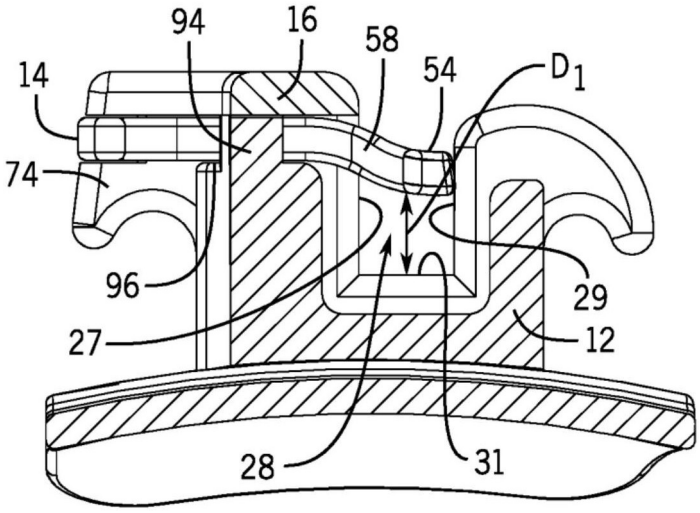


图3

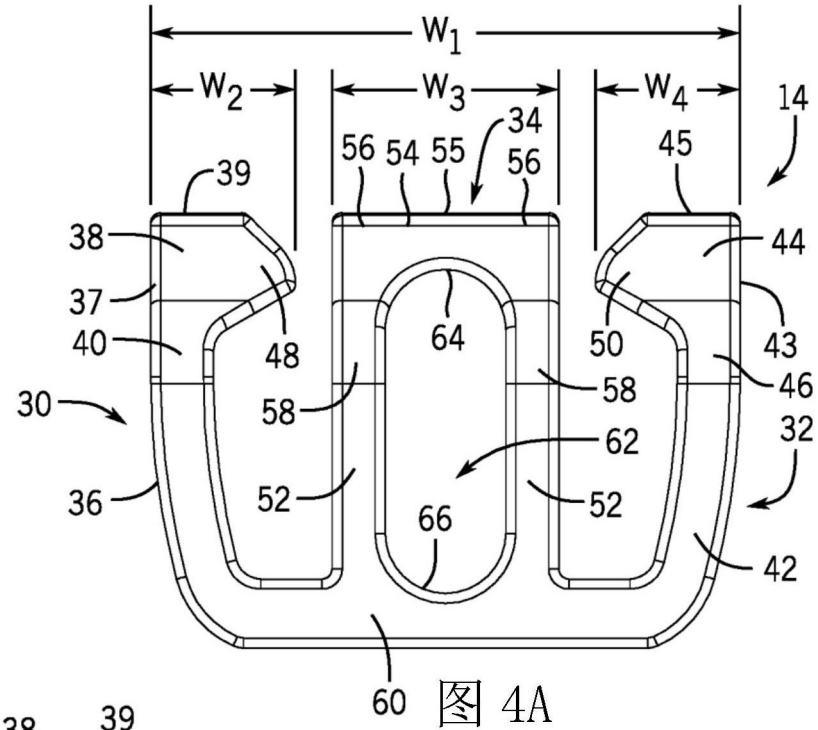

W1
W2
W3
W4
14
34
56
54
55
56
45
39
38
44
37
40
48
64
50
43
46
30
58
58
62
32
36
52
52
66
42
60

图 4A

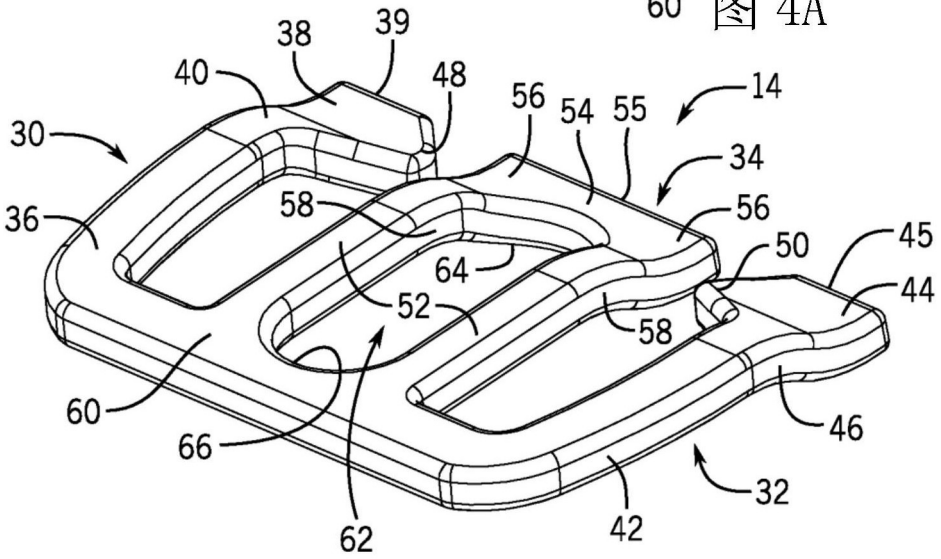

38
39
40
48
56
54
55
14
30
34
36
58
56
50
45
64
44
52
58
60
46
66
32
62
42

图 4B

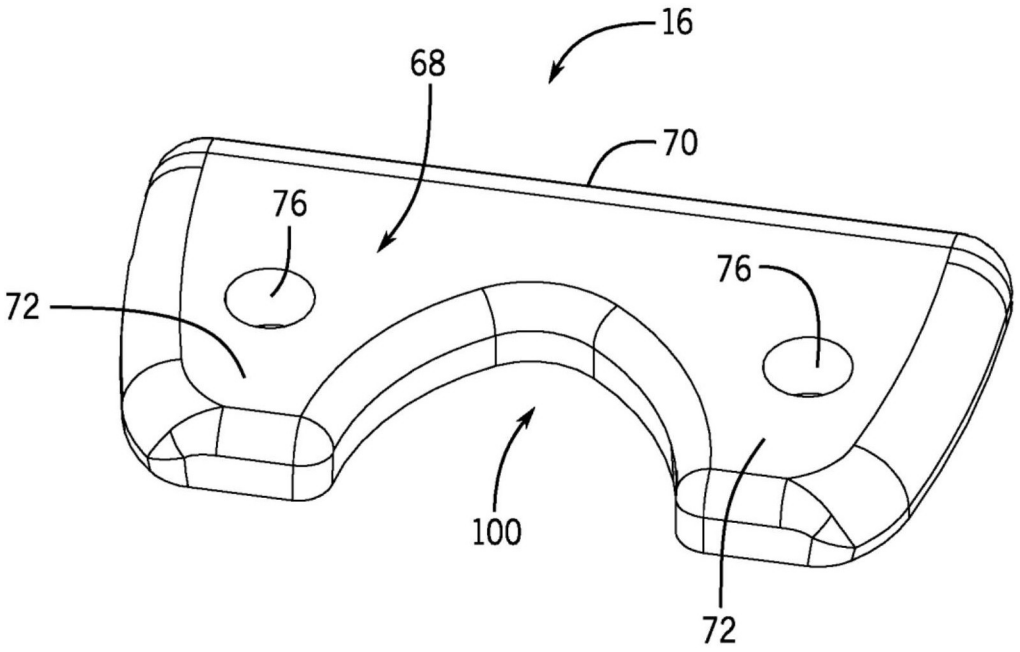

16
68
70
76
76
72
100
72

图5

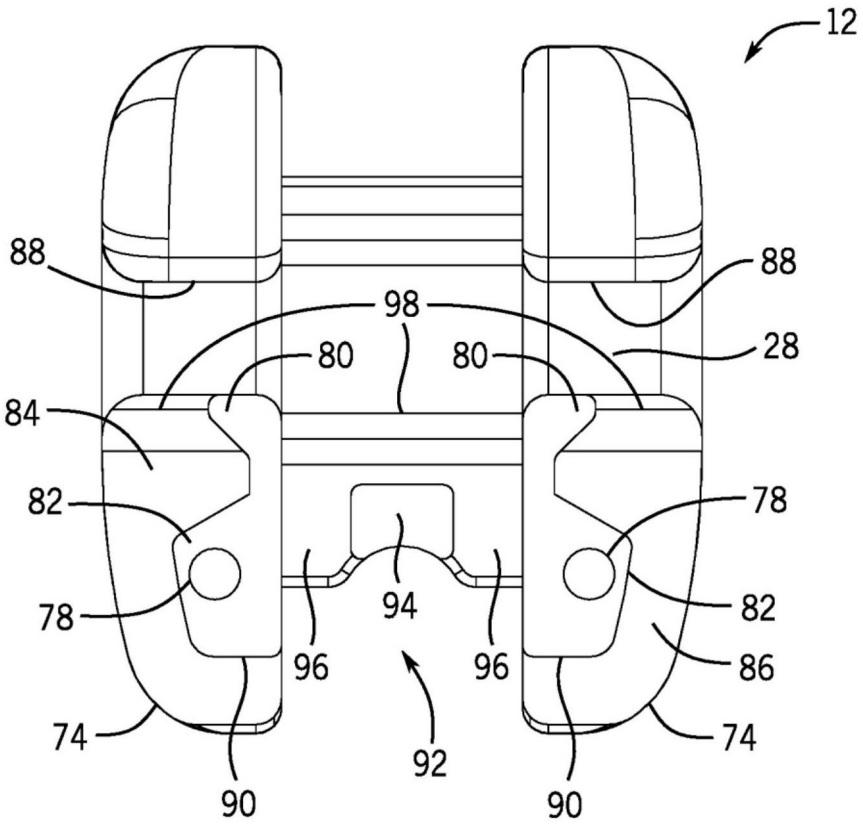

12
88
88
98
80
80
28
84
82
78
78
82
94
96
96
86
74
74
92
90
90

图6

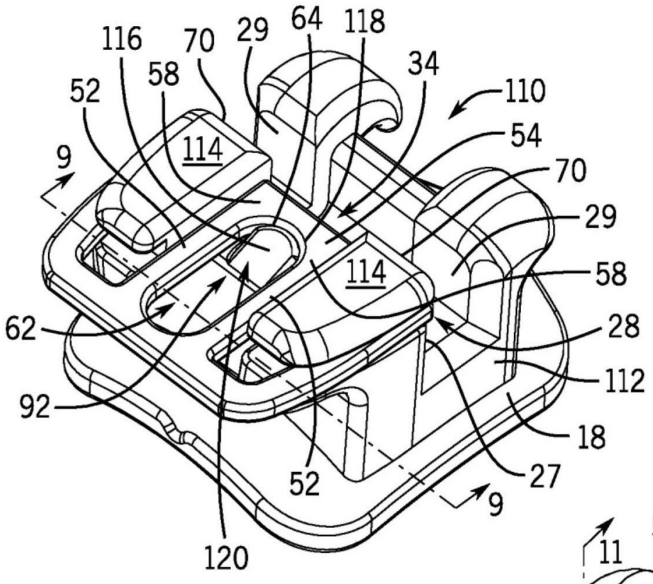

116
70
29
64
118
58
52
34
110
54
9
114
70
29
114
58
62
28
112
92
18
27
52
9
120

图 7

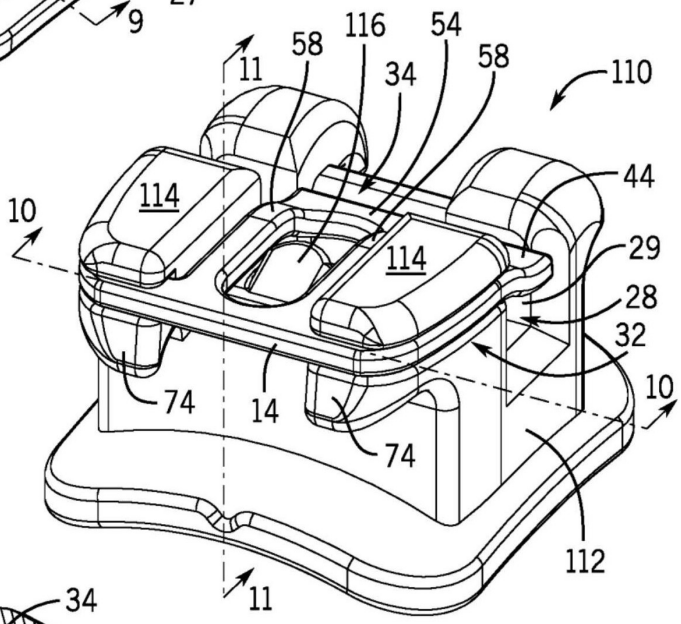

11
58
116
54
58
34
110
44
114
10
114
29
28
32
10
74
14
74
112
11

图 8

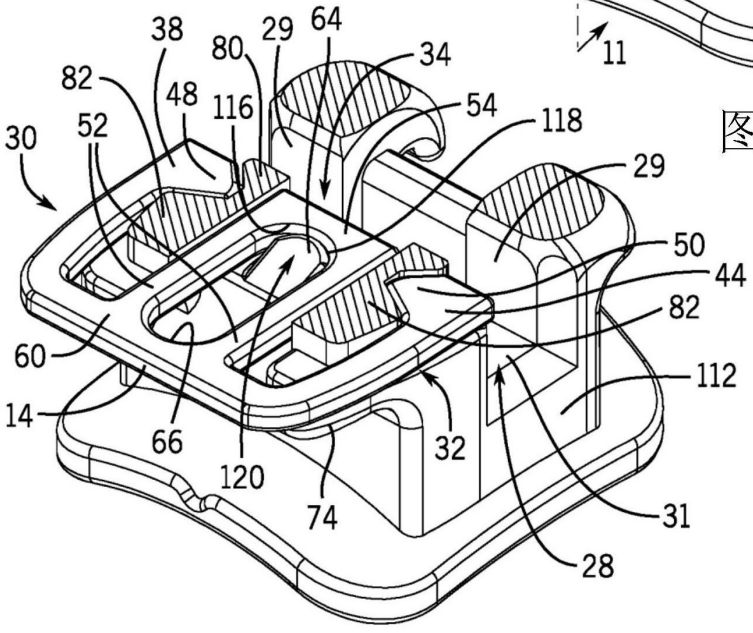

38
80
29
64
34
82
48
116
54
118
30
52
29
50
44
82
60
112
14
66
120
32
74
31
28

图 9

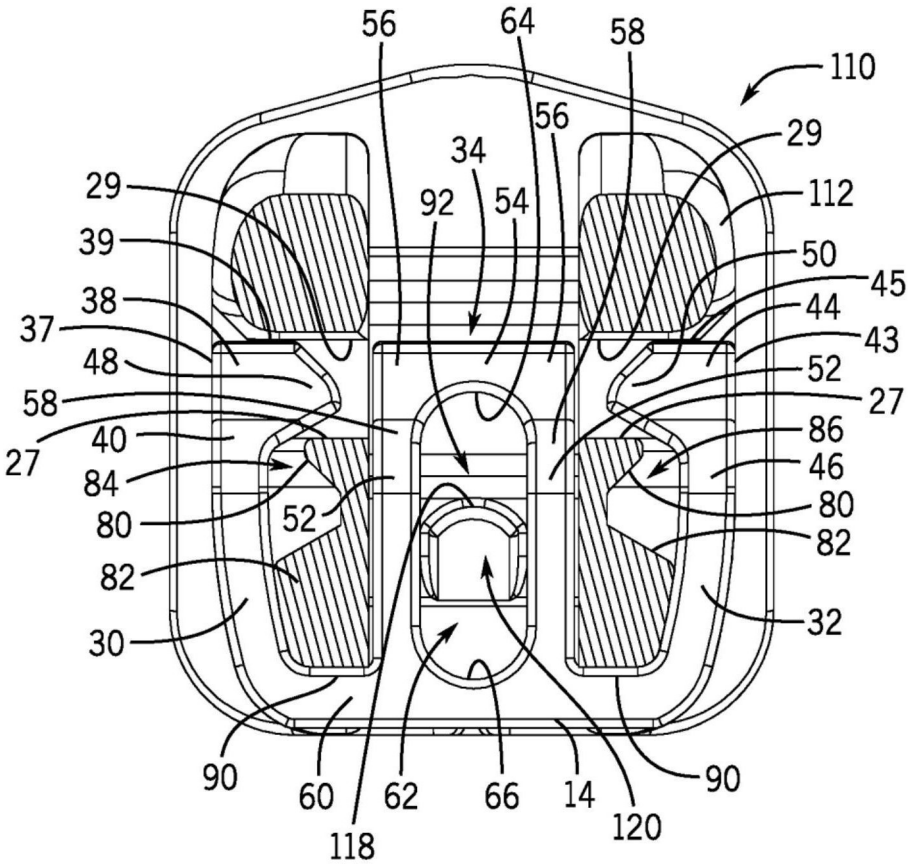

56
64
58
110
56
29
34
112
29
92
54
39
50
45
38
44
37
43
48
52
58
27
40
86
27
46
84
80
52
80
82
82
32
30
90
60
62
66
14
90
118
120

图10

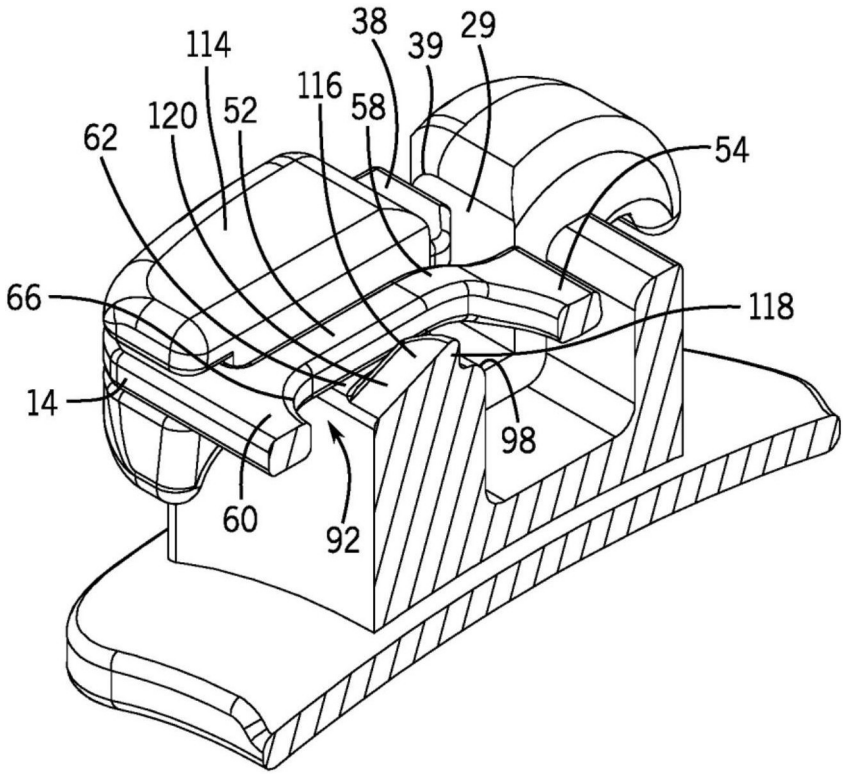


图11