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(72) Inventors; and
(71) Applicants: **GUREL, Galip** [TR/TR]; Tesvikiye Cad. Bayer Apt. No:63 Kat:6 Nisantasi, Istanbul (TR). **SOUSA DIAS, Nuno** [PT/PT]; Rua Cais do Cavaco, 90, 3-B, Vila Nova De Gaia (PT).

(74) Agent: **ATALAY, Baris**; Alfa Patent Stan Advoka Ltd. Co., Dumen Sok. Gumussuyu Is Merkezi No:11 Kat:4, 34427 Beyoglu/ Istanbul (TR).

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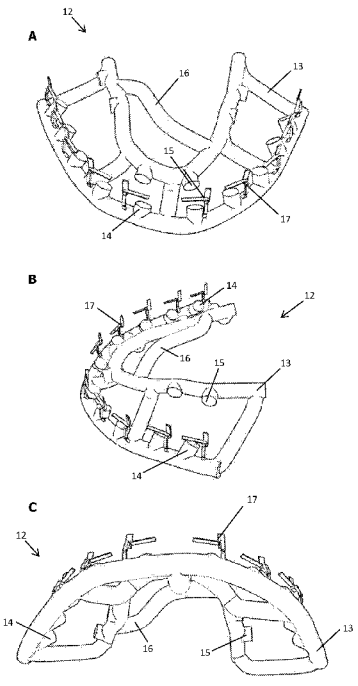

Figure 5

(57) Abstract: Present invention relates to a device for installing orthodontic elements, specifically brackets (22) to teeth (11) on a patient's dental arch (10) in orthodontic treatment options via computer modeling and digital impression. Disclosed invention comprises a dental frame (13) prompted into relation with said dental arch (10) through the use of buccal-labial (14) and palati-lingual support (15) means; said dental frame (13) further comprising positioning support attachment bars (18) mounted thereon to jointly extend primary and secondary (19, 20) positioning support bars, in themselves which form a positioning frame (17) as a zone to house brackets (22). Said secondary positioning support surface (20) further comprises an outwardly sloped adhesive cleaning surface (21) for collection and removal of excess adhesive material, next to as a general system improving precision and accuracy, as well as speed and reducing waste.

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GUIDE FOR INSTALLING ORTHODONTIC BRACKETS

Technical Field of the Present Invention

The present invention relates to an apparatus for positioning, placement and bonding of dental brackets to a tooth or teeth over the course of orthodontic treatment. The present invention also relates to the computer assisted orthodontic methods for maintaining desired position of teeth.

Background of the Present Invention

Orthodontics is the branch of dentistry dealing with teeth irregularities and corrections thereof through realignment, such as by means of braces. The primary purpose of orthodontic treatment is to alter the position and reorient an individual's teeth so as to modify or improve their formation and thus function. Teeth may also be reoriented to serve cosmetic purposes.

In orthodontic treatment as currently practiced, it is necessary to affix various orthodontic components to the surfaces of a patient's teeth. (In this specification we shall only refer to brackets as the orthodontic element or component to be anchored on a tooth's surface, but it is to be understood that this is only by way of example and the invention applies to all other types of orthodontics elements, mutatis mutandis, such as for example tubes, springs and other appliances) The location of the bracket on the tooth as well as its orientation is a critical factor in determining the direction of movement of the teeth during the treatment, and accurate placement may ensure that the teeth are aligned with a single bracket bonding treatment. Conversely, less accurate placement of brackets may require repeated treatments,

including repeated bonding and wire bending procedures until the final alignment is achieved.

Brackets affixed to teeth surfaces serve to support wires and tensioning springs to exert moments of force acting to move the teeth subjected to these forces to a degree and in a direction causing the teeth to assume a desired posture in the dental arch.

In current orthodontic practice, the orthodontist decides on a general scheme of placing the brackets on the buccal (front) surface of teeth and attaches them thereto, in a predetermined precise location and orientation. It is known in the practice that, prior to this step, the orthodontist prepares a three dimensional plaster model of the patient's teeth, based on which the positioning and application details of the bracket scheme is determined as well as the desired position of each of the force-exerting orthodontic implements on patient's teeth. Said placement determines the overall outcome of said movements such as the degree and direction of force exerted which cause teeth to move to new positions and orientations. Deviations from these planned positions are detrimental to the final outcome, which obligates the precision in positioning brackets and accuracy with the positioning scheme.

Yet again in current state of the orthodontic practice, proper positioning of brackets include steps of positioning the bracket element on the tooth surface and then affixing said bracket element thereto with the aid of a bonding agent such as a chemical adhesive that self-cures within 1 to 3 minutes. Manual positioning, as described rather briefly above, depend critically on mechanical skill and therefore is prone to human error. Firstly, positioning of brackets onto buccal surfaces of teeth are inherently difficult due to slippery

and tackles surface of teeth. In addition, there is also difficulty in the disengagement of the bracket from the positioning tool, as this process causes a slight movement of the bracket on the tooth.

The attempts made in the state of the art to alleviate the problems associated with properly positioning brackets on the surfaces of teeth are described in the following patents.

WO2016210402A1 discloses a system and computer-implemented method for guiding the placement of orthodontic brackets. Said system can include an indexing tool designed to conform to at least a portion of a patient's teeth. The system can receive signals from a sensor at the indexing tool as well as signals from a sensor at a bracket positioning tool in order to track spatial location and/or orientation of one or more brackets relative to the surface of the patient's actual or modeled teeth.

US2014287376A1 discloses an apparatus and method for placing bracket guide features on a model dentition to assist in accurate bracket placement. Said apparatus comprises a dentition scanner that outputs an electronic model of a dentition and a tray forming station wherein the tray forming station further includes a bracket guide feature placement engine for placing bracket guide features on the electronic model of the dentition, and a three-dimensional printer for printing a physical model of the dentition with the bracket guide features appropriately placed.

WO2013153325A1 discloses a device for adhering orthodontic attachments to a dental arch, which includes clips and a general splint. In addition the invention makes it possible to standardize the clips as a function of the orthodontic fasteners and to limit the bulk of said orthodontic fastener

bonding device so as to facilitate its placement in the patient's mouth.

US2010092904A1 discloses a device for positioning at least one orthodontic element on a dentition by means of an orthodontic element holder for holding at least one orthodontic element. The device comprises a positioning template for fitting on at least a part of the dentition, having at least one open area for allowing an orthodontic element to contact the dentition. The positioning template is further provided with at least one guide coupled to and extending from the positioning template, which suitable for cooperating with an orthodontic element holder for guiding the orthodontic element held by the orthodontic element holder to the at least one open area.

US2005233276A1 discloses a targeting device and method for enabling one or more orthodontic elements to be aligned with and bonded onto at least one tooth in a predetermined manner. The device is in the form of a shell that has, for each tooth with respect to which it is desired to align an orthodontic element, a cavity shaped to receive the tooth. Targeting indicators are also provided, and are configured for enabling the corresponding orthodontic elements to be guided into alignment in the required predetermined manner with respect to a tooth that is received in a corresponding cavity.

The disclosed invention offers a cost-effective, precise and efficient solution to the problem of positioning brackets with the use of just the right amount of adhesive and repositioning brackets in case of need. The device according to the disclosed invention preferably comprises a dental frame extended with buccal and labial supports for enhanced traction and fixed stance in relation to the patient’s dental arch supported further with a tongue depressor. Device further comprises positioning support with primary and secondary

wedge characteristics for bottom and side respectively, forming an incomplete yet sufficient frame for the positioning and adhesion of brackets.

Objects of the Present Invention

The object of the disclosed invention is to provide a bracket positioning guide for enabling the positioning of said brackets onto a patient's teeth with improved accuracy.

Another object of the disclosed invention is to provide a bracket positioning guide for enabling the positioned brackets to be repositioned and reattached in case of need.

Another object of the disclosed invention is to provide a bracket positioning guide for enabling the removal of excess bracket adhesive with increased speed and efficiency.

Brief Description of the Figures of the Present Invention

Accompanying drawings are given solely for the purpose of exemplifying an orthodontic device for positioning, placement and bonding of dental brackets to a tooth or teeth, whose advantages over prior art were outlined above and will be explained in brief hereinafter.

The drawings are not meant to delimit the scope of protection as identified in the claims nor should they be referred to alone in an effort to interpret the scope identified in said claims without recourse to the technical disclosure in the description of the present invention.

Figures 1A-D demonstrate frontal views of the steps of attaching brackets onto a patient's teeth using an orthodontic apparatus in accordance with the disclosed invention.

Figures 2A-B demonstrate top perspective views of the steps of attaching brackets onto a patient's teeth using an orthodontic apparatus in accordance with the disclosed invention.

Figure 3 demonstrates a bottom perspective view of a patient's teeth and an orthodontic apparatus in accordance with the disclosed invention

Figures 4A-B demonstrate close up views of the steps of attaching brackets onto a patient's teeth using an orthodontic apparatus in accordance with the disclosed invention.

Figures 5A-C demonstrate perspective views of an orthodontic apparatus in accordance with the disclosed invention.

Referenced Parts List

10 Dental arch
11 Tooth
12 Orthodontic apparatus
13 Dental frame
14 Buccal support
15 Labial support
16 Tongue depressor
17 Bracket positioning frame
18 Positioning support attachment bar

19 Primary positioning support bar
20 Secondary positioning support surface
21 Adhesive cleaning surface
22 Bracket
23 Bracket groove

Detailed Description of the Present Invention

Figure 1 demonstrates the steps of attaching brackets (22) onto a patient's teeth (11) using an orthodontic apparatus (12) of the invention. Orthodontic apparatus (12) comprises a dental frame (13) and a plurality of bracket positioning frames (17). Said dental frame (13) is designed to fit over the gum and the dental arch (10) of the patient. The buccal supports (14) and labial supports (15) on dental frame (13) are complementary to the external shape of the teeth (11) arranged over the dental arch (10) that is received thereby, in particular the buccal and labial surfaces of the teeth respectively, as can be seen in further detail in Figure 3. Such structures, namely buccal (14) and labial (15) supports extending from the dental frame (13) enhance the stability of the apparatus (12) by and large, in addition to providing a passive and indirect physical guide to the attachment of brackets (22) onto teeth (11) situated on said dental arch (10), which is demonstrated in actual or digitally modeled incarnation in Fig. 1A. Position of said dental frame (13) with respect to teeth could be found in further illustration, Fig. 1B, where buccal supports (14) visibly contact individual teeth (11) at reciprocating locations. Extending yet still from said dental frame (13) are bracket positioning frames (17) connection of which are established to the body portion of the dental frame (13) through support attachment bars (18), more visible in the proximity of incisors compared to molars. Fig. 1C displays the next step of the attachment process, where brackets (22) for individual teeth

(11) are landed on their digitally designated locations using the joint structure of primary (19) and secondary (20) positioning support bars/surfaces. At this configuration, brackets (22) are attached to the desired location marked by said primary and secondary (19, 20) positioning support bars, and finally as seen in Fig. 1D, apparatus (12) is removed, leaving brackets (22) fixed at their digitally designated locations.

Referring now to Figure 2A, which illustrates the close-up perspective view of the state of the orthodontic apparatus (12) in relation to the upper jaw and dental arch (10) of the patient, structural characteristics of primary and secondary (19, 20) positioning support bars, which are wedge-shaped with shorter sides facing outward from the teeth (11) of the patient. Longer sides of wedges comprising primary and secondary (19, 20) positioning support bars conversely face inward, touching patient's teeth (11) and thus forming the half-frame for brackets (22). Figure 2B demonstrates the orthodontic apparatus (12) with the brackets (22) positioned at their designated slots formed by said half-frame brought together by the joining of primary and secondary (19, 20) positioning support bars in wedge form as mentioned earlier.

Figure 3 displays a patient's dental arch (10) fitted with the orthodontic apparatus (12), with a bottom perspective view showing the dental frame (13) in the forefront. Also, relatively more prominently visible are palati-lingual supports (15) landing on palate locations across respective first two molars on both sides, and tongue depressor (16) installed with the purpose of keeping the tongue of the patient under restriction during the quite precise and delicate process of bracket (22) attachment. While figure in question illustrates an embodiment in a bracketing setting of ten teeth, different embodiments may cover cases of different numbers of teeth to be bracketed

in the context of orthodontic treatment.

Figure 4 illustrates even a greater focus on bracket (22) attachment detail on one tooth (11) on the dental arch (10) of the patient. Figure 4A is further close-up view of a one tooth (11) of the patient, with one positioning frame (17) formed on the surface of said tooth (11), formed by the spatial relationship between one primary and one secondary (19, 20) positioning support bars, that extend upwards from the dental frame (13) of the orthodontic apparatus (12), not shown, with the aid of a positioning support attachment bar (18). Said secondary positioning support surface (20), as previously stated, displays wedge characteristics i.e. the side of said secondary positioning support surface (20) that face away from the tooth (11) on the dental arch (10) it is positioned thereon is horizontally sloped in the manner that the positioning frame (17) formed thereon becomes thicker as it moves away from the center of said tooth (11). The name of the structure arising from such properties is called adhesive cleaning surface (21) in the figures and part list, as well as on numerous occasions within the description.

In Figure 4B, the arrangement is illustrated again with brackets (22) shown placed on the positioning frame (17) formed by the primary and secondary (19, 20) positioning support bars. Said bracket (22) can be seen pre-attachment phase, landed on said positioning frame (17) in the manner that its groove (23) which is directly underneath, sits on the primary positioning support bar (19) comfortably and spatially coherent with its intended final position. Said groove (23), once comes into contact with the primary positioning support bar (19) is able to stay without its own weight not knocking itself over, however, as this is not in any embodiment an intended consequence of a formation or positioning, is of trivial function and merely a

byproduct of said primary positioning support bar (19) not displaying wedge geometry as its secondary positioning support (20) counterpart.

Figure 4B also illustrates the possible view of a bracket (22) once adhesive is applied to the surface of a tooth (11) on the dental arch (10), following which said bracket (22) is pressed thereon with appropriate force to activate the adhesive, subject to which excess amount of adhesive will exit the shrinking space from the side of said bracket (22), causing a buildup in said secondary positioning support bar (20) surface. Said surface, referred to as the adhesive cleaning surface (21) in the part list and figures, located on the face that looks away from the surface of the tooth (11) it is positioned upon; possesses slope character, edge of which closer to the surface of said tooth (11) is considerably shorter to allow excess adhesive to be delivered thereto.

Insofar as the adhesion/attachment process of brackets (22) onto teeth (11) on the dental arch (10) is a matter of utmost precision, it is of equal importance to use appropriate amount of adhesive. Fixing orthodontic brackets (22) may require different sets of material constraints as brackets (22) may contain ceramics, metals and plastics, accordingly which chemically or light-cured adhesive types are considered. One aspect that doesn't change with the material used in the production of orthodontic brackets (22) or the type of adhesive used is the importance of not applying excessive amounts of glue on the surface of teeth (11) to improve efficiency and reduce waste. Wedge design of the secondary positioning support surface (20) which, combined with primary positioning support bar (19) forms the positioning frames (17) arises as an effective solution to this particular technical problem, with the said adhesive cleaning surface (21) formed above and thereon. As shown in figures, especially regarding Fig. 1A-C, it could be observed that positioning frames (17) formed by the joining of primary and secondary

positioning support bars (19, 20) are established in a horizontally symmetrical manner: Taking face midline as the axis of symmetry, right side of the dental arch (10) are subject to positioning frames (17) with a secondary positioning support surface (20) on the right-hand side with wedge slope shallower towards left. Conversely, on the left side of the dental arch (10), positioning frames (17) comprise secondary positioning support surfaces (20) on the left-hand side. It is to be noted here that, regardless of which side of the face midline they may be positioned, positioning frames (17) always form a volume chunk that, as it moves away from the surface of the tooth (11) it is scaffolded on, grows away from the direction of the midline.

When pressure is applied on the bracket (22) in the direction of the tooth (11), excess glue is pushed in the direction parallel to the surface of said tooth (11) and therefore delivered towards the wedge, where it gathers on the adhesive cleaning surface (21) to be collected and removed.

Referring now to Figure 5, the orthodontic apparatus (12) is illustrated in a singular form, isolated for effective display of its physical properties. Figure 5A demonstrates front top perspective view of the orthodontic device (12) according to at least one embodiment, where dental frame (13) and virtually any other extension thereon, such as positioning frames (17), tongue depressor (16), buccal-labial (14) and palati-lingual (15) extremities are visible. Figure 5B, displays said orthodontic device (12) from the top left perspective view, still visible are all extremities an various aspects; while 5C shows the front bottom perspective, showing tongue depressor (16) in particular focus.

To reiterate; the disclosed invention relates to a device for installing orthodontic elements, specifically brackets (22) to teeth (11) on a patient's

dental arch (10) in the course of orthodontic treatment with the aid of computer modeling and digital impression. Disclosed invention comprises a dental frame (13) prompted into relation with said dental arch (10) through the use of buccal-labial (14) and palati-lingual support (15) means; said dental frame (13) further comprising positioning support attachment bars (18) mounted thereon to jointly extend primary and secondary (19, 20) positioning support bars, in themselves which form a positioning frame (17) as a zone to house brackets (22). Said secondary positioning support surface (20) further comprises an outwardly sloped adhesive cleaning surface (21) for collection and removal of excess adhesive material, next to as a general system improving precision and accuracy, as well as speed and reducing waste.

When orthodontic apparatus (12) is properly seated over the patient's dental arch (10), the standing placement of the positioning frames (17) indicates the location on one tooth (11) where a bracket (22) is planned to be attached, which is first determined by a computer modeling of digital impression. Each positioning frame (17) comprises a primary positioning support bar (19) and a secondary positioning support surface (20) attached perpendicular to each other to provide support to the bottom and side of bracket (22), and a positioning support attachment bar (18) for attaching said primary positioning support bar (19) and a secondary positioning support surface (20) to said dental frame (13). Possible other embodiments include further details concerning different sets of teeth (11) to be bracketed resulting in different design specifications, changing the number, orientation and separation of elements such as positioning support attachment bar (18), buccal-labial support (14) and palati-lingual support (15).

In one embodiment of the present invention, an orthodontic device (12) for installing orthodontic elements such as brackets (22) onto a dental arch (10) with the aid of a dental frame (13) positioned over said dental arch (10) based on digital modeling is proposed.

In a further embodiment of the present invention, said dental frame (13) comprises at least one monolithic arc modeled after said dental arch (10) on which at least one positioning support placement bar (18) extends per tooth to be bracketed.

In a further embodiment of the present invention, said at least one positioning support placement bar (18) comprises a joint for one primary positioning support bar (19) to meet.

In a further embodiment of the present invention, said secondary positioning support surface (20) further comprises one adhesive cleaning surface (21) possessing wedge characteristics for excess glue material to accumulate.

In a further embodiment of the present invention, said dental frame (13) further comprises at least one positioning frame (17) conceived as a plurality of said primary and secondary (19, 20) positioning support bars.

In a further embodiment of the present invention, said at least one positioning support bar (18) joint comprises a connection with said primary and secondary (19, 20) positioning support bars at respective ends.

In a further embodiment of the present invention, said primary positioning support bar (19) further comprises a horizontal orientation.

In a further embodiment of the present invention, said primary positioning support bar (19) provides a linear surface for hosting brackets (22) on their own weight.

In a further embodiment of the present invention, said linear surface formed by said primary positioning support bar (19) fits comfortably through a bracket groove (23) found in said brackets (22).

In a further embodiment of the present invention, said dental frame (13) further comprises at least one buccal-labial support (14) extending from its body towards a tooth, providing an offset and attachment means.

In a further embodiment of the present invention, said dental frame (13) further comprises at least one palati-lingual support (15) extending from its body towards sides of the palate, providing attachment means.

In a further embodiment of the present invention, said dental frame (13) further comprises a tongue depressor (16) crossing the palate, providing tongue restraint during bracketing.

In a further embodiment of the present invention, said at least one buccal-labial support (14) and at least one palati-labial support (15) constitute antagonist positioning in terms of force applied to the gum, enabling firm positioning of said dental frame (13).

CLAIMS

1) An orthodontic device (12) for installing orthodontic elements such as brackets (22) onto a dental arch (10) with the aid of a dental frame (13) positioned over said dental arch (10) based on digital modeling **characterized in that**;

said dental frame (13) comprises at least one monolithic arc modeled after said dental arch (10) on which at least one positioning support placement bar (18) extends per tooth to be bracketed,

said at least one positioning support placement bar (18) comprises a joint for one primary positioning support bar (19) and one secondary positioning support surface (20) to meet,

said secondary positioning support surface (20) further comprises one adhesive cleaning surface (21) ascending outwards a slope for excess glue/adhesive material to accumulate.

2) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 1, characterized in that said dental frame (13) further comprises at least one positioning frame (17) having said primary and secondary (19, 20) positioning support bars.

3) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 1, characterized in that said at least one positioning support bar (18) joint is formed as an intersection of said primary and secondary (19, 20) positioning support bars at respective ends.

4) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 3, characterized in that said primary positioning support bar

(19) further comprises a parallel orientation with respect to said dental frame (13).

5) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 3 or 4, characterized in that said primary positioning support bar (19) provides a planar surface for hosting brackets (22) on their own weight.

6) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 5, characterized in that said planar surface formed by said primary positioning support bar (19) fits comfortably through a bracket groove (23) found in said brackets (22).

7) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 1, characterized in that said dental frame (13) further comprises at least one buccal-labial support (14) extending from its body towards a tooth, providing an offset and attachment means.

8) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 1, characterized in that said dental frame (13) further comprises at least one palati-lingual support (15) extending from its body towards sides of the palate, providing attachment means.

9) An orthodontic device (12) for installing orthodontic elements as set forth in Claim 1, characterized in that said dental frame (13) further comprises a tongue depressor (16) crossing the palate, providing tongue restraint during bracketing.

10) An orthodontic device (12) for installing orthodontic elements as set

forth in Claim 7 and 8, characterized in that said at least one buccal-labial support (14) and at least one palati-labial support (15) constitute antagonist positioning in terms of force applied to the gum, enabling firm positioning of said dental frame (13).

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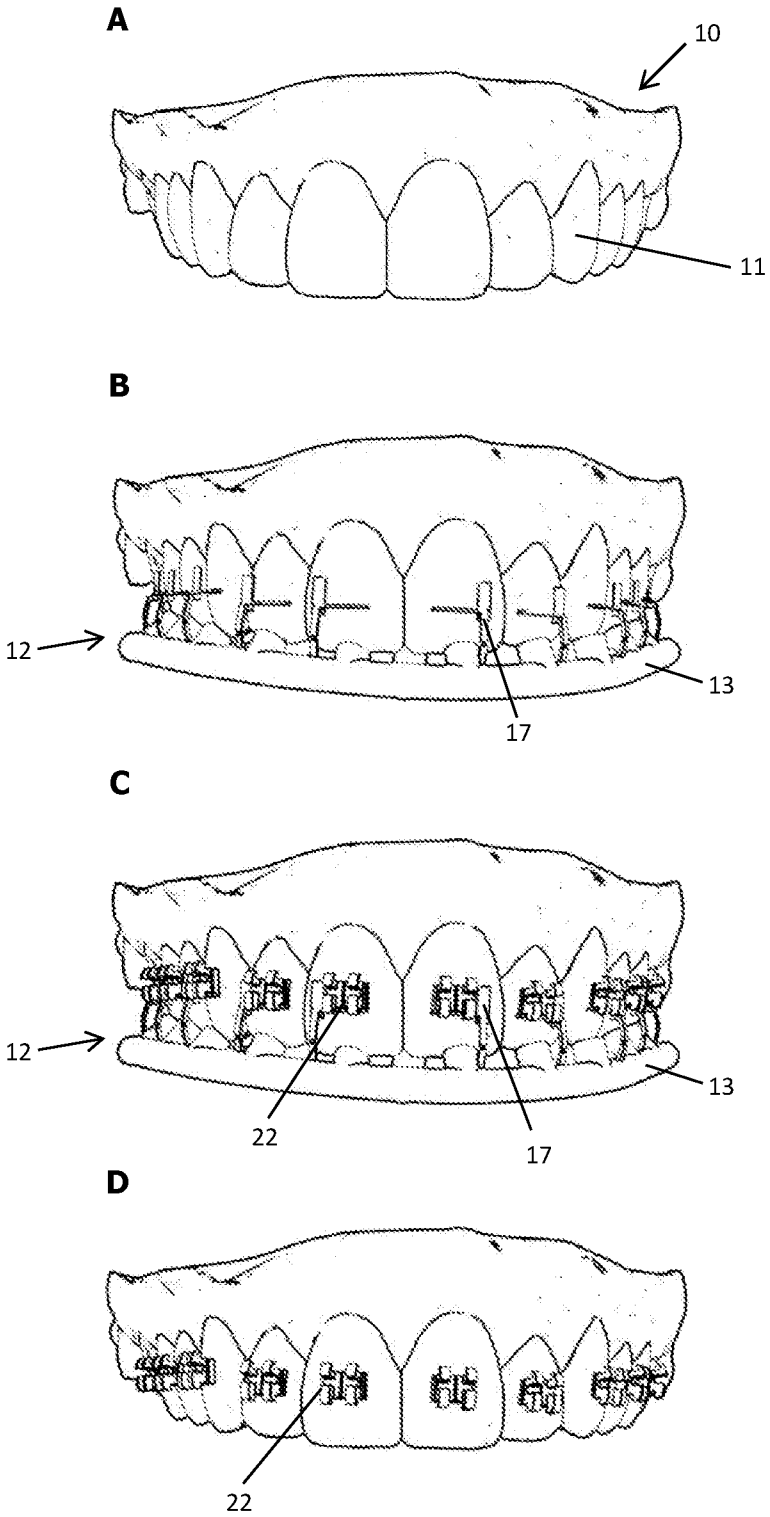


Figure 1

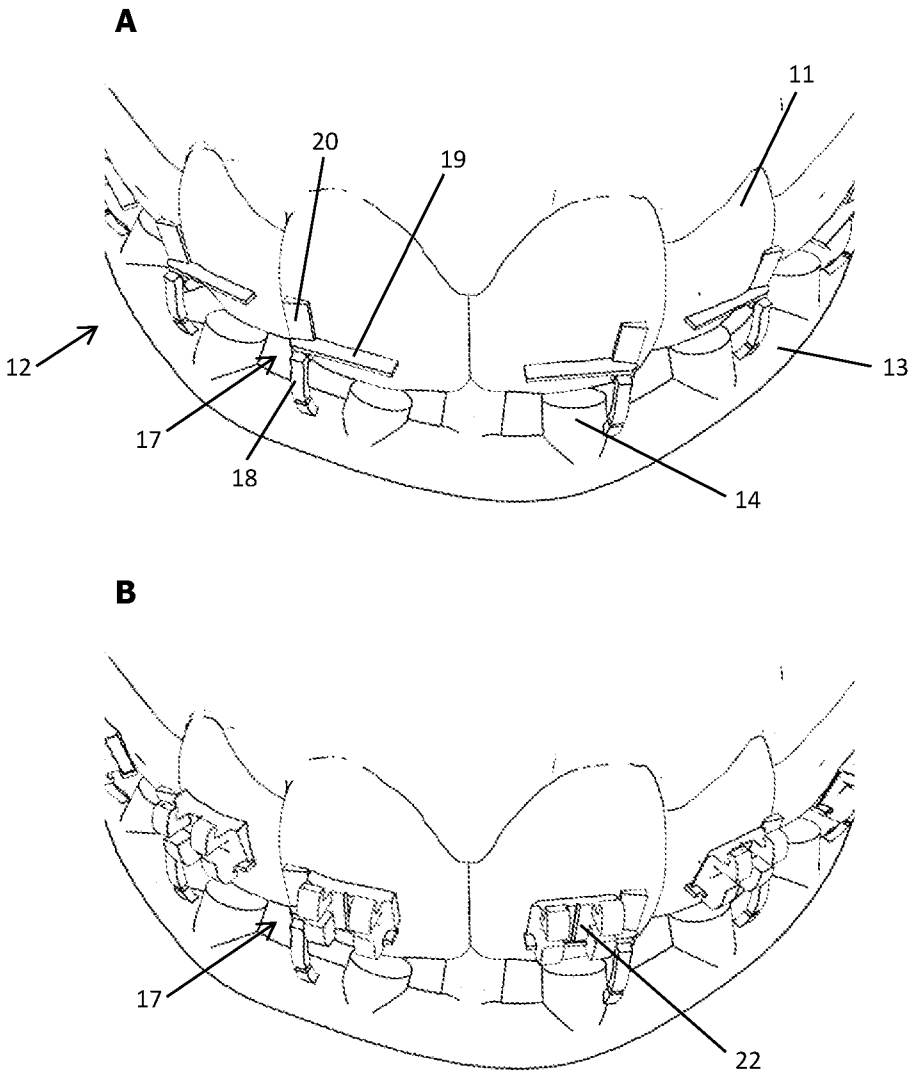


Figure 2

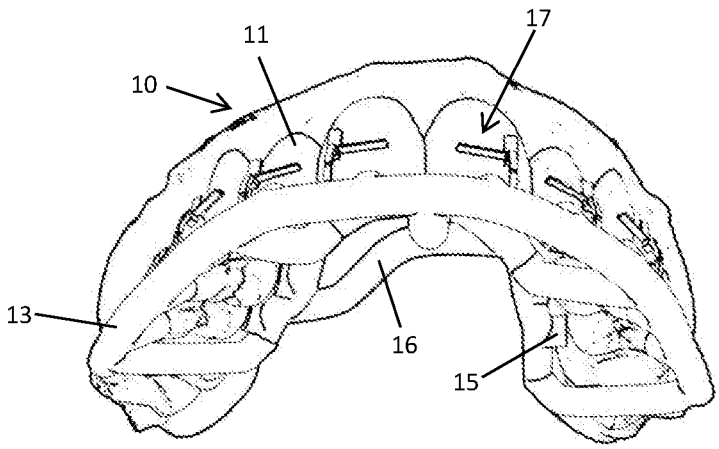
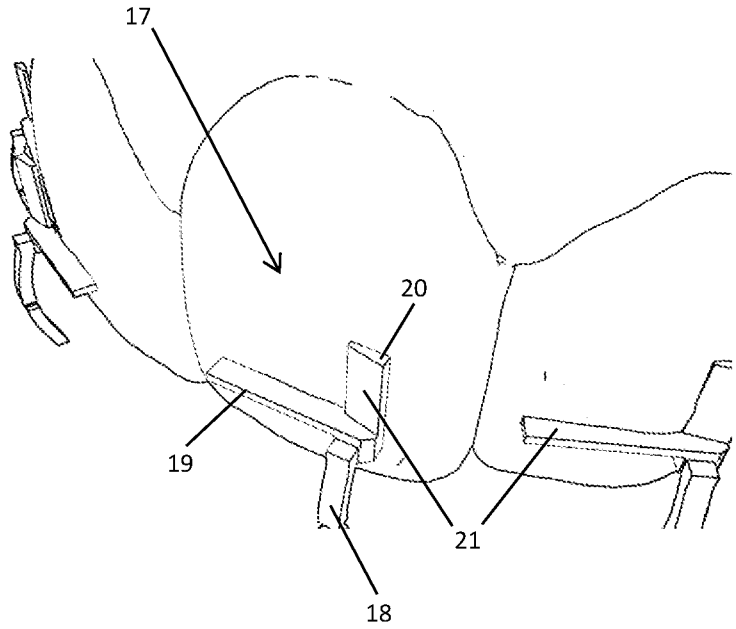


Figure 3

A



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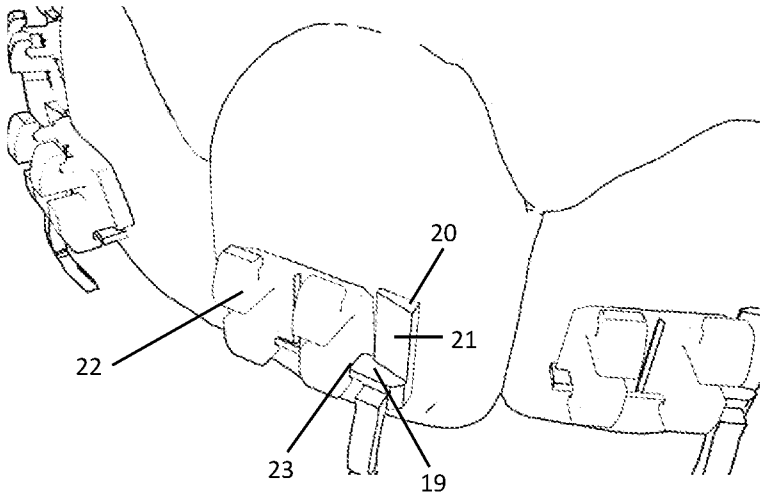

Figure 4

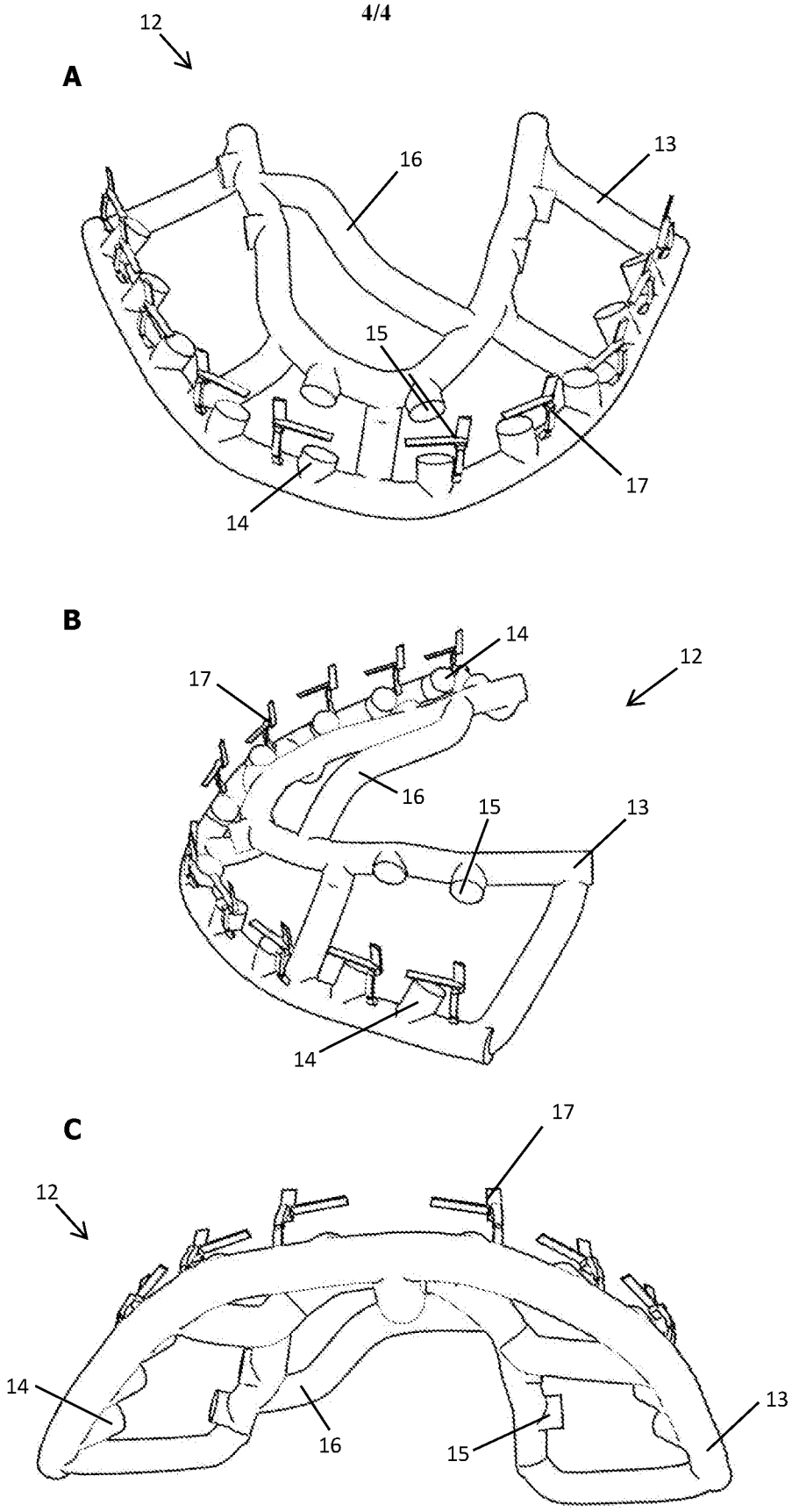

Figure 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2018/050666

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C7/14 A61C7/00
ADD.

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)
A61C

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 105 832 433 A (UNIV SICHUAN) 10 August 2016 (2016-08-10)	1-5,9
A	paragraphs [0046] - [0085] figures 1-11	7,8,10

A	CN 107 049 531 A (SHENZHEN BECOMING MEDICAL E-COMMERCE CO LTD) 18 August 2017 (2017-08-18) paragraphs [0030] - [0057] figures 1-9	1-10

A	CN 105 496 575 B (SHANGHAI NINTH PEOPLE'S HOSPITAL AFFILIATED TO SHANGHAI JIAOTONG UNIV) 22 June 2018 (2018-06-22) paragraphs [0039] - [0075] figures 1-11	1-10

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

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 June 2019	08/07/2019

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European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pisseloup, Arnaud

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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