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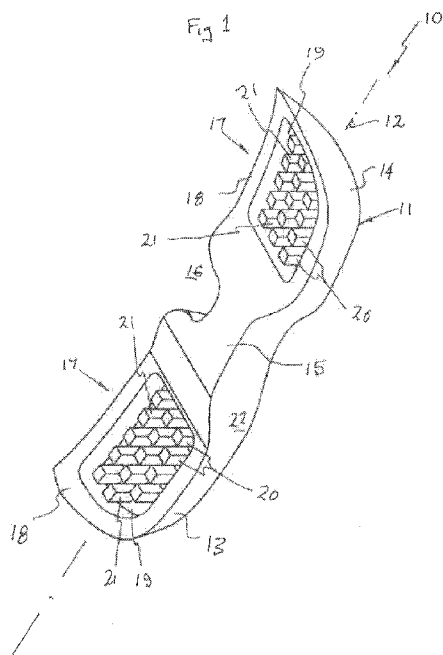
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(57) Abstract: An orthodontic device (10) including a body (11) that is integrally formed of relatively rigid material. The body (11) has a longitudinal axis (12) with the body (11) being longitudinally elongated in the direction of the axis (12), so as to provide a first end portion (13) and a second end portion (14). The portions (13 and 14) are joined by a stem (15). The end portions (13, 14) each have an attachment zone (17) that are fixed to adjacent teeth by an adhesive.



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AN ORTHODONTIC ANCHORAGE ASSEMBLY

FIELD

[0001] The present invention relates to orthodontic anchorage devices and more particularly but not exclusively to orthodontic anchorage devices that extend between and attach to two adjacent teeth.

BACKGROUND

[0002] Orthodontics traditionally and usually involves the treatment of either all the teeth in the mouth or all the teeth in one arch (maxillary or mandibular). However, there has been an increasing trend in recent decades for the cosmetically motivated treatment of only the anterior teeth – especially those primarily visible in the smile, which are often the maxillary teeth. There are six anterior teeth involved in the smile, be they maxillary or mandibular, with this anterior segment often referred to as the “social six” because of the impact they have on a person’s smile and appearance. The treatment of these socially critical anterior teeth with either conventional orthodontic brackets and wires or clear plastic removable shells or trays - such as the Invisalign brand, the Clear Smile brand etc is highlighting the size and growth of the market in the alignment and treatment of the anterior teeth, as distinct from the correction of all the orthodontic problems within the mouth. This may be because many people, especially adults, are primarily concerned with the appearance of their front teeth. They are not as concerned about fixing cross bite, insufficient arch width, open or deep bites or irregularities of alignment in the posterior segments which are often not readily visible. Quite often enamel is removed from between many teeth in the anterior or pre molar segments to make space, and this space created is repositioned and used to allow for the realignment of crooked or malaligned anterior teeth. However when the molar teeth are used as anchorage units used to exert force on the anterior teeth – and especially where there are forces that are pulling the molars of the Anchorage unit towards the mesial, it is quite common for these molar teeth to tilt quickly to the mesial or rotate instead of moving slowly forward in a bodily fashion. The rapid tilting and often rotating of these teeth indicates a failure of anchorage caused by traditional devices and also causes the loss of the spaces created by stripping of precious enamel – with the effect that more enamel needs to be stripped later to provide sufficient space to achieve the realignment of the anterior teeth, and creating the double problem of an impaired and upset biting condition

which can lead to temporomandibular joint dysfunction and other issues. Quite often the maximum amount of enamel has already been taken and there is no more available. Even if there is more available, there are negative effects on the tooth and sometimes negative effects on the periodontal health of the teeth involved where the roots are too close together.

[0003] Conventional orthodontics usually involves the placement of brackets or bands onto the molars which have a tube or slot set at an ideal angle relative to the tooth axis so that when the straight wire technique delivers its usual forces, and sufficient time has passed, the posterior teeth are correctly aligned and in harmony with the anterior segments. The brackets are placed in such a way that when the wire is passed through or placed into the brackets or the buccal tube, the wire will be distorted if the tooth is malaligned, causing a force to act on the teeth and thus causing the molar teeth to realign into a perfectly ideal alignment. The bracket is put at a perfect angle relative to the tooth orientation – but if the tooth has a malaligned orientation it will be the wire that then is distorted and then provides the force to move the tooth into the correct orientation. Typically brackets are placed on molars in such a way as to cause them to move into the correct orientation when the straight wire technique is employed.

[0004] Disclosed in International Patent Application PCT/AU2016/000250 is an orthodontic molar/premolar splinting device (a three-piece device) where there are two adhesive pads attached at either end of connector bar or tube. The object of the splinting device is to fix two adjacent molars together so as to increase the anchorage value of the two adjacent teeth for the purposes of delivering forces to other teeth without moving the anchorage units. A disadvantage of this device is that it requires at least two brackets to be bonded to the teeth, (or two bands to be cemented to the teeth if using molar bands instead of brackets), and then the operator must select an appropriate connector bar or tube to be cut to length and modified in shape and alignment so that it fits between the two large buccal receptacles – and then use a cementation or bonding process that attaches this connector bar or tube to the two teeth involved in a way that does not put any force on these teeth and cements and splints them together in a passive way, so that there is no movement to this stable molar position or to the bite.

[0005] An advantage of the three-piece device is that it allows the adhesive pads to fit exactly to whatever malocclusion or orientation the two anchorage molars are in. This allows for a thin film of adhesive. Any deviation in the orientation of the molars is accommodated for in the slack between the splinting bar or tube and the large diameter hole that it fits into and also the

splinting bar or tube – if it is made out of metal – can be bent so as to accommodate even greater extremes of malalignment of the two molars which it is rigidly fixing together.

[0006] A further disadvantage of known orthodontic anchorages, is that the anchorages consist of a pad that is fixed to the tooth, with the pad then providing a pair of projections between which there is a groove or slot. The orthodontic wire is placed in the groove. For the anchorage to work correctly, the bracket must be correctly adhered to the tooth – they are typically designed to match and fit to the anatomy of the tooth such that the groove will be correctly oriented when the molar is eventually brought into correct alignment – typically in 9 to 18 months. Anchorage coming from the molars only happens once the wire diameter and type has progressed to large stainless steel diameters towards the end of the treatment. Also the wire must fit intimately into the groove. If the wire is a loose fit then the tooth can move forward before the wire engages the groove and resists its forward tipping. Typically the groove size is the largest size the operator will go to at the end of the treatment and is set at the beginning of the treatment and is not changed, however wires are small to start with and are a very loose fit and only properly fit and fill up the groove towards the end of the treatment – during which time the anchorage value of this situation is very limited to non-existent.

[0007] Conventional splinting techniques for molars usually involve a rigid bar and two composite resin attachment lumps bonded to the teeth which embed and fix the bar to the teeth. However a disadvantage is that attaching elastics to these conventional splints is difficult and time-consuming, which is why most molar brackets, come with a hook or are provided with a hook option. An additional disadvantage is that the construction of and trimming of these lumps is very difficult in the molar area.

OBJECT

[0008] It is the object of the present invention to overcome or substantially ameliorate at least one of the above disadvantages.

SUMMARY OF INVENTION

[0009] There is disclosed herein an orthodontic anchorage to extend between two adjacent teeth, each tooth having an arcuate surface to which the anchorage is to be applied, the anchorage

having a body that is integrally formed of relative rigid material so as to resist deformation, the body having a first end portion and a second end portion, with the end portions being spaced and joined by a stem, the body being longitudinally elongated so as to extend between the end portions, and wherein the end portions each have a transverse cross-sectional area, and the stem has a transverse cross-sectional area less than the cross-sectional area of the end portions, with each end portion providing an attachment zone for attachment to a respective one of the teeth so that the anchorage extends between the teeth.

[0010] Preferably, the attachment zones are arcuate to at least approximate the arcuate surfaces of the teeth to which the anchorage is to be applied.

[0011] Preferably, the body is moulded from plastics material.

[0012] Preferably, the plastics material is fibre reinforced.

[0013] In an alternative preferred form, the body is moulded of ceramic material.

[0014] In a still further alternative preferred form, the body is formed of metal.

[0015] Preferably, the anchorage has a longitudinal axis, with the attachment zones being located along said axis.

[0016] Preferably, the attachment zones are angularly spaced from each other about said axis by an acute angle.

[0017] In an alternative preferred form, the attachment zones are offset with respect to said axis.

[0018] In a further alternative preferred form, the attachment zones extend at acute angles to said axis.

[0019] Preferably, each attachment zone includes a hollow that is to receive an adhesive to aid in securing the anchorage to the teeth.

[0020] Preferably, each attachment zone includes a plurality of projections in said hollow that aid in engaging the adhesive.

[0021] There is further disclosed herein an anchorage device to be secured to a tooth, the anchorage device including a base to be secured to the tooth, and an outer wall fixed to the base and extending therefrom so as to enclose a cavity, with said outer wall having an end aperture providing access to said cavity, with said cavity being closed at a location remote from said aperture by an end wall portion of said wall.

[0022] Preferably, said wall includes a further aperture providing for the delivery of a settable adhesive to be applied to said cavity.

[0023] Preferably, the anchorage device includes a projection extending outwardly from said side wall.

[0024] Preferably, said projection extends from the side wall and away from said end wall portion.

[0025] Preferably, said anchorage device has a longitudinal axis extending through said end wall portion and end aperture, with said projection having a component of a direction of extension generally parallel to said axis.

[0026] There is further disclosed herein an anchorage assembly including said anchorage device, with said anchorage device being a first anchorage device and the assembly including a second anchorage device, and a rod fixed to each anchorage device and extending between the cavities of the anchorage devices.

[0027] Preferably, the anchorage assembly includes an adhesive in each cavity securing the rod to the anchorage devices.

BRIEF DESCRIPTION OF DRAWINGS

[0028] Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings wherein;

[0029] Figure 1 is a schematic isometric view of an orthodontic anchorage to extend between two adjacent teeth;

[0030] Figure 2 is a series of schematic illustrations of the anchorage of Figure 1;

[0031] Figure 3 is a schematic isometric view of a modification of the anchorage of Figure 1;

[0032] Figure 4 is a series of schematic illustrations of the anchorage of Figure 3;

[0033] Figure 5 is a series of isometric illustrations of a further anchorage;

[0034] Figure 6 is a series of isometric illustrations of a further anchorage;

[0035] Figure 7 is a series of isometric illustrations of a further anchorage;

[0036] Figure 8 is a series of isometric illustrations of a further anchorage;

[0037] Figure 9 is a schematic isometric view of an orthodontic anchorage assembly;

[0038] Figure 10 is a schematic isometric view of portion of the assembly of Figure 9; and

[0039] Figure 11 is a schematic isometric view of a modification of the portion of Figure 10.

DESCRIPTION OF EMBODIMENTS

[0040] In Figures 1 to 8 of the accompanying drawings there is schematically depicted an anchorage 10 to be fixed to two adjacent teeth so that the two adjacent teeth provide for secure anchoring of further orthodontic devices to the two teeth.

[0041] The orthodontic anchorage 10 includes a body 11 that is integrally formed of relatively stiff (preferably substantially rigid) material such as metal, plastics material that is reinforced with glass fiber, high strength ceramics, or reinforced composite resin. Preferably the material forming the body 11 is coloured to match the colour of the teeth to which the anchorage 10 is attached. The anchorage 10 has a longitudinal axis 12 with the body 11 longitudinally elongated so as to have a first end portion 13 and a second end portion 14 spaced from the end portion 13, with the end portions 13 and 14 joined by a stem 15. The end portions 13 and 14 have transverse cross-sectional areas that are greater than the transverse cross-sectional area of the stem 15 to allow for better access for cleaning in the gap between the teeth and between the teeth

and the anchorage 10, and to prevent inflammation of the gingiva by harbouring plaque and the food particles. Accordingly, adjacent the stem 15 there are recesses 16 between the end portions 13 and 14.

[0042] Accordingly, the end portions 13 and 14 are enlarged relative to the stem 15.

[0043] The end portions 13 and 14 each have an attachment zone 17, each attachment zone 17 is configured to be attached to a respective one of the adjacent teeth by an adhesive. In particular, each attachment zone 17 includes a surface area 18 that surrounds a hollow 19 in which there is included a plurality of projections 20 that are spaced. The hollow 19 provides a cavity that receives the adhesive, with the adhesive also securely engaging the projections 20. The projections 20 may be isolated individual stalks or a series of bars and slots and provide surfaces 21 that extend generally transverse relative to the axis 12 to aid in securing the anchorage 10 to the surface of each adjacent tooth.

[0044] The “external” surfaces 22 are smooth and arcuate to minimise irritation in respect of the wearer of the anchorage 10.

[0045] The surface areas 18 are arcuate so as at least approximately match the arcuate outer surfaces of the teeth to which they attached. To this end, a plurality of anchorages 10 can be provided in which the attachment zone 17 have varying inclinations relative to each other so as to best adapt to the orientation of the surfaces of adjacent teeth to which they are to be applied, given the wide variety of malocclusions and varying orientations that the two or three molars present with. Sometimes there is a Bucco- lingual variation in position between the two molars – sometimes there is an occluso-gingival offset between the two molars – and sometimes there is a difference in the extent of the mesial tipping between the two molars, especially when a second molar has been removed and a third molar grows into its position at a substantially tilted angle.

[0046] Accordingly, in Figure 3 there is schematically depicted the anchorage 10 in which the attachment zone 17 have a different inclinations relative to the anchorage 10 of Figure 1.

[0047] In the embodiment of Figure 5, the attachment zones 17 are displaced relative to the axis 12 by acute angles 23.

[0048] In the embodiment of Figure 6, the attachment zones 17 are displaced laterally relative to each other and relative to the axis 12.

[0049] In the embodiment of Figure 7, the attachment zones 17 are spaced angularly about the axis 12 by different angles, so that they are angularly spaced about the axis 12 from each other.

[0050] In the embodiment of Figure 8, there is provided a projection 24 that is fixed to and extends away from one of the end portions 13/14. Projection 24 extends firstly away from the end portion 13/14, and then generally parallel to the axis 12 so as to provide a hook, that can be engaged by bands or wires of an orthodontic assembly.

[0051] The above anchorage 10 has the advantage that it is easier for a dentist to apply the anchorage 10 to adjacent teeth, while assisting in accurate location of the anchorage 10. As the anchorage 10 is readily easy to install, the time required for installation is reduced relative to previously known anchorages. A further advantage is that the shapes of the pre-made anchorages 10 can be communicated to orthodontic companies that construct clear plastic aligners to go over the teeth. When the teeth are scanned and digital files created of the shape of these teeth it is a relatively simple matter to choose and prescribe one of the available anchorages 10 – the anchorage 10 which fits the most accurately – and to set this up in the virtual model of the teeth as an attachment which can be added at the time inside the attachment trays are issued to the dentist or orthodontist and which are used to add other attachment devices made of composite resin to the other teeth in order to enhance the retention and grip that the clear aligners the other teeth and in order to transmit forces to teeth that present difficult movements. The provision of these premade anchorages 10 and the ability to put them inside the clear plastic attachment tray or an actual orthodontic aligner tray has the advantage of saving the operator the inconvenience of having to hand attach the anchorage 10 and also assures the position of the anchorage 10 is locked into the exact position that is set up on the 3-D digital file and to which all the plastic aligner trays have been formed. However the anchorage 10 also has the advantage of being able to be cemented to the teeth prior to the impression or the scanning process which is done prior to the file being sent to the provider of the clear plastic aligner trays. Once the file is received the anchorage 10 is already in possession and the clear plastic aligner trays can all be made to go over this existing shape, just as though it was a large molar. Any undercuts in the stem area can be blocked out with the relevant computer software at the time of the clinical set up – and any undercuts in this area can be blocked out with red wax if an impression is being

taken. Therefore the one piece anchorage 10 as described has great flexibility in that it can be put on within the tray at the beginning of the aligner treatment in conjunction with the other attachments or it can be placed very early in the treatment prior to impressions or scanning, and prior to the other attachments which are often prescribed by the orthodontic aligner company. A still further advantage is that the anchorage 10 is less likely to retain food debris, thereby ameliorating any problems in respect of bad taste and bad smell, and enhancing the prospects of cleaning the space between the teeth and between the anchorage 10 – thus reducing gingivitis and any pain or bleeding associated with it.

[0052] In Figures 9 and 10 there is schematically depicted a pair of adjacent teeth 30. Applied to surfaces of the teeth is an orthodontic anchorage assembly 31. The assembly 31 includes a first and a second anchorage device 32. Each anchorage device 32 includes a base 33 that is secured to the surface 34 of a respective tooth 30. Each device 32 includes an outer wall 34 that in conjunction with the base 33 encloses a cavity 35. The wall 34 also includes an end wall portion 36 while the wall 34 also provides an aperture 37 providing access to the cavity 35. The wall portion 36 is spaced from the aperture 37. Accordingly, apart from the aperture 37, the cavity 35 is enclosed by the base 33 and wall 34, including end wall portion 36.

[0053] The wall 34 may also be provided with a second aperture 38 that provides for injection of a flowable substance into the cavity 35, the flowable substance being settable so as to harden. In use of the above described anchorage assembly 31, once the anchorage devices 32 are secured to the teeth by an appropriate adhesive, a rod (wire) 39 is located so as to extend between the two anchorage devices 32 so as to extend into each of the cavities 35. If necessary, the wire 39 may be plastically deformed so as to accommodate various inclinations between the teeth 30. Thereafter, the abovementioned flowable substance is injected into the cavities 35, with the flowable substance then hardening so as to provide a relatively rigid assembly 31. Typically the flowable substance will be a liquid or past, and may be light cured or self curing or dual cured.

[0054] In the embodiment of Figure 11, the anchorage device 32 is provided with a projection 39 that engages another portion of an orthodontic assembly by bands or wires. In this embodiment, the projection 39 extends away from the end wall portion 36 so as to provide a “hook”.

[0055] Each of the anchorage devices 32 has a longitudinal axis 40, with the projection 39 having a direction of extension including a component generally parallel to the axis 40, and a component away from the end wall portion 36.

[0056] It is the purpose of the above described embodiments to provide an anchorage 10 which enhances the anchorage value of the posterior segments, especially the first and second molars, such that these anchorages 10 can be relied on to be used to apply force without them moving in order to move the anterior teeth without anchorage tilting or rotating, and with absolutely minimal mesial slippage. This allows the anchorages 10 to transmit the necessary forces to get the desired result in the anterior segment and also preserves any space or gaps created by stripping or removing enamel for repositioning the anterior teeth.

[0057] It is not the purpose of the above described embodiment to realign the molars into a perfectly ideal alignment – it is one of the purposes of the embodiments to hold them in whatever good alignment or malalignment they present with so that the existing and comfortable bite is preserved in its current form. Conventional orthodontics usually likes to create a class one bite and to eliminate any cross bite – however the purpose of the embodiments is not to correct these posterior malalignments, if present, but rather to preserve the existing status quo so as to enhance its anchorage value by not causing any histological changes or widening of the periodontal ligament or softening in the bone caused by unnecessary tooth movement. Unnecessary in this case is defined as what the patient wants rather than what should be done in an ideal orthodontic world. In this way the anchorage value is maximised – and when used in conjunction with the splinting technique which prevents the forward or mesial tipping, or rotation of these molars then the anchorage value is taken to a very high level making it possible to avoid the use of other surgical anchorage devices such as implants or TAD's (temporary anchorage devices) and improving substantially on the common situation of just leaving the molars as they are without any anchorage enhancements. It is the purpose of the above embodiments to 'freeze' these molars in their existing position. Quite often these rapid cosmetic orthodontic patients have lived with their bite for a long time and have been comfortable with it and have accepted their bite and their posterior malalignment, if any, as it is, and are happy to continue to live with it, albeit not perfect according to textbook definitions of the optimal orthodontic occlusion. The purpose of the orthodontics for them may well be to concentrate on improving the position and orientations of the anterior teeth for cosmetic purposes only. Therefore it is desirable to keep these molars in exactly the position they are already in and have been in for many years because

it is a stable position and the bone is hard around them and resistant to forces. Also the bite is stable, and any changes to the bite can sometimes have an unexpected and undesirable effect on the patients temporomandibular joint or facial musculature and propensity to get headaches – and any changes to the bite especially in adults can be unpredictable in terms of pain and discomfort. It is one of the purposes of the above embodiments to reduce this potential threat of pain and discomfort by keeping the bite in the existing position that the patient is happy with and has lived with for some time.

[0058] Conventional known orthodontic devices also utilise two molar pads – sometimes called brackets or bondable bases – which can be adhered or bonded to the buccal enamel of the two molars, usually referred to as the first and second molars, these molar brackets are bonded on the buccal side for greater comfort to the tongue. These molar pads may be glued or bonded to the tooth and form the base foundation for the metallic device (the ‘bracket’ with a slot or a tube) that attaches onto them which then engages the arch wire. Sometimes the term ‘bracket’ refers to both the bondable base and the overlying attached metallic material that forms the receptacle for the arch wire- be it a buccal tube or a conventional slot with wings that engage elastic or wire ligatures to hold the wire into the slot. However it is also known to replace the molar pads with molar bands which wrap around the tooth in order to attach firmly to the tooth. Attached onto these molar bands or pads are what is usually known in orthodontics as a buccal tube.

Sometimes there is a secondary tube available for the insertion of wires from headgear, or a secondary wire. Other times there is a slot instead of a tube so that the wire can be placed on top and into the slot rather than inserted into the front of the tube. Sometimes the tube has a loosely affixed lid on it which can be peeled off. This is called a convertible tube so that it can be converted to a slot if the operator prefers. Typically the wire size is increased over about one the year to 18 months in these conventional orthodontic molar brackets until it gets to a large and rigid diameter of approximately 0.02 inches or something like 0.019 x 0.025 inches stainless steel rectangular wire. At these large wire sizes and with their associated rigidity the two molars that are joined by these wires have an anchorage value that is improved and increased dramatically over the initial wire size of 0.012 inches or thereabouts. In other words the anchorage value of these molars is almost non-existent at the start of the treatment and only becomes evident and somewhat useful at the end of the treatment once the patient is in large diameter and rigid wires. However in order to get the wire in an out of the slot or the tube there must be a little bit of flexibility and slack – so that the molars may still move slightly compared to rigid fixation with cemented splinting devices. It is the purpose of the above embodiments to

provide high levels of anchorage at the beginning of the treatment and maintain those high levels of anchorage throughout the course of the treatment so that anchorages 10 can be used to speed up and enhance the movement of the anterior segments. It is also the purpose of the above embodiments to provide improved rigidity between the two molars than that which can be obtained by the use of conventional stainless steel or nickel titanium wire – no matter what the size of the wire is when used in a conventional orthodontic way. There is no orthodontic wire held into a slot in a conventional orthodontic bracket or buccal tube that provides the rigidity that a 1.3 mm stainless steel bar or tube bonded to the molars can provide – or that the above embodiments can provide by virtue of a thick composite resin, metallic or ceramic stem between the two devices 32. The provision of this rigidity is very important as it stops the molars drifting forward under mesial pressure. Every millimeter of mesial drift counts when it is being stripped away from nonrenewable and precious enamel, and when every millimetre of enamel loss increases the risk to the tooth in the long-term.

[0059] However the above embodiments have the advantage of being a single unit device 10 which is selected from a range of different sizes, orientations and offsets – it is not necessary to provide an infinite range of shapes and sizes because the adhesive cement is usually of a sufficiently thick viscous nature and sufficiently strong – such as that used for posterior composite restorations – to accommodate and fill in any slight or even substantial deficiency. The cement in this case is no worse than a conventional posterior composite as far as strength is concerned and provides sufficient strength to span the gap from an imperfect fit due to the lack of an infinite range of shapes and sizes, and thus this cementing technique enables the current invention to be produced with practical and limited range of sizes, and still have a satisfactory clinical outcome. However the cementing process and the provision of an anchorage 10 is massively simplified by having a one-piece device chosen from a range of options. Another disadvantage of these previously disclosed three-piece splinting devices is that they were typically made of metal and the connection bar may have been metal and it may have created a metallic and less than cosmetically desirable effect for patients who are using clear plastic trays in order to minimise the negative aesthetic impact of the orthodontic treatment. Typically these patients do not want metallic braces brackets or wires on their teeth. It is an object of the above embodiments to simplify the provision of anchorage enhancing devices and to provide a splinting device with greater aesthetic appeal by having the option to make the device sufficiently strong using tooth coloured materials.

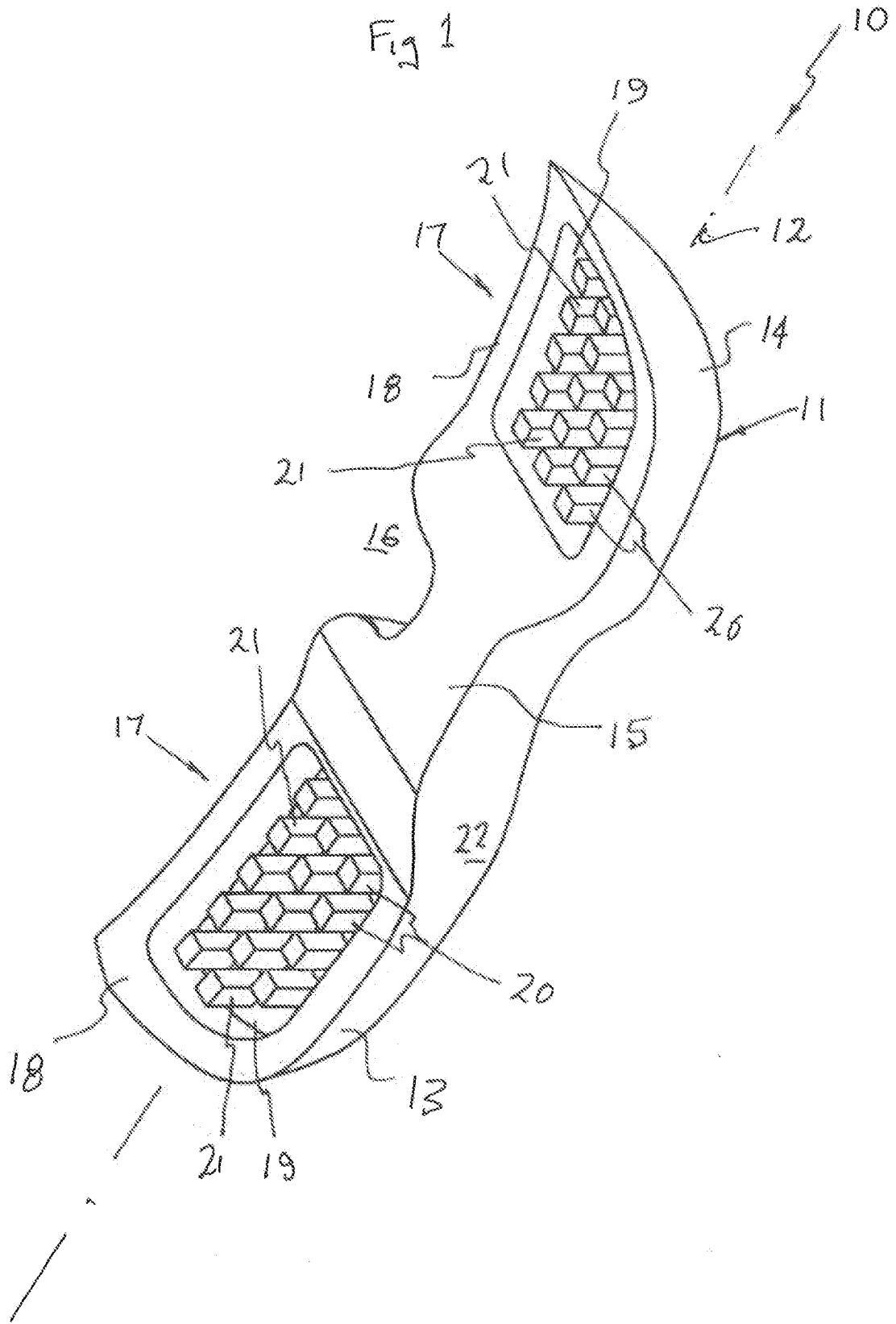
[0060] It is also an object of the above embodiments to provide a splinting anchorage 10 which functions as an anchorage enhancing device that also includes the option of a hook 39 which enables the easy attachment of elastics (chain, thread or bands) or metallic springs which can then pull on the anterior teeth to pull them backwards – distally – towards the molars so as to unravel any anterior crowding or to provide a derotating force to twist an anterior or premolar tooth which has an anaesthetic twisted or crooked appearance. From the above it would be appreciated that any distal force applied to the premolars or the canines or the incisors will have an equal and opposite force on the molars causing them to drift towards the mesial – thus disturbing the bite and wasting precious stripped enamel – and it is the purpose of this anchorage 10 to resist that mesial tipping or rotating force.

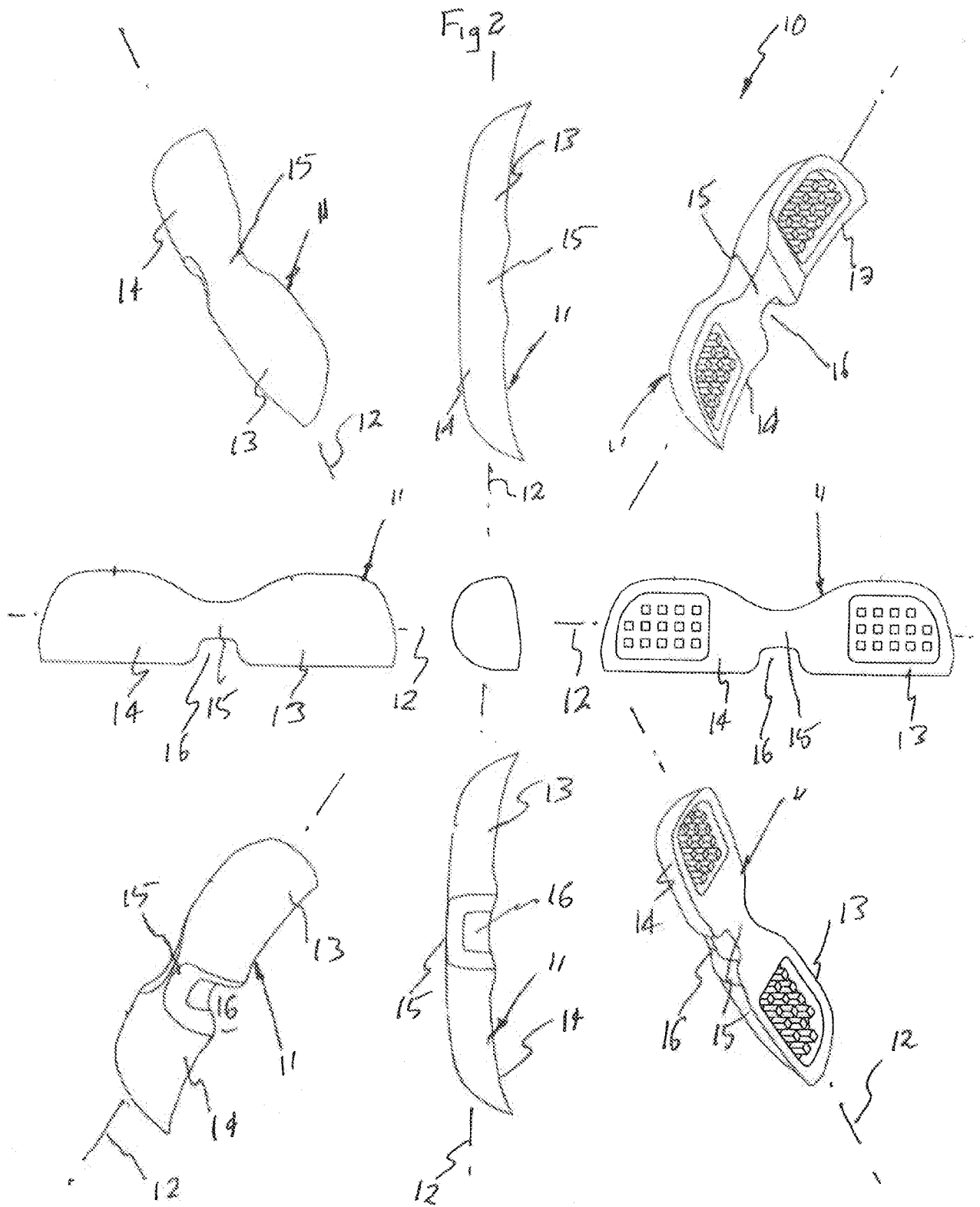
[0061] Also the shape of the attachment zones 17 are such that they optimally fit to the anatomy of first and second molars in the human dentition. In another variation there may be a shape which is optimised to fit to the second premolar at the mesial and the first molar at the distal end. Also the occlusal surface of these attachment end portions is shaped and modified so that it does not cover the entire buccal surface of the tooth, typically leaving an area at the occlusal unbonded so that the anchorage 10 is clear of interference caused when the molars mesh together during chewing when there is intercuspation and partial overlap of the molars. On the lingual surface these restrictions are not so relevant, unless the molars are in cross bite, in which case any lingual appliance will have the same restrictions on shape and thickness.

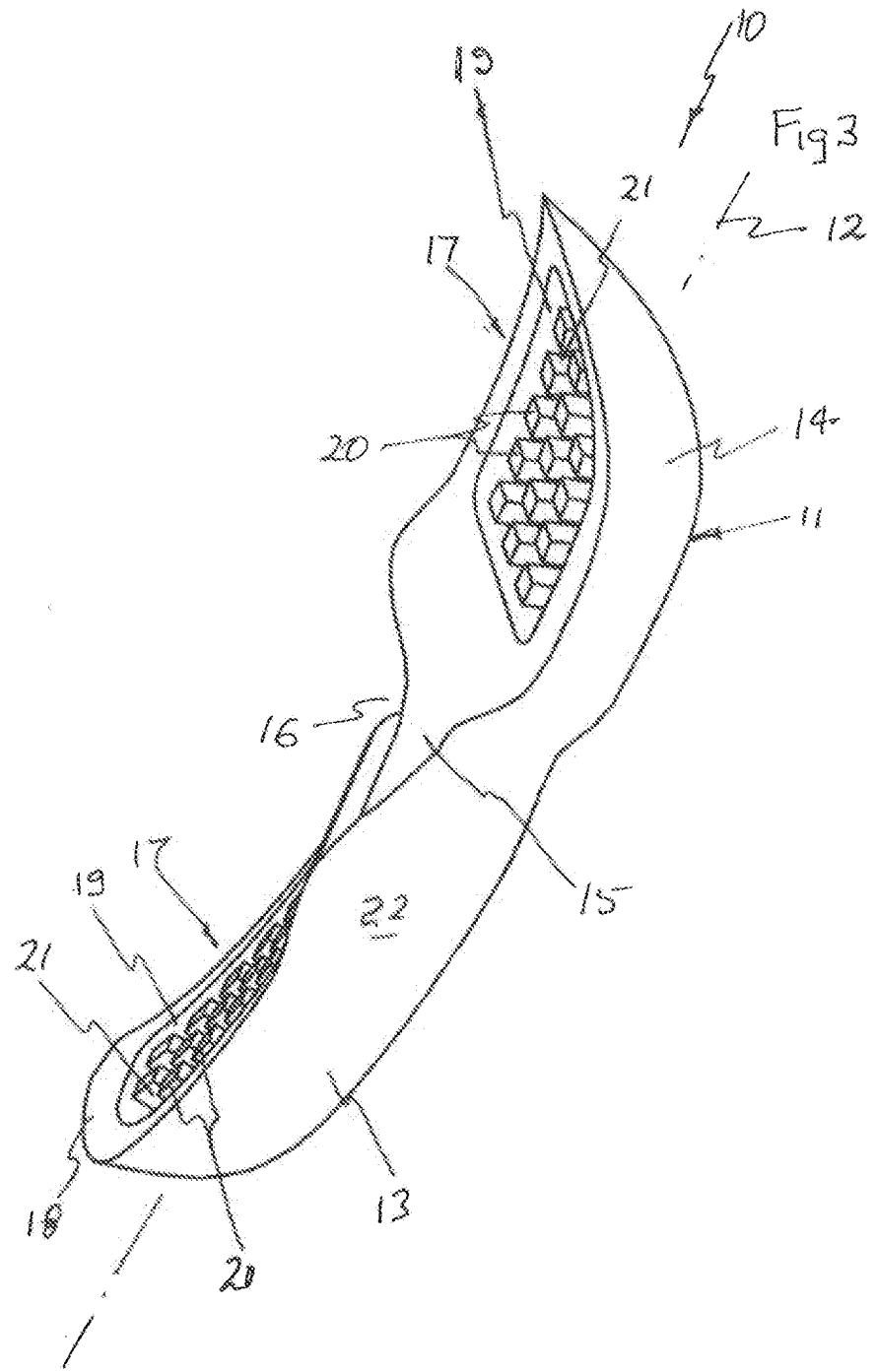
CLAIMS:

1. An orthodontic anchorage to extend between two adjacent teeth, each tooth having an arcuate surface to which the anchorage is to be applied, the anchorage having a body that is integrally formed of relative rigid material so as to resist deformation, the body having a first end portion and a second end portion, with the end portions being spaced and joined by a stem, the body being longitudinally elongated so as to extend between the end portions, and wherein the end portions each have a transverse cross-sectional area, and the stem has a transverse cross-sectional area less than the cross-sectional area of the end portions, with each end portion providing an attachment zone for attachment to a respective one of the teeth so that the anchorage extends between the teeth.
2. The anchorage of claim 1, wherein the attachment zones are arcuate to at least approximate the arcuate surfaces of the teeth to which the anchorage is to be applied.
3. The anchorage of claim 1 or 2, wherein the body is moulded from plastics material.
4. The anchorage of claim 3, wherein the plastics material is fibre reinforced.
5. The anchorage of claim 1 or 2, wherein the body is moulded of ceramic material.
6. The anchorage of claim 1 or 2, wherein the body is formed of metal.
7. The anchorage of any one of claims 1 to 6, wherein the anchorage has a longitudinal axis, with the attachment zones being located along said axis.
8. The anchorage of claim 7, wherein the attachment zones are angularly spaced from each other about said axis by an acute angle.
9. The anchorage of claim 7, wherein the attachment zones are offset with respect to said axis.
10. The anchorage of claim 7, wherein the attachment zones extend at acute angles to said axis.

11. The anchorage of any one of claims 1 to 10, wherein each attachment zone include a hollow that is to receive an adhesive to aid in securing the anchorage to the teeth.
12. The anchorage of any one of claims 1 to 10, wherein each attachment zone includes a plurality of projections in said hollow that aid in engaging the adhesive.
13. An anchorage device to be secured to a tooth, the anchorage device including a base to be secured to the tooth, and an outer wall fixed to the base and extending therefrom so as to enclose a cavity, with said outer wall having an end aperture providing access to said cavity, with said cavity being closed at a location remote from said aperture by an end wall portion of said wall.
14. The anchorage device of claim 13, wherein said wall includes a further aperture providing for the delivery of a settable adhesive to be applied to said cavity.
15. The anchorage device of claim 13 or 14, wherein the anchorage device includes a projection extending outwardly from said side wall.
16. The anchorage device of claim 15, wherein, said projection extends from the side wall and away from said end wall portion.
17. The anchorage device of any one of claims 13 to 16, wherein, said anchorage device has a longitudinal axis extending through said end wall portion and end aperture, with said projection having a component of a direction of extension generally parallel to said axis.
18. An anchorage assembly including said anchorage device, with said anchorage device being a first anchorage device and the assembly including a second anchorage device, and a rod fixed to each anchorage device and extending between the cavities of the anchorage devices.
19. The anchorage assembly of claim 18, further including an adhesive in each cavity securing the rod to the anchorage devices.







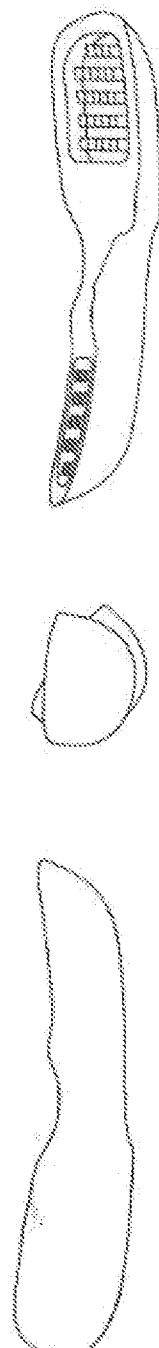
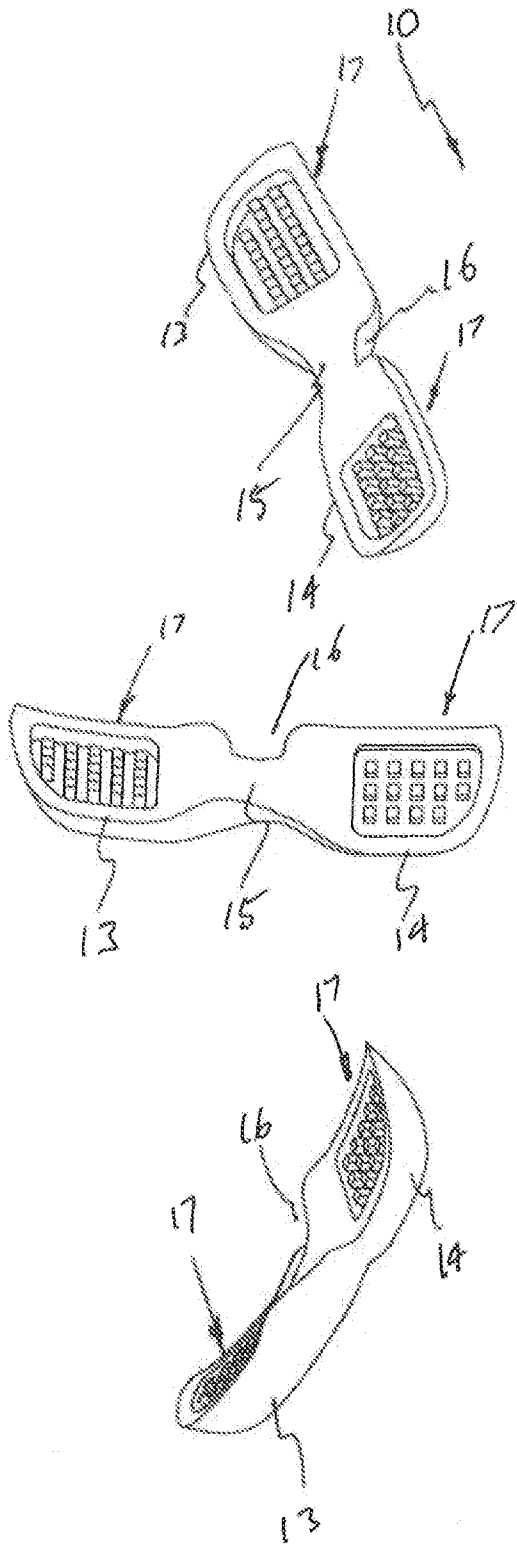
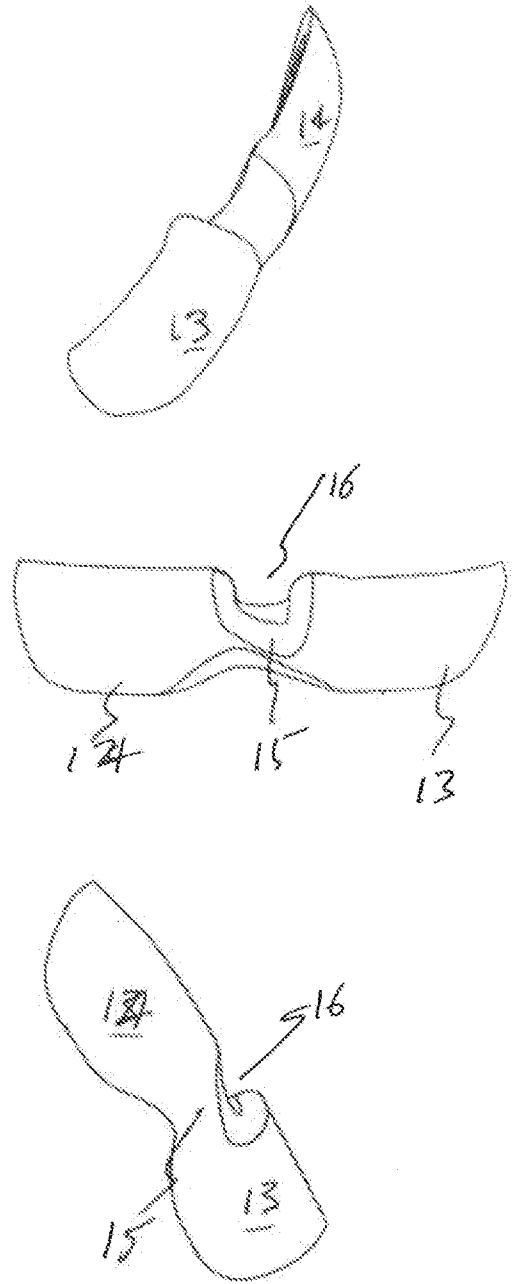
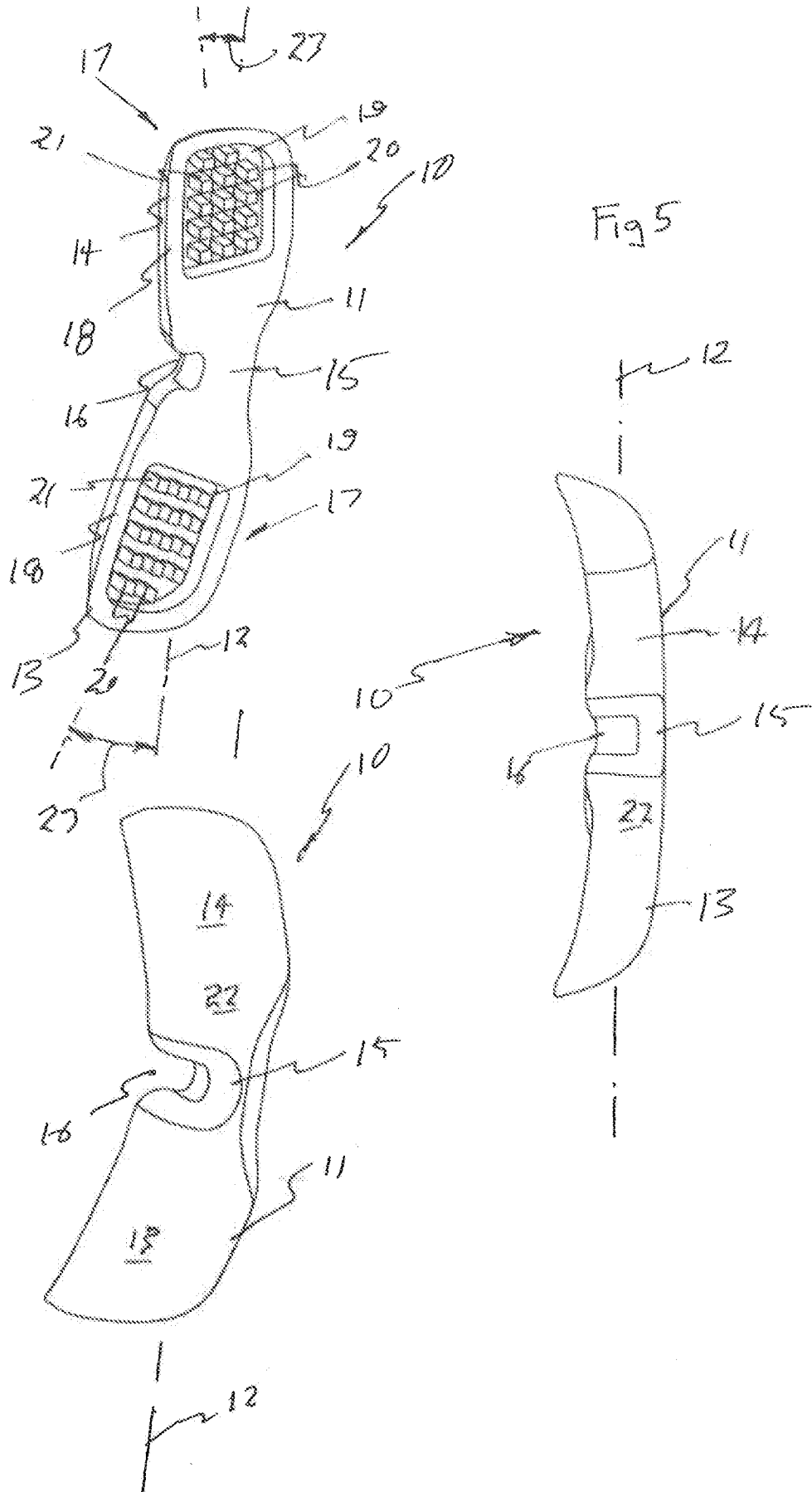
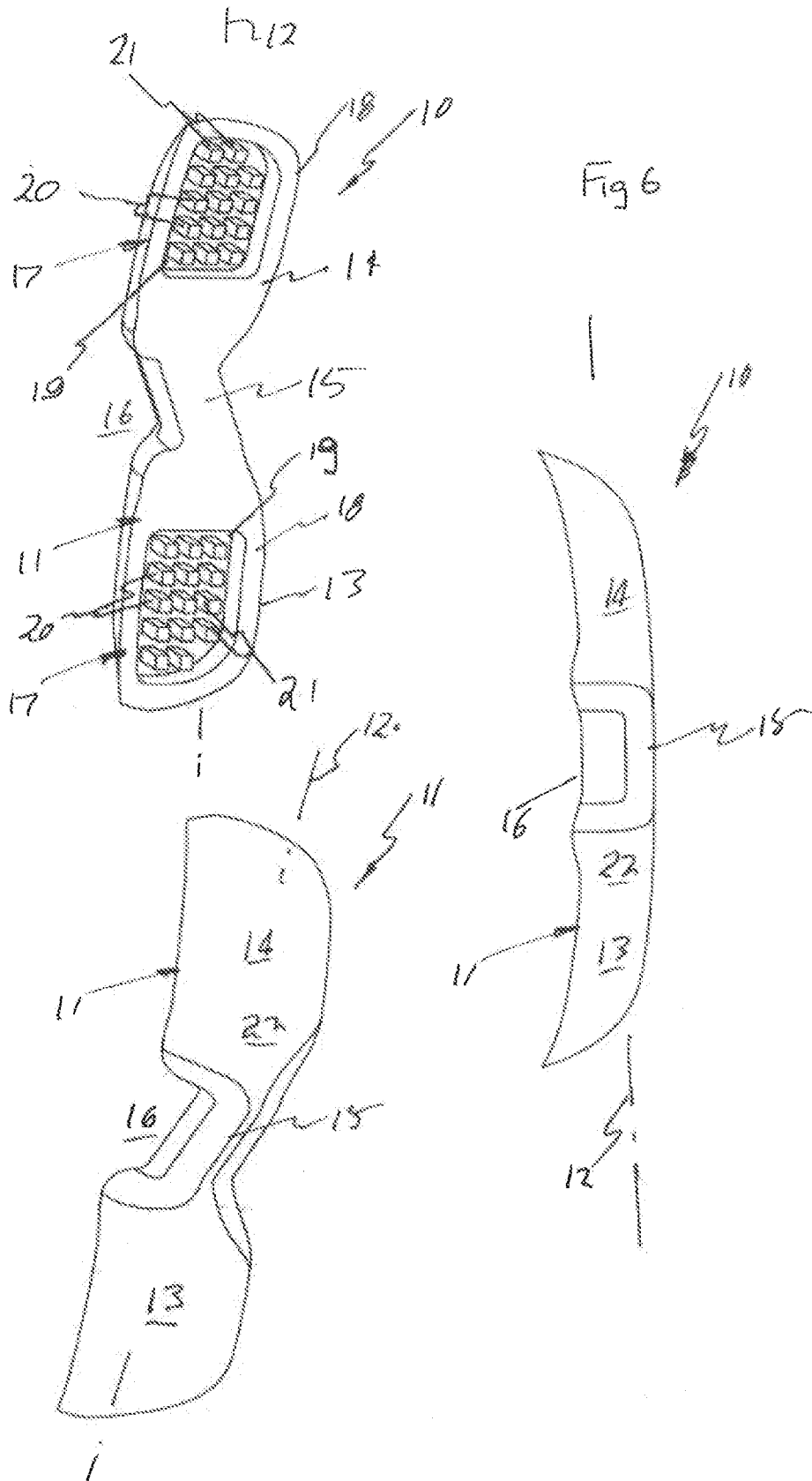
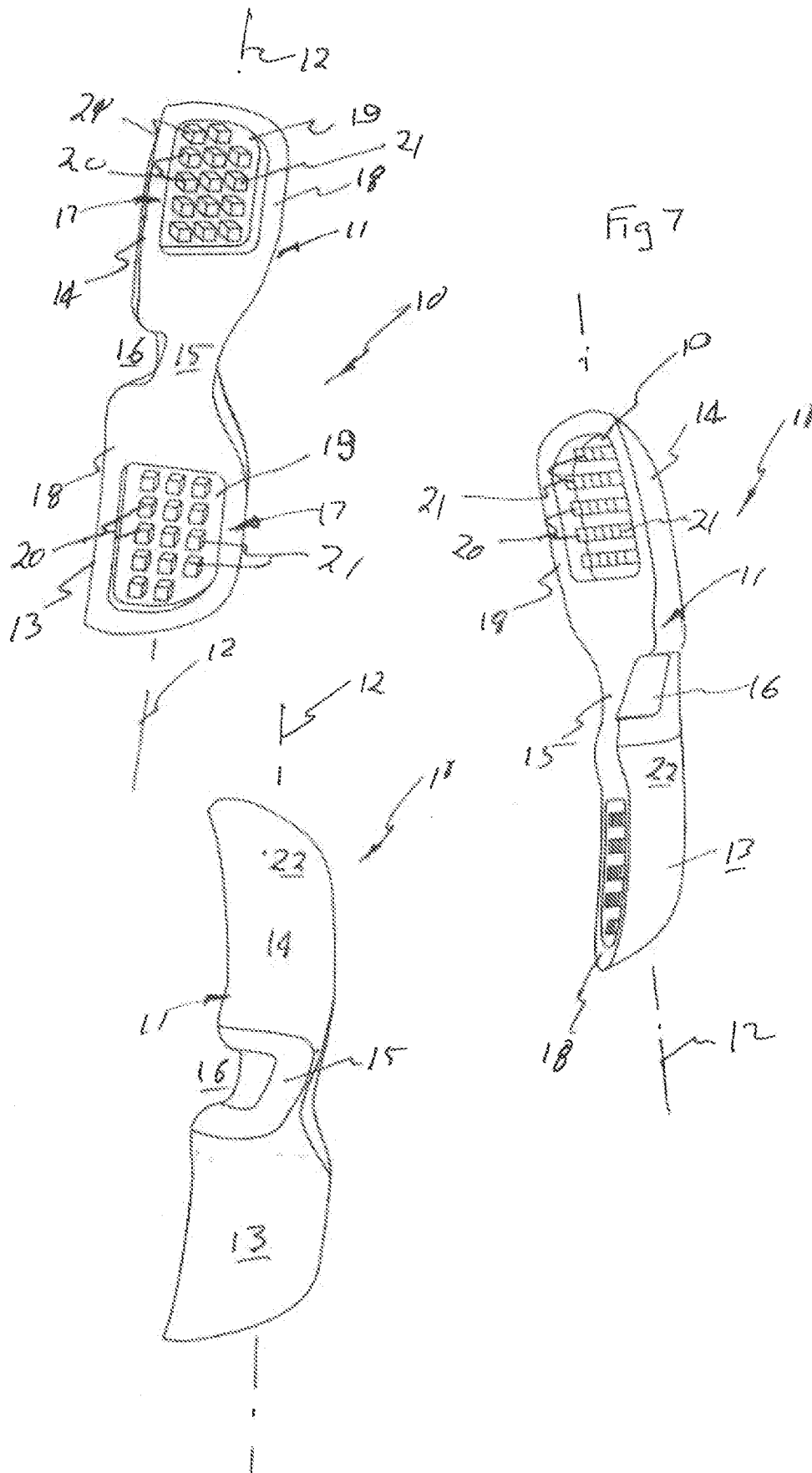


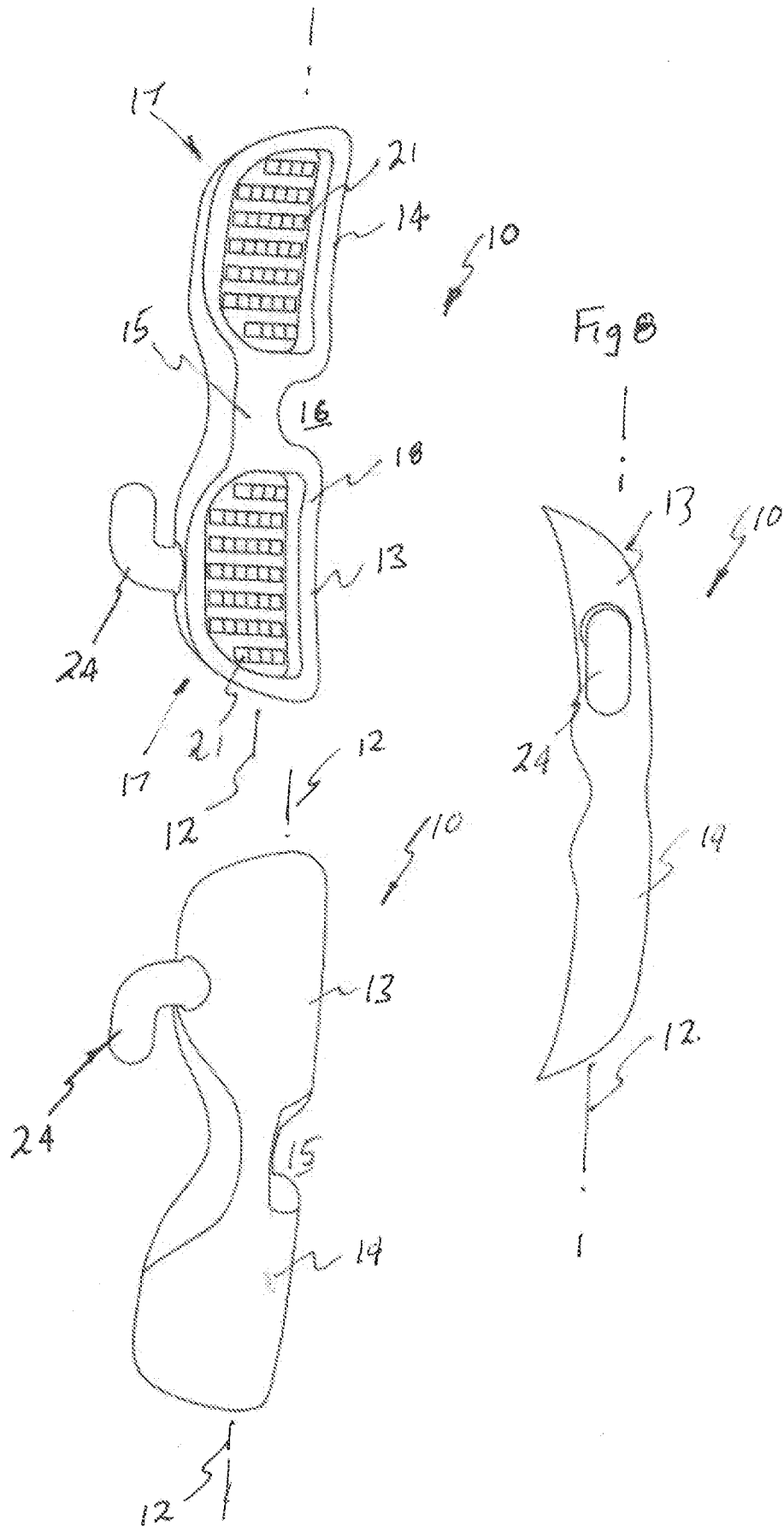
Fig 4

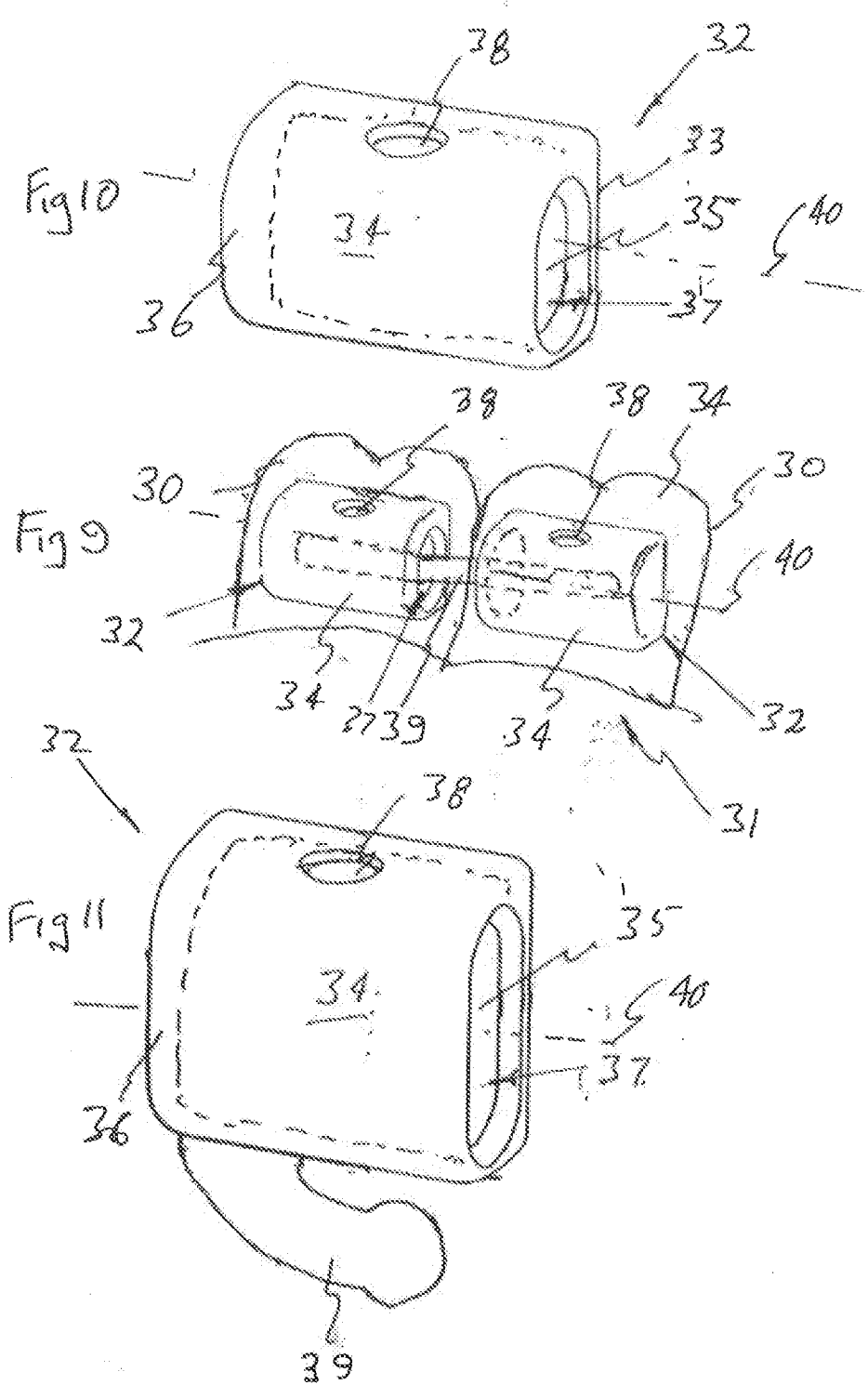












INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2019/050400

A. CLASSIFICATION OF SUBJECT MATTER

A61C 7/16 (2006.01) A61C 7/28 (2006.01)

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)

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)

Databases: PATENW, Espacenet, Google Patents

Keywords: Dental, orthodontics, adjacent, teeth, attachment, two, integral, unitary, adhesive, hollow, cavity, zone, barbell, dumbbell, hourglass, end wall, outer wall, parallel, projection, rod and like terms

IPC/CPC: A61C7/16, A61K6/0023, A61C7/14/LOW, A61C7/28, A61C7/14/LOW, A61C7/20/LOW

Applicant/Inventor names searched in PATENW and internal databases provided by IP Australia.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

 Further documents are listed in the continuation of Box C See patent family annex

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"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	
"E" earlier application or patent but published on or after the international filing date	"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	
"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)	"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	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
3 June 2019Date of mailing of the international search report
03 June 2019

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INTERNATIONAL SEARCH REPORT		International application No. PCT/AU2019/050400
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0188833 A1 (CARRIERE LLUCH) 24 August 2006 fig. 1-2, abstract, [0026], [0040], claim 2	1-12
X	WO 2013/134031 A1 (3M INNOVATIVE PROPERTIES COMPANY) 12 September 2013 fig. 1-4, p.4 l. 28 - p.5 l.23	1-12
X	WO 2009/150634 A2 (CARRILLO GONZALEZ ET AL.) 17 December 2009 fig. 1A-4, [0059]-[0062], [0067]	1-12
X	US 2016/0270885 A1 (KWON ET AL.) 22 September 2016 fig. 1-10, 14, [0049]-[0052]	13-19
X	WO 2010/105069 A1 (ULTRADENT PRODUCTS, INC.) 16 September 2010 fig. 4-5B, p.7 l.12-21	13-14
X	WO 2017/020062 A1 (ERSKINE PRODUCTS PTY LTD) 09 February 2017 fig. 7, 14-17, [0048]-[0056]	13-19

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:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
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.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

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

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

See Supplemental Box for Details

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.

Supplemental Box**Continuation of: Box III**

This International Application does not comply with the requirements of unity of invention. This application does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

(1) Claims 1-12 are directed to an orthodontic anchorage. The feature of *an integrally formed body of a rigid material, two end portions each with an attachment zone and an elongated stem that is narrower than the end portions* is unique to this group of claims.

(2) Claims 13-19 are directed to an anchorage device assembly. The feature of *a base, an outer wall enclosing a cavity, an end aperture providing access to the cavity and an end wall closing off another end of the cavity* is unique to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. Therefore, there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied, *a priori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2019/050400

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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		EP 1681033 A1	19 Jul 2006
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		CA 2994022 A1	09 Feb 2017
		CN 108135673 A	08 Jun 2018
		EP 3328312 A1	06 Jun 2018
		US 2018228576 A1	16 Aug 2018

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(revised January 2019)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2019/050400

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Patent Document/s Cited in Search Report**Patent Family Member/s****Publication Number****Publication Date****Publication Number****Publication Date**