

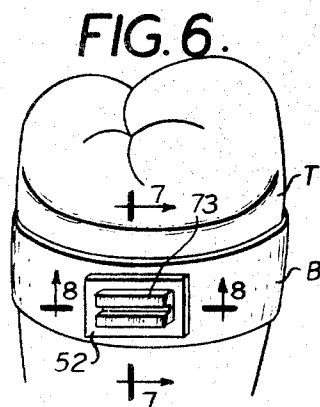
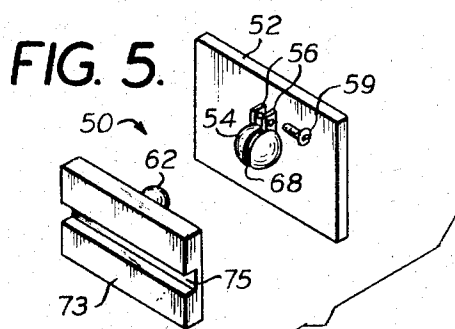
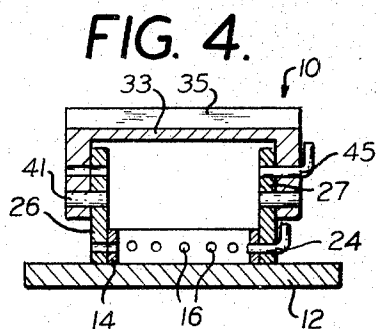
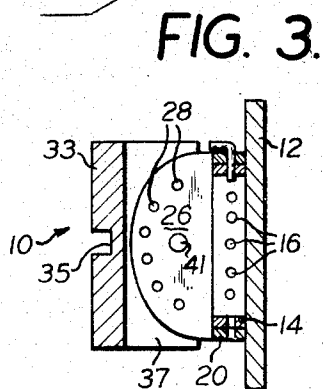
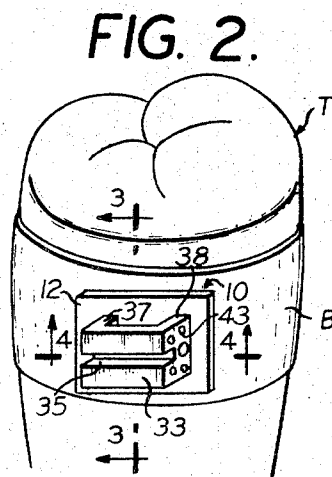
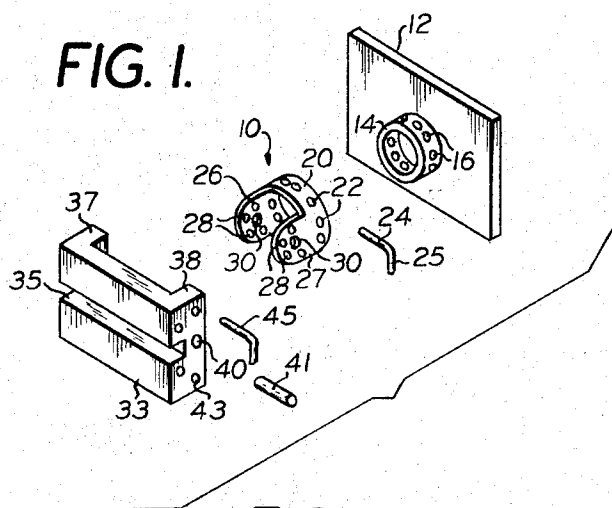


FIG. 7.

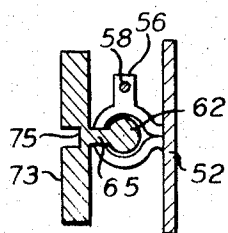
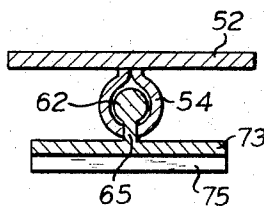


FIG. 8.



INVENTOR
HOWARD COHEN
BY *Ed W. Siddle*
ATTORNEY.

ORTHODONTIC BRACKET**BACKGROUND OF THE INVENTION**

This invention relates to the art of orthodontic appliances, and more particularly to an improved bracket for use in both torqueing and uprighting of malpositioned teeth. Thus a single bracket serves for uprighting to correct mesiodistal displacement of the teeth (i.e., displacement of the teeth between the mid and end points of the dental arch); as well as for torqueing to correct buccal or lingual tooth displacement (i.e., displacement of the tooth out of or into the mouth).

In effecting repositioning of teeth by presently evolved orthodontic techniques, bands are positioned about the teeth of the patient, and the bands are provided with a bracket having a horizontally extending rectangular in cross-section slot for receiving and fixedly engaging a rectangular in cross-section arch wire which extends across one or more teeth to be corrected. The arch wire is anchored at its ends by inserting these ends into sockets secured to the bands at the lateral extremities of the teeth over which the arch wire extends.

Torqueing of a tooth to correct an undesired forward or inward tilt of the tooth is accomplished by twisting the arch wire about its axis, before anchoring its ends. The torque imparted to the wire which tends to return to its non-twisted position is transferred to the tooth via the bracket and band so as to "torque" the tooth. The degree of twisting of the wire is not subject to desired careful adjustment, since the amount of twist which is put into the wire before it is positioned in the socket often changes between the time of twisting and the time of insertion of the wire into the anchoring socket and bracket slot.

In correcting a lateral misorientation of a tooth in which the malpositioned tooth tilts to one side or the other, techniques have been evolved utilizing a bracket along with means for twisting the bracket about a horizontal axis perpendicular to the axis of the arch wire. The conventionally employed twisting means are rubber bands or wires connected to the bracket to "upright" same. The use of these auxiliary members such as rubber bands or wires presents problems, in that the wires or bands tend to stretch and require manipulation in a relatively constricted area, thus preventing the desired precise positioning to produce the necessary uprighting forces.

Attempts have been made in the prior art to minimize these problems of precise adjustment. Thus in Pearlman U.S. Pat. No. 3,423,833, an uprighting bracket is provided which is rotatable about an axis perpendicular to the tooth axis and may be set in a rotated position so that the arch wire will provide desired uprighting force to the tooth. This selectively adjustable rotation of the bracket after positioning of the arch wire though facilitating uprighting minimizes only a part of the problem, and still requires a twisting of the arch wire to produce torqueing to correct buccal or lingual malpositionings.

BRIEF DESCRIPTION OF THE INVENTION

It is with the above considerations in mind that the present improved combination uprighting and torqueing bracket has been evolved, providing for the maintenance of a selectively fixable connection between an

arch wire and a tooth band, with the twisting of the arch wire in both an axial and transverse direction being effected after the arch wire is in position to permit both uprighting and torqueing to be provided by a single bracket without requiring the use of auxiliary anchoring members, or preliminary arch wire twisting.

It is accordingly among the primary objects of this invention to provide an improved orthodontic bracket suitable for use in providing both uprighting and torqueing displacement to a tooth.

A further object of the invention is to provide an orthodontic bracket which may be adjusted in the mouth of a patient to obtain desired accuracy of positioning.

Another object of the invention is to provide a combined torqueing and uprighting orthodontic bracket which may be set merely by adjustment of the bracket to provide both torqueing and uprighting forces to a tooth.

It is also an object of the invention to provide an orthodontic bracket which can be used for torqueing without requiring any pre-twisting of the arch wire, before positioning of the arch wire in the mouth of a patient.

A further object of the invention is to provide an orthodontic bracket which may be used for uprighting without requiring the use of auxiliary rubber bands, wires, or springs to maintain the bracket in desired orientation.

Another object is to provide an orthodontic bracket for connecting an arch wire to a tooth which is simple of installation, requiring minimal manipulation, and subject to rapid and simple adjustment.

These and other objects of the invention which will become hereafter apparent are achieved by forming an orthodontic bracket with an arch wire engaging plate having means for securely gripping and engaging an arch wire. The rear face of the arch wire engaging plate is coupled to the tooth to be oriented by a universal joint which permits selective adjustment of the bracket to provide desired torqueing and/or uprighting forces to be transmitted between the arch wire and the tooth.

A feature of the invention resides in the fact that the universal joint between the arch wire engaging plate and the tooth can be selectively set in any selected orientation while in the mouth of the wearer.

Another feature of the invention resides in the fact that different brackets or auxiliary rubber bands, wires, or springs do not have to be employed to provide both uprighting and torqueing, and both torqueing and uprighting are provided by a relatively simple adjustment of the universal joint.

BRIEF DESCRIPTION OF DRAWINGS

The specific details of the invention, and their mode of functioning will be described in clear, concise, and exact terms in conjunction with the accompanying drawings wherein:

FIG. 1 is an enlarged perspective exploded view of one embodiment of the bracket illustrating the details of one form of universal joint for coupling the arch wire engaging plate to the tooth;

FIG. 2 is an enlarged perspective front elevational view of the bracket shown in FIG. 1 applied to a tooth;

FIG. 3 is a cross-sectional view on a vertical plane through the bracket on line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view through the bracket on line 4—4 of FIG. 2 showing a section transverse to that of FIG. 3;

FIG. 5 is an enlarged perspective view of another embodiment of the bracket illustrating a ball and socket type of universal joint connecting the arch wire engaging plate to the tooth;

FIG. 6 is an enlarged front elevational perspective view of the bracket of FIG. 5 applied to a tooth;

FIG. 7 is a cross-sectional view on a vertical plane through the bracket of FIG. 5 on line 7—7 of FIG. 6; and

FIG. 8 is a cross-sectional view through the bracket of FIG. 5 on line 8—8 of FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENTS OF INVENTION

Referring now more particularly to the drawings, like numerals in the various figures of the drawing will be employed to designate like parts.

In the embodiment of the invention illustratively shown in FIGS. 1—4 the bracket 10 is formed with a base plate 12 adapted for fixed securement with respect to a tooth T (see FIG. 2) the orientation of which is to be corrected. Fixedly secured to the base plate 12 is a perforated base ring 14, having a plurality of spaced peripheral perforations 16.

A gimbal ring 20 is arranged over base ring 14. Gimbal ring 20 is of an internal diameter slightly larger than that of the external diameter of base ring 14 so as to provide at least a push fit between gimbal ring 20 and base ring 14 when gimbal ring 20 is nested over base ring 14, and preferably a slip fit. The gimbal ring 20 is provided with one or more perforations 22 about its periphery and a ring lock pin 24 is provided of a dimension to extend through base ring aperture 16 into gimbal ring aperture 22 to lock the rings 14 and 20 against relative rotation with respect to each other. As illustrated, it is preferred that lock pin 24 have an offset end 25 to facilitate manipulation. The lock pin should preferably have a diameter such as to provide a push fit in the ring apertures. Pivot ears 26 and 27 are provided on diametrically opposed ends of gimbal ring 20 as best seen in FIGS. 1 and 4, having a plurality of spaced ear apertures 28 arranged in an arc on the ear and surrounding a pivot pin opening 30 on each ear.

An arch wire engaging plate 33 is formed with a slot 35 to receive and engage an arch wire. The slot 35 is illustratively shown as rectangular in cross-section to engage the conventional rectangular in cross-section arch wire. It will however be understood by those skilled in the art that a variety of other slot configurations and techniques may be employed for securing the plate 33 to an arch wire within the scope of the invention. Flanges 37 and 38 are formed on the arch wire engaging plate 33 extending from the plate on the side opposite the arch wire receiving slot and spaced apart a distance to straddle the gimbal ring ears 26 and 27. The flanges 37 and 38 are provided with a pivot pin opening 40 aligned with pivot pin opening 30 in ears 26 and 27, so that the plate 33 may be pivoted on gimbal ears 26 and 27 by means of pivot pin 41. A locking pin aperture 43 is provided in each of flanges 37 and 38 spaced from the pivot pin opening 40 a distance equal to the distance of apertures 28 from pivot pin opening 30 in the ears 26 and 27, so that the plate lock pin 45 may be

inserted through the flange locking pin aperture 43 into ear apertures 28 to fix the angle of inclination of the plate 33 with respect to gimbal ring 20. Though a single locking pin aperture 43 may be employed in flanges 37 and 38, it is preferred to provide a plurality of such apertures arranged in an arc of a radius like that of the arc of apertures 28 in ears 26 and 27 to facilitate adjustment of the plate angle.

In the embodiment of the invention illustrated in FIGS. 5—8, a ball and socket universal joint is substituted for the gimbal ring joint of the FIGS. 1—4 embodiment.

The bracket 50 is formed with a base plate 52 to which is secured a split hollow ball shaped socket 54. Socket 54 is formed of resilient sheet material, and depending on the fabrication techniques employed may be stamped from a stainless steel or alloy of the type used for orthodontic appliances and welded or otherwise affixed to the base plate 52, or it may be upset from the base plate itself by conventionally employed sheet forming techniques. The socket 54 is formed in two halves with ears 56 extending adjacent each other from the socket halves. The ears 56 are formed with an aperture 58, and at least one of the apertures 58 is threaded to engage machine screw 59 after it has passed through the aperture 58 in the other ear to thus bring the socket halves toward each other.

The resilient nature of socket 54 permits the socket halves to be spread to receive ball 62 which is dimensioned to be slightly larger than the internal diameter of the socket so that the ball though fitting in the socket will be securely engaged by the socket walls when screw 59 is tightened. A stud 65 extends from the ball 62 through the slot 68 between the socket halves. The stud is of a dimension such that there is clearance between the edges of the socket and the stud sufficient to permit the ball to rotate laterally as viewed in FIG. 5, as well as vertically in the slot providing desired universal movement.

Arch wire engaging plate 73 is rigidly coupled to the stud 65. Plate 73 like plate 33 is formed with an arch wire engaging slot 75.

OPERATION

In use both embodiments of the orthodontic bracket are applied by conventional orthodontic techniques between the conventionally employed arch wire and the tooth. Thus, the base plate 12 of the FIGS. 1—4 embodiment, or the base plate 52 of the FIGS. 5—8 embodiment are secured either directly to the tooth, or preferably utilizing more conventional orthodontic techniques to the conventionally employed tooth band B (see FIGS. 2 and 6). Securement of the base plate places the arch wire engaging plates in position to receive the arch wire.

In the FIGS. 1—4 embodiment after the bracket and arch wire are positioned in the mouth of the patient, adjustment of the bracket to provide desired lines of force transmission between the arch wire and the tooth is accomplished by adjusting the angle of the arch wire engaging plate with respect to the base plate. Thus uprighting forces to correct mesiodistal displacement of the tooth are provided by removing gimbal ring adjusting pin 24 from engagement in the base ring apertures 16, and turning the gimbal ring 22 about the axis

of generation of the ring to tilt the plate 33, as viewed in FIG. 2, to the right or left. After a desired lateral tilt is attained, the adjusting pin 24 is moved to seat in a base ring aperture 16 locking the gimbal 20 in a position such that the forces transmitted from the arch wire to the tooth will provide desired uprighting.

Desired forces to produce torqueing to correct buccal-lingual displacement are obtained by tilting the arch wire engaging plate 33 about pivot pins 41 as viewed in FIGS. 1 and 3. In order to effect pivoting, lock pin 45 is withdrawn from ear aperture 28 permitting plate 33 to be rotated about pivot pin 41 to a desired orientation, at which time the lock pin 45 is moved into the ear aperture 28 to lock the plate in its selected position with respect to the tooth T to insure the transmission of desired torqueing forces from the arch wire to the tooth.

In using the bracket of the FIGS. 5-8 embodiment of the invention, adjustment of the position of the arch wire engaging plate 73 to a desired angle with respect to the tooth to provide the transmission of desired uprighting or torqueing forces between the arch wire and the tooth is accomplished by loosening machine screw 59 to permit separation of the halves of socket 54. Upon separation of the halves of socket 54, ball 62 may be pivoted about the longitudinal axis of stud 65 to tilt plate 73, as viewed in FIGS. 5 and 6 to provide a desired uprighting angle. Tilting of the plate 73 to slide stud 65 in slot 68 is also possible to provide a desired torqueing angle. After the plate 73 is set, the machine screw is tightened in the threaded aperture in socket ear 56 to draw the halves of socket 73 together to engage the ball 62 and lock the arch wire engaging plate in desired position.

It will of course be understood by those skilled in the art that the above described orthodontic brackets may be fabricated of conventionally employed materials such as stainless steel, nichrome, acrylics, other plastics or metal alloys or the like non-toxic substances used in orthodontic appliances.

The above disclosure has been given by way of illustration and elucidation and not by way of limitation and it is desired to protect all embodiments of the inventive concept within the scope of the appended claims.

What is claimed is:

1. An orthodontic bracket comprising:
 - a base member fixedly securable with respect to a tooth, the position of which is to be corrected;
 - an arch wire engaging plate coupled to said base member;
 - a pivot coupling between said arch wire engaging plate and said base member permitting selective pivoting of said plate about an axis parallel to the arch wire; and
 - means for locking the plate against pivoting after it is set in a desired angle whereby desired lines of torqueing force may be established between the arch wire and tooth to correct buccal or lingual displacement of the tooth.
2. An orthodontic bracket as in claim 1 in which said pivot coupling comprises:
 - means supporting said arch wire engaging plate for rotation with respect to said base member about an axis perpendicular to the arch wire and extend-

ing into the dental arch in addition to permitting rotation about an axis parallel to the arch wire, whereby both torqueing and uprighting forces may be provided.

3. An orthodontic bracket as in claim 1 in which said pivot coupling comprises a pivot support member extending perpendicularly between the plane of said arch wire engaging plate and said base member fixed to the tooth, said support member having a point providing an axis about which said arch wire engaging support may be pivoted.

4. An orthodontic bracket as in claim 3 in which said pivot support member comprises a pair of spaced ears upstanding from said base member; a pivot pin connection between said ears and said arch wire engaging plate along an axis parallel to the arch wire; and said means for locking the plate comprise a lock pin extending into a locking aperture in said ears eccentric of said pivot pin.

5. An orthodontic bracket as in claim 4 in which said ears are positioned on a gimbal ring rotatably mounted on said base member about an axis perpendicular to said base member.

6. An orthodontic bracket as in claim 5 in which said gimbal ring is provided with means for selectively fixing same in a selected position after it has been rotated with respect to said base member.

7. An orthodontic bracket as in claim 6 in which said gimbal ring is mounted on a base ring, said gimbal ring and said locking ring each having a locking aperture subject to alignment as said gimbal ring is rotated; and a locking pin insertable into said apertures to fix said gimbal ring against rotation with respect to said base ring.

8. An orthodontic bracket as in claim 1 in which said pivot coupling comprises: a socket; a member rotatably secured in said socket and pivotable about two axes at 90° with respect to each other; and said means for locking the plate against pivoting comprise means effecting fixing engagement between said socket and member rotatably received therein to lock said member in a desired orientation in said socket.

9. An orthodontic bracket as in claim 1 in which said pivot coupling comprises:

- a hollow split spherical socket member secured to said base member; and
 - a ball secured to said arch wire engaging plate; and seated in said socket; and said locking means comprise a selectively adjustable screw extending between said socket member parts to bring same together against said ball.

10. A method of applying torqueing forces to a buccally or lingually displaced tooth comprising the steps of:

- securing an arch wire in position in the mouth of a patient to extend over the tooth, the orientation of which is to be corrected;
 - securing a base member to the tooth;
 - securing a bracket to the arch wire;
 - pivoting the racket to the base member about an axis parallel to the arch wire;
 - adjusting the bracket to a desired torqueing angle; and
 - fixing the bracket in the adjusted position.

* * * * *