

[54] **PREFORMED UNIVERSAL ORTHODONTIC ARCH**

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[51] **Int. Cl. A61c 7/00**

[58] **Field of Search 32/14 A**

[56] **References Cited**

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Primary Examiner—Russell R. Kinsey

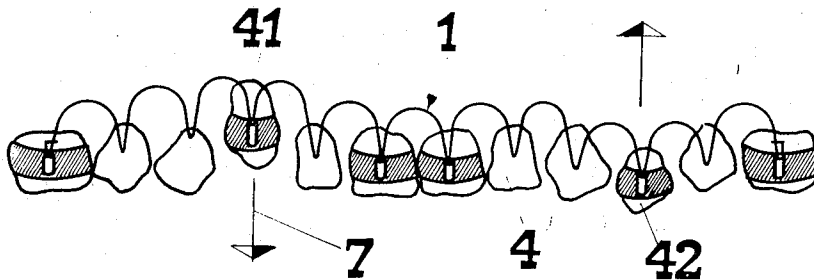
Assistant Examiner—J. O. Lever

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[57] **ABSTRACT**

A preformed orthodontic arch made of a row of minor arches whose apices extend in the same general direction and that are joined to each other by arch ends that are common to adjacent minor arches in the row. Each minor arch end is mounted in a tooth through the intermediary of a mounting member.

24 Claims, 21 Drawing Figures



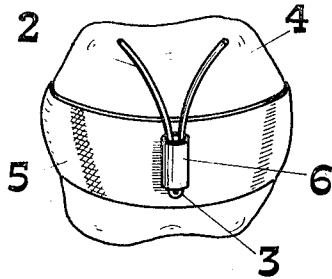
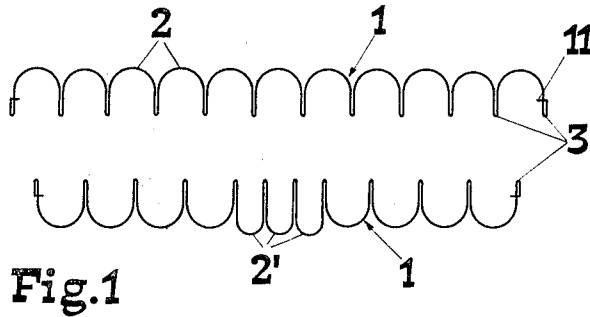


Fig. 2

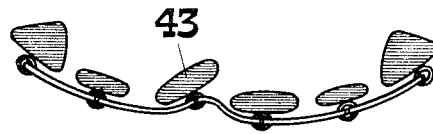


Fig. 4

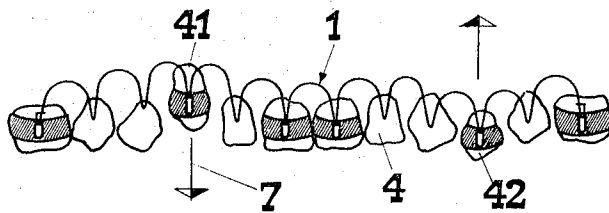


Fig. 3

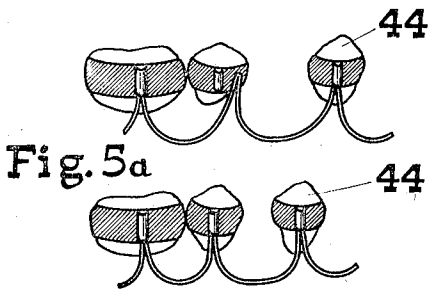


Fig. 5a

Fig. 5b

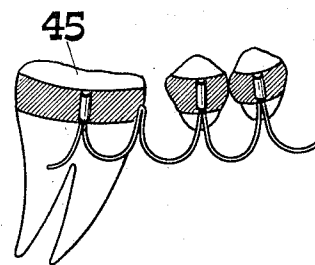


Fig. 6

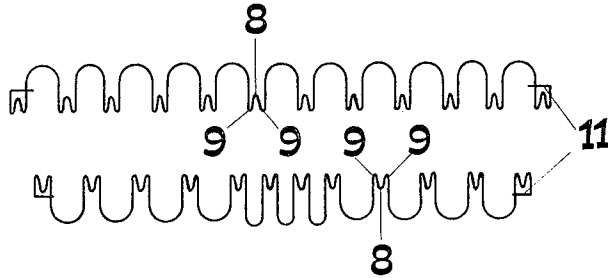


Fig. 8

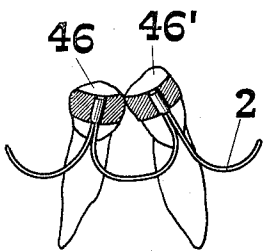


Fig. 7

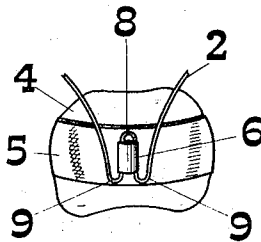


Fig. 10

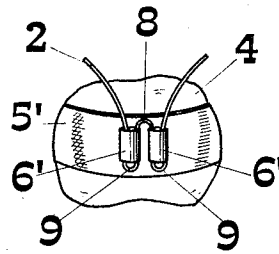


Fig. 9

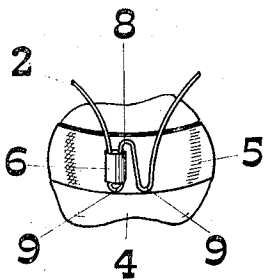


Fig. 11

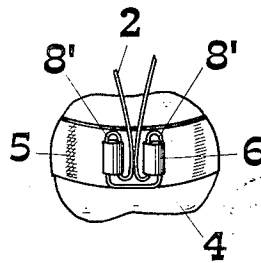


Fig. 13

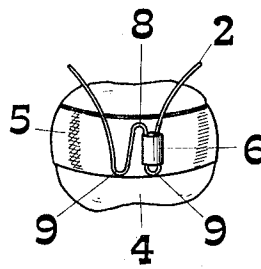


Fig. 12

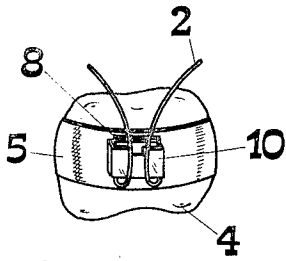


Fig. 14

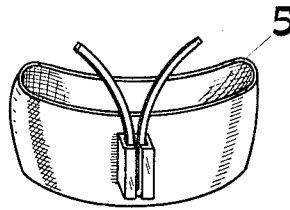


Fig. 15

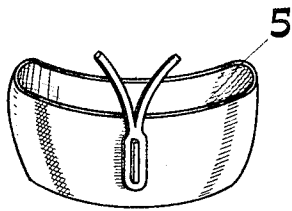


Fig. 16

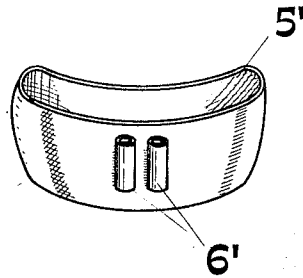


Fig. 17

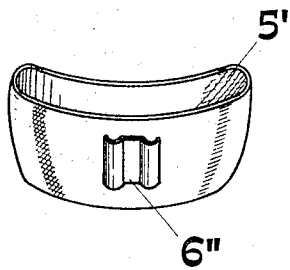


Fig. 18

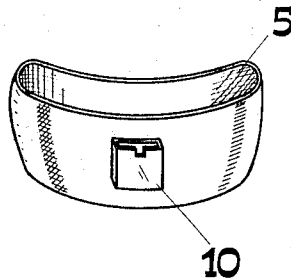


Fig. 19



Fig. 20

PREFORMED UNIVERSAL ORTHODONTIC ARCH BACKGROUND OF THE INVENTION

This invention is concerned with a universal orthodontic arch that improves on the principles of the known orthodontic techniques using fixed multiband orthodontic appliances.

Orthodontic arches are known that are made of appropriately formed generally horizontally extending orthodontic wire attached to the teeth to correct the malposition of the teeth. An attempt to form this wire with vertical ends that are inserted into tubular members mounted to the teeth has been abandoned because the rigidity of the wire made it difficult to insert the ends into the tubular members.

Orthodontic arches are presently made of wires with various types of vertical bends, loops, and eyelets that extend away from the generally horizontal arch wire and are provided with springs and rubber bands in various combinations that are usually mounted to the teeth by horizontal brackets.

A great disadvantage of these orthodontic arches lies in the fact that they often require an individual design and construction patterned to the patient's teeth which makes their design and manufacture a difficult procedure that can be practiced only by skilled operators after long training.

The necessity of the individual construction of the orthodontic arch based on the actual malposition of the patient's teeth involves a great waste of time, a low performance accuracy, and an individual adjustment of the arch to the teeth. Moreover, this involves the necessity of a model of the patient's dental arch to construct the orthodontic arch and creates the dangers of over-corrections and poor oral hygiene due to the presence of the arch in the spaces between the teeth.

SUMMARY OF THE INVENTION

An object of this invention is to avoid the aforementioned disadvantages by the use of a preformed universal orthodontic arch that is simple and versatile and that can be utilized without the need of specialized training by the operator. The orthodontic arches of this invention are interchangeable and can, with minimal adjustments, correct with great consistency and efficiency most dental malpositions by simultaneous pressures in three planes. The orthodontic arches of this invention also provide an effective centrifugal (expansive) or centripetal (contractive) effect on the patient's dental arch.

A further object of this invention is to provide an orthodontic arch that, while retaining its universality, incorporates certain features that are dependent on the type of malformation of the patient's dental arch or on the type of teeth malposition. These features include a variable quantity of vertical ends in the orthodontic arch, a variable distance between the vertical ends, a variation in the degree of elasticity of the orthodontic arch, the ability to provide for occlusal or apical insertion, and other characteristics in other areas.

The orthodontic arch according to this invention is formed of a row of minor arches whose extremities are joined to each other by arch ends. Mounting members secured to the minor arch ends are vertically mounted to the teeth.

Advantageously, the ends of the minor arches are bent to form loops whose apices extend in the same

general direction as the minor arch apices and thus in the general direction of the associated teeth apices. The mounting members are arch ends preferably in the form of attachments in which the minor arch ends are inserted and the arch ends at the outermost extremities of the row are bent so as to extend about the attachment ends that face the minor arch apices so as to prevent the escape of the minor arch ends from the attachments.

The mounting members, in accordance with this invention, may be in the form of a band that is mounted to its associated tooth and that receives its associated arch end.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of two orthodontic arches for the upper and lower teeth made of orthodontic wire and having twelve minor arch ends;

FIG. 2 is a perspective view of a portion of the orthodontic wire of FIG. 1 mounted to an upper tooth by means of a band;

FIG. 3 is a schematic representation of an upper dental arch to which the upper orthodontic arch of FIG. 1 has been applied so as to apply a vertical correction to the teeth;

FIG. 4 is a schematic representation in plan showing the mounting of the orthodontic arch of this invention to a dental arch so as to apply a torsional correction to the teeth about vertical axes;

FIG. 5a is a partial view of the orthodontic arches of FIG. 4 partially applied to the lower dental arch;

FIG. 5b is a partial view of the orthodontic arches of FIG. 4 fully applied to a lower dental arch so as to close the space between the teeth of the dental arch after the extraction of a tooth in the dental arch;

FIG. 6 is a schematic partial view of the orthodontic arch of FIG. 5 used to correct a mesioinclination (tangential forward inclination) and a mesialination (tangential forward translation) of a lower tooth;

FIG. 7 is a schematic representation of the orthodontic arch of FIGS. 5 and 6 applied to a dental arch to correct the inclination of its teeth;

FIG. 8 is a view similar to FIG. 1 showing a preferred form of the orthodontic arches;

FIG. 9 shows a portion of the arch of FIG. 8 applied apically by means of a double tube to an upper tooth; FIG. 10 shows the arch of FIG. 8 applied occlusally to an upper tooth;

FIGS. 11 and 12 show two additional modes of application of the arch of FIG. 8;

FIGS. 13 and 14 show further variations of orthodontic arches applied occlusally to upper teeth;

FIG. 15 shows in perspective an orthodontic arch with a rail attachment for attaching the orthodontic arch wire thereto;

FIG. 16 shows in perspective a clutch arrangement for attaching an orthodontic arch wire to a band;

FIGS. 17, 18, and 19 show in perspective other orthodontic bands furnished with attachments for the orthodontic arches shown in FIGS. 8-14; and

FIG. 20 shows in perspective an orthodontic arch for the upper dental arch made by shearing a metal plate.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The universal preformed orthodontic arch 1 for the upper teeth is constructed with a spring-type (prefera-

bly heat treated) wire having a diameter of from 0.3 mm to 0.6 mm (usually 0.4 mm). This wire is bent to form a row of similarly facing arches 2 (normally 12 in number and less frequently 14 in number) that are joined by common ends 3 that extend away from the minor arch apices, the ends 3 being secured to teeth 4. The minor arch ends 3 are spaced in accordance with the spacing of the teeth in an ideal dental arch, thus enabling the orthodontic arch to be made in a shape that is independent of the shape of the dental arch of the patient in which the orthodontic arch is to be utilized. In practice, for construction reasons, it is desirable to make the orthodontic arches (see FIGS. 1 and 8) with the minor arches 2 having uniform and average dimensions. These dimensions, which are easily increasable by stretching and easily reducible by pliers, are normally about 9 mm in height and about 8 mm in width, thus providing an approximate correspondence between the spacing of the ends 3 and the ideal arrangement of the teeth in a dental arch. Therefore, one can always obtain satisfactory results. Moreover, as set forth above, modifications may easily be made in the orthodontic arch in accordance with the individual size of the teeth and the type of malformation of the dental arches.

The orthodontic arches in FIGS. 1 and 8 for the lower dental arch preferably has minor arches 2' that correspond to the incisor teeth, narrower than its other minor arches.

For mounting the arch 1 to the teeth 4, bands 5 are mounted on the anterior faces of the teeth. Fixed to each band 5, in any desired conventional manner, are attachment members in the form of tubes 6 having flattened sections. The arch 1 is secured to the teeth by inserting a minor arch end 3 in each of the tubes 6.

Both the upper and lower orthodontic arches have at their outermost extremities bends 11 that extend forwardly across the ends of their associated tubes 6 that face the minor arch apices to prevent the escape of the orthodontic arches from the tubes 6.

By the use of special adhesives, the minor arch ends 3 or the tubes 6 may be cemented directly to the anterior faces of the teeth. Moreover, other devices may be used for mounting the minor arch ends to the teeth instead of the bands 5 and the tubes 6, as for example:

- a. the rail-like device of FIG. 15;
- b. the clutch-like device of FIG. 16 that includes a prong mounted to the band that is received in a cleft in the minor arch end;
- c. the fully closed double tube device of FIG. 17;
- d. the laterally open double tube device of FIG. 18; and
- e. the square section device of FIG. 19.

In the functioning of the orthodontic arch, because of the malposition of one or more of the patient's teeth, there will obviously be a misalignment between some of the bands 5 and their tubes 6 and the corresponding ends of the teeth that are to be inserted into the bands 5. The forced insertion (allowed by the great elasticity of this orthodontic arch) of this tooth end into its associated band will create a deformation of the orthodontic arch that will tend elastically to return to the initial position; i.e., to that position corresponding to an ideal arrangement of teeth in the dental arch.

If for example, a tooth 41 of the upper dental arch is higher in relation to the occlusal plane of the other teeth (FIG. 3), the elastic reaction of the orthodontic

arch (arrow 7) will bring it down; and conversely, if a tooth 42 is situated lower in relation to the same occlusal plane, the elastic reaction of the orthodontic arch will raise it. If a tooth 43 is swung on its vertical axis in relation to its regular position (FIG. 4), the elastic reaction of the orthodontic arch to the torsional stress to which the tooth end is subjected for its forced insertion in the tube will bring the malpositioned tooth to its regular position.

In the case of a tooth 44 that is horizontally translated in relation to its regular or desired position (for example, when the space of a missing tooth has to be closed), the distortion to which the arch is forced will bring the teeth in a uniform distribution. In these cases, there will be a convenient two-stage correction. In a first stage (FIG. 5a) not all the minor arch ends are inserted into the tubes mounted to the teeth concerned with the correction. In a second stage (FIG. 5b) after a partial correction is obtained, the remaining free minor arch ends are inserted into the corresponding tubes. Obviously, the number of minor arch ends shall correspond to the number of teeth of the dental arch, taking into account the completion of the treatment. In the case of a tooth 45 translated and inclined forwardly and closing a space of another tooth (FIG. 6), the orthodontic arch compelled into a smaller space in relation to that occupied in its rest position tends to create the space missing in the dental arch. In the case of inclined teeth 46 and 46' (FIG. 7), the forced insertion of the teeth ends out of their normal axis brings about a re-dressment of the teeth.

On account of its great flexibility when made with wires of normal size (light wires), the orthodontic arch may be used in its flat form; i.e., without being previously curved on the horizontal plane. It thus results in an often desired light expansion of the dental arch. When this has been avoided, the orthodontic arch may be bent in order to correspond to the shape of the dental arch.

The main advantage of the orthodontic arch of this invention lies in the fact that it is universal and that it does not have to be custom built in accordance with the patient's dental arch as with the traditionally used orthodontic arches.

Further advantages of the orthodontic arch of this invention are:

- simplicity of use even simplifying the orthodontic treatments;
- versatility enabling it to be adapted to the correction of different orthodontic problems with only a simple adoption to the patient's dental arch size as contrasted with the prior practice of manufacturing a particular orthodontic arch or molding for the particular dental malposition or malformation;
- the enabling of the correction of one or more teeth at the same time regardless of their number and their relative position;
- the obtaining, when desired, of a complete centrifugal expansion or centripetal contraction of the dental arch;
- the application to a dental arch without previously making impressions or models of the dental arch;
- the ability to immediately substitute a new orthodontic arch in case an earlier-used orthodontic arch is ruptured, damaged or distorted as contrasted with the traditional orthodontic arches which must be

custom made and therefore cannot provide for an identical substitute orthodontic arch;

better oral hygiene due to the orthodontic arch not being located in the interdental spaces, but running along side the gums;

ease in inserting and removing the orthodontic arch by inserting the minor arch ends in the tubes, as contrasted with the prior orthodontic arches that are complicated by metal wiring and other locking devices; and

the ease of control of the action of the entire orthodontic arch or one or more of its portions by simply pulling out the minor arch ends from the teeth.

FIGS. 8-12 show a preferred form of the invention wherein the minor arch ends are formed by a central loop 8 whose apex faces toward the minor arch apices and outside loops 9 on each side of the central loop whose apices face away from the minor arch apices and are symmetrically disposed with respect to the central loop. The loops 8 and 9 are all of the same width so that anyone of them may be inserted into a tube having a size corresponding to the width of the loops.

For mounting the minor arch ends to the teeth 4 of the patient, the bands 5 may be provided with a vertical tube 6 having a flattened section corresponding in size to the minor arch ends and about 3 mm in height (FIG. 2). Alternatively, the bands 5' may be provided with two tubes 6' (FIG. 17) or with two laterally open mounting elements 6'' (FIG. 18).

Particular advantages arise with these variants depending on the number of the loops 8 and 9 that are mounted to the teeth 4 and depending on the way that the loops are mounted to the teeth. For example, if a band 5 is used that has only one tube 6, the central loop 8 (FIG. 10) may be occlusally inserted into the tube (upwardly in the case of an upper tooth and downwardly in the case of a lower tooth). This provides for an easier application, particularly with the back teeth, and an increased elasticity of the orthodontic arch wire due to the looped portions 9 of the minor arch ends being free to flex. One can insert one of the outside loops 9 in the tube 6 instead of the central loop 8 (FIGS. 11 and 12), thus varying the corrective force of the orthodontic arch wire at that point.

If a band 5' with two vertical tubes 6' is used, both outer loops 9 may be inserted so that their apices extend away from the minor arch apices (downwardly for the upper teeth and upwardly for the lower teeth), thus increasing the strength of the attachment of the orthodontic arch wire to the band and the efficiency of the arch wire in the case of distorted or inclined teeth (FIG. 9).

According to another form of the invention (FIG. 13), the minor arch ends 2 are bent in an anchorlike manner with the lateral ends looped so that the loop apices face toward the minor arch apices.

According to another form of the invention (FIG. 14), each minor arch end is bent so as to extend towards the band 5 and thus towards the anterior surface of the tooth 4 and then is turned to lie on an axis that is parallel to the plane of the minor arches and that extends towards the minor arch apices and the apex of its associated tooth.

The orthodontic arch of this invention may be made by using, instead of the usual wire of round cross-section, wires of other cross-sections such as square or rectangular cross-sections.

The orthodontic arch may also be made by molding a metal wire, by shearing a plate, or by a pressing operation. In these cases, there is no difficulty in reproducing the ideal spacing of the teeth in the patient's dental arches instead of making the minor arches of the same average width.

The orthodontic arch may also be made of a metal or synthetic plastic material.

I claim:

1. A preformed universal orthodontic arch made of a spring-type material comprising: a row of minor arches having apices that extend in the same general direction, each minor arch curving from the opposite sides of its apex in a direction away from said first mentioned direction to spaced minor arch ends, the adjacent minor arch ends of adjacent minor arches being common to each other and joining the adjacent minor arch ends to each other, said joined minor arch ends being spaced in accordance with the desired spacing of the teeth in the dental arch; and a mounting member secured to each of the joined minor arch ends that is adapted to be mounted on a tooth.
2. The orthodontic arch according to claim 1 wherein the minor arches are all of the same size.
3. The orthodontic arch according to claim 1 wherein each minor arch has a height of about 9 mm and a width of about 7 mm to 9 mm.
4. The orthodontic arch according to claim 1 wherein each of said minor arch ends has at least one looped portion whose apex faces in the general direction of the minor arch apices and thus in the general direction of its associated tooth apex.
5. The orthodontic arch according to claim 1 wherein each mounting member comprises an attachment in which a minor arch end is inserted; and wherein the arch ends at the outermost extremities of the row are each formed into a bend that extends about the attachment end that faces the minor arch apices.
6. The orthodontic arch according to claim 4 wherein each of said looped portions is located between two other looped portions in its minor arch end that faces away from the minor arch apices.
7. The orthodontic arch according to claim 4 wherein each of said minor arch ends is anchor-shaped to form two of said looped portions at its lateral extremities.
8. The orthodontic arch according to claim 4 wherein each of said looped portions is bent towards its associated mounting member, and thus towards its associated tooth anterior, and then is turned to lie on an axis that is parallel to the plane of the minor arches and that extends towards the minor arch apices and the apex of its associated tooth.
9. The orthodontic arch according to claim 6 said first mentioned looped portion and said other looped portions are of equal widths.
10. The orthodontic arch according to claim 7 wherein said two looped portions are of equal widths.
11. The orthodontic arch of claim 1 wherein the orthodontic arch comprises a molded wirelike element.
12. The orthodontic arch of claim 1 wherein the orthodontic arch is comprised of orthodontic wire having a diameter between 0.2 mm and 0.7 mm.
13. The orthodontic arch of claim 1 wherein the orthodontic arch is comprised of metal wire of square cross-section.

14. The orthodontic arch of claim 1 wherein the orthodontic arch is comprised of metal wire of rectangular cross-section.

15. The orthodontic arch of claim 1 wherein the orthodontic arch is made from a sheared plate.

16. The orthodontic arch of claim 1 wherein the orthodontic arch is made from pressed material.

17. The orthodontic arch of claim 1 wherein the orthodontic arch is made from metal.

18. The orthodontic arch of claim 1 wherein the orthodontic arch is made from a synthetic plastic material.

19. The orthodontic arch according to claim 1 wherein each mounting member comprises: at least one tubular member, adapted to lie on an axis generally parallel to the axis of its associated tooth, in which its associated minor arch end is engaged.

20. The orthodontic arch according to claim 19 further comprising: means enabling each tubular member to be cemented to the anterior surface of its associated

tooth.

21. The orthodontic arch according to claim 19 wherein each tubular member is secured to a band that is adapted to be mounted on its associated tooth.

22. The orthodontic arch according to claim 19 wherein each mounting member comprises a pair of said tubular members.

23. The orthodontic arch according to claim 19 wherein at least a part of said tubular member is flattened to thereby provide torsion-resistant frictional grip with its associated minor arch end.

24. The orthodontic arch according to claim 1 wherein each minor arch end has a cleft therein; and wherein said mounting member comprises a prong that is received in its associated cleft to thereby form a clutchlike attachment between each minor arch end and its associated mounting member.

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