Jan. 28, 1964 F. R. MILLER ETAL 3,119,182

ORTHODONTIC APPLIANCE

Filed April 25, 1961 2 Sheets-Sheet 1

Fig. 1

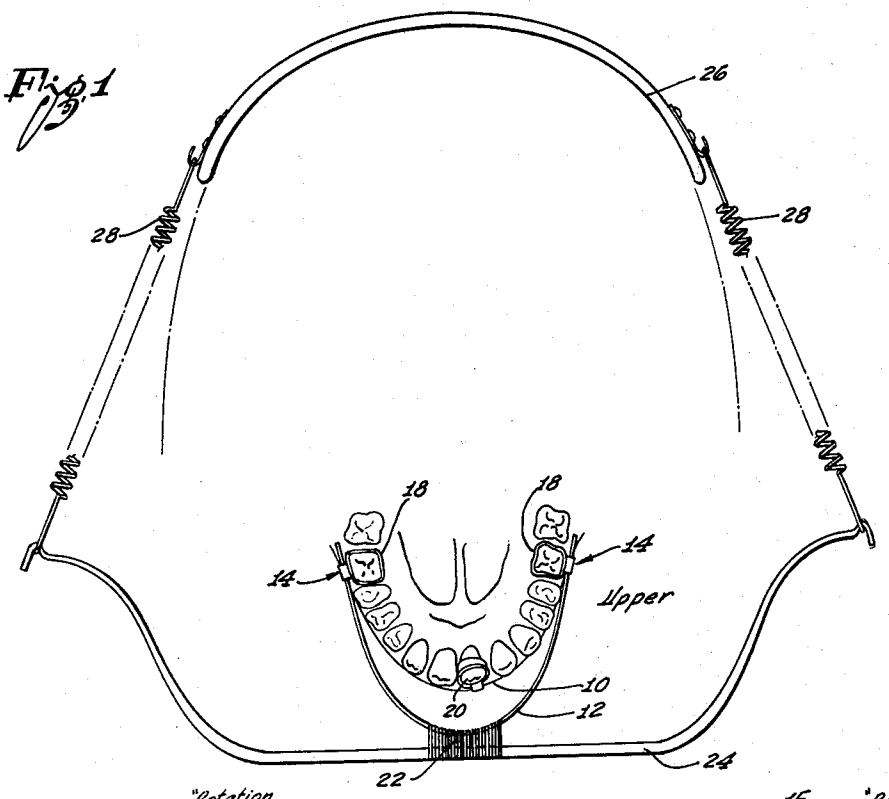


Fig. 2

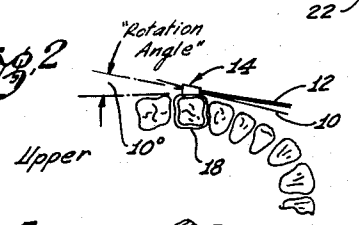


Fig. 3

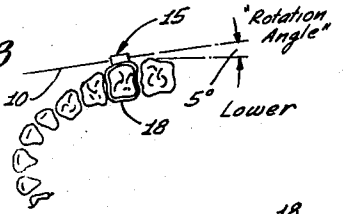
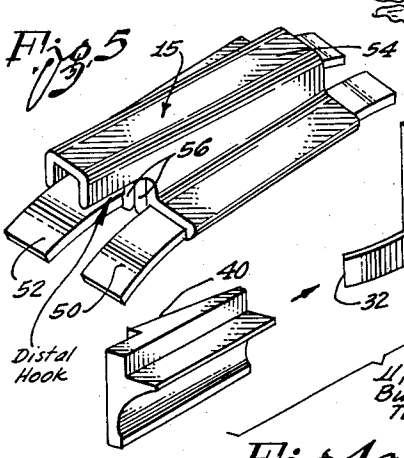


Fig. 5



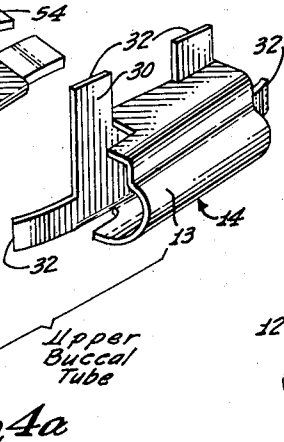


Fig. 4a

Fig. 4b

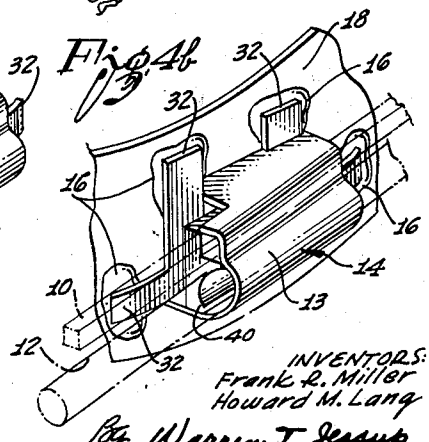


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Fig. 6

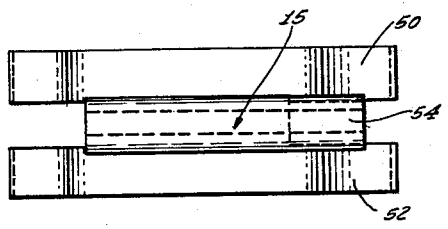


Fig. 8

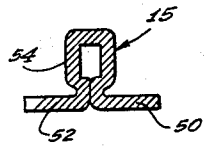


Fig. 9

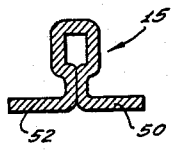


Fig. 7

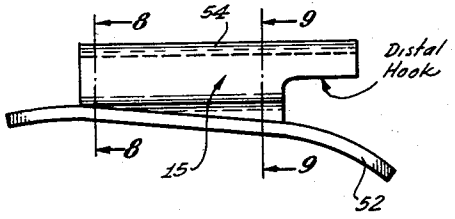


Fig. 10

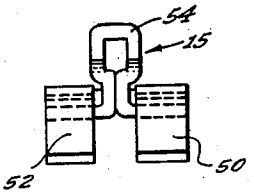
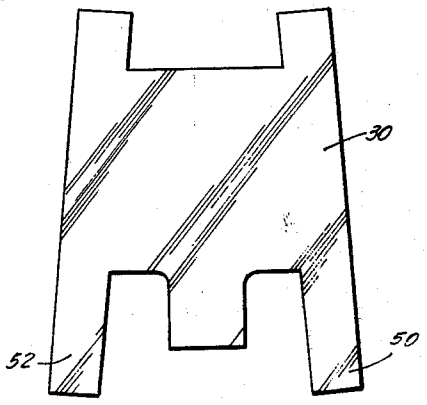


Fig. 11



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ORTHODONTIC APPLIANCE

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4 Claims. (Cl. 32—14)

The present invention relates generally to an improved orthodontic appliance, and it relates more particularly to an improved buccal tube which is intended to be fastened to a tooth band, or directly to a tooth, to provide an attachment for an arch wire, or similar member, used in orthodontic treatment.

As is well known, the buccal arch is employed in accordance with orthodontic practice on the exterior or buccal side of the patient's teeth. The buccal arch usually comprises a spring wire which is curved to conform approximately to the normal dental arch of the patient. The ends of the buccal arch wire are fastened to buccal tubes, which, in turn, are welded or soldered to tooth bands which surround selected molars of the patient and which serve as terminals of the arch wires. One or more of the intermediate portions of the arch wire may be attached to intermediate teeth.

The buccal arch spring wire is secured to the anchoring molars in the following manner. First, a tooth band is positioned on each of the selected molars. A buccal tube is then soldered, or otherwise attached, to each of the tooth bands on the buccal side of the dental arch of the patient. These tubes receive the ends of the buccal arch spring wires, as mentioned above, and they serve to support the arch wires on the anchoring molars.

The buccal arch described briefly in the preceding paragraphs is used in orthodontic treatment for straightening teeth in either the lower or upper dental arches of the patient, or both.

The present invention, as noted above, is concerned particularly with the mounting tubes which are used to support the ends of the arch wires on the molars. These tubes have been referred to above, and will be referred to subsequently herein, as "buccal tubes" to distinguish them from similar tubes which are used on the inner or lingual side of the dental arch.

One of the types of buccal tubes to be described herein is constructed to include a body portion which is formed of sheet metal, and which is adapted to receive and accommodate a variety of different inserts. These inserts define passageways with the body portion of the tube, and these passageways receive the ends of the arch wires. By utilizing different sizes of inserts with a single body portion, a large variety of sizes and shapes of arch wires may be accommodated by a buccal tube constructed in accordance with one of the embodiments of the invention.

It has been usual in the art to mount buccal tubes on the tooth bands encircling the molars, and then to bend the ends of the arch wires to align the ends with the passageways in the buccal tubes. This bending of the arch wires, although considered essential in the prior art, adds materially to the difficulty of fitting the orthodontic corrective equipment into the mouth of the patient.

The buccal tubes constructed in accordance with the present invention in one of its aspects are conceived and constructed in such a manner that there is no need to bend the arch wire, as is the case with the prior art buccal tubes, in order to enable the ends of the arch wire to be inserted into the passageways of the buccal tubes.

It is, accordingly, an object of the present invention to provide an improved buccal tube which is conceived to facilitate to a large extent the fitting of orthodontic equipment into the mouth of a patient.

Another object of the invention is to provide such an improved buccal tube which is constructed and configured to permit the end of the arch wire to be inserted directly into it without the need for bending the wire when the tube is mounted on an anchoring molar.

The appliance of the invention in one of its embodiments to be described comprises a single piece of sheet metal formed into a tubular configuration, and an insert which is adapted to fit into the tubular sheet metal body portion to provide at least one longitudinal wire receiving passage in the resulting buccal tube assembly. This passage is open at its ends so as to permit the passage of the end arch wire through it. A portion of the sheet metal forms the mounting wall of the buccal tube assembly, and this wall is adapted to lie against and to be soldered or welded to the tooth band on which the buccal tube is to be mounted. Mounting tabs may be provided at each end of the buccal tube assembly to lie in an essentially common plane with the mounting wall, as will be described, and these tabs may be bent to conform to the curved surface of the tooth band. The insert and body portion of the buccal tube of the present invention, in the embodiment to be described, are so formed that the wire receiving passage defined thereby is inclined with respect to the mounting wall.

The sheet metal from which the body portion of the buccal tube of the above mentioned embodiment of the invention is made may be relatively thin, but sturdy and bendable so that it may be formed into the desired configuration. The tooth band on which the buccal tube assembly is mounted is usually formed, for example, of soft stainless steel. The body portion of the buccal tube assembly of the above mentioned embodiment of the present invention may be formed, for example, of relatively hard stainless steel of the order of 12 mils thickness, and the tooth band may be of the order of 6 mils thickness.

The features of the invention which are believed to be new are set forth with particularity in the claims. The invention itself, however, may be best understood by considering the following description, when taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a schematic view of the upper dental arch of a patient, and of a buccal arch and face bow arch assembly fitted onto the upper dental arch for orthodontic treatment;

FIGURE 2 is a schematic showing of a portion of the upper dentaal arch of a patient, and the manner in which a combination buccal tube constructed in accordance with one embodiment of the invention may be supported on an anchoring molar to receive the ends of the arch wires;

FIGURE 3 is a view, similar to FIGURE 2, but showing a portion of the lower dental arch of the patient, and the manner in which a buccal tube constructed in accordance with a second embodiment of the invention may be used;

FIGURE 4*a* is an enlarged perspective disassembled view of an upper combination buccal tube constructed in accordance with a first embodiment of the invention; this view showing the body portion of the buccal tube and an insert which is received in the body portion;

FIGURE 4*b* is an enlarged perspective view of the buccal tube of FIGURE 4*a* assembled and fastened to the tooth band of an anchoring molar;

FIGURE 5 is an enlarged perspective view of a lower buccal tube constructed in accordance with a second embodiment of the invention;

FIGURE 6 is a top view of the tube of FIGURE 5;

FIGURE 7 is a side view of the tube of FIGURE 5;

FIGURES 8 and 9 are cross-sectional views of the tube of FIGURE 5 taken along the lines 8—8 and 9—9, respectively;

FIGURE 10 is an end view of the tube tube of FIGURE 5; and

FIGURE 11 illustrates an integral piece of sheet metal from which the tube of FIGURE 5 may be formed.

The assembly of FIGURE 1 is mounted on the upper dental arch of the patient, and as noted above, the view is taken looking up at the upper jaw. The assembly of FIGURE 1, in addition to incorporating an inner buccal arch wire **10**, includes a face bow inner arch wire **12**. The ends of both the buccal arch wire and the face bow inner arch wire are supported in combination buccal tubes **14** which are constructed in accordance with one of the embodiments of the invention. As best shown in FIGURE *4b*, each buccal tube **14** is soldered or welded, as at **16**, to a tooth band **18**.

The tooth bands **18** surround the selected molars of the patient. The ends of the buccal arch wire **10** extend into the buccal tubes **14** and are anchored therein. The anchoring of the arch wires **10** in the buccal tubes **14** may be in accordance with usual orthodontic techniques. At least one intermediate portion of the arch wire **10** is locked to a tooth, such as the tooth **20**, of the patient. This tooth is to be straightened in accordance with usual orthodontic practice, by the buccal arch and by the face bow arch.

The inner face bow arch wire **12** is securely attached, as at **22**, to an outer face bow arch **24**. A neck strap **26** extends around the head of the patient, and the neck strap is attached to the outer face bow arch through suitable resilient couplers, such as springs **28**.

The inner face bow arch **12** is removable from the buccal arch tubes **14**, and the entire face bow assembly can be removed by the patient. Suitable stops (not shown) are mounted on the inner face bow arch **12**, and these stops bear against the buccal tubes **14** to exert the desired force on the buccal tubes **14**, when the face bow assembly is in place.

In accordance with the concepts of the present invention, and as mentioned above, the buccal tubes **14** are so constructed that the passageways which receive the arch wires **10** and **12** extend at a mesial-distal or rotation angle to the respective tooth bands **18** to which the buccal tubes are attached. This mesial-distal or rotation angle is chosen so that the arch wires **10** and **12** can be inserted without any need to provide a sharp bend therein which was previously required to align the ends of the arch wires with the passageways in the prior art buccal tubes; and in fact without any need to provide any bend whatever in the arch wires.

The angle referred to in the preceding paragraph, and to be referred to hereinafter, as the rotation or mesial-distal angle, is defined by axes lying in the plane of the paper in FIGURES 1, 2 and 3. This angle is not to be confused with "tip-back" angles or "torque" angles formed by axes lying in other planes.

The feature of the invention described in the preceding paragraph not only facilitates the orthodontic fitting of the buccal arch **10**, but also permits the face bow assembly to function with greater precision than was possible in the prior art arrangements. This latter feature is realized, because the prior art face bows did not provide optimum force angles with respect to the arch wire **10**.

The fragmentary view of FIGURE 2 illustrates the mean mesial-distal or rotation angle at which the arch wires **10** and **12** are received in the buccal tube **14** with respect to the adjacent buccal surface of the tooth band **18** on the corresponding molar. This view is of the upper jaw of the patient, as noted above, and the usual jaw mesial-distal or rotation angle for most patients has been found to be of the order of 10 degrees, as shown. However, upper jaw mesial-distal or rotation angles in the range of substantially from 8 degrees to 20 degrees are desirable in conjunction with the upper jaws of different patients, for optimum operating efficiency.

The fragmentary view of FIGURE 3 shows the angles which the arch wires **10** is received in a buccal tube **15** with respect to the adjacent buccal surface of the tooth band **18** on the corresponding molar, the latter view being of the lower jaw of the patient. For most patients, the optimum lower rotation angle has been found to be of the order of 5 degrees, as illustrated. However, the lower rotation angles in the range of substantially from 3 degrees to 12 degrees are usually encountered for different patients for optimum effects.

The construction of the upper combination buccal tube **14** in accordance with one embodiment of the invention is shown in FIGURES *4a* and *4b*. This particular tube is a right hand unit, and is intended to be mounted on the right hand side of the patient's upper jaw. It is evident, of course, that the left hand unit may be similar in its construction to that illustrated in FIGURES *4a* and *4b*, and will complement the illustrated unit.

The combination upper jaw buccal tube **14** of FIGURES *4a* and *4b* includes a clip-like body portion **13** which may be formed, as noted above, of sheet metal. The sheet metal body portion **13** has a first surface which forms the mounting wall **30** of the tube, and a plurality of tabs **32** are formed integral with the mounting wall **30**. The tabs **32** and the mounting wall **30** of the body portion **13** are configured to conform with the surface of the tooth band **10** to which the buccal tube is to be attached, as by welding or soldering, as described above in conjunction with FIGURE *4b*.

The sheet metal forming the body portion **13** of the buccal tube **14** is bent over into a clip-like configuration to define, in the illustrated embodiment of FIGURES *4a* and *4b*, two walls of a rectangular passage and a semicircular portion of the wall of a circular passage. The bent-over body portion of the buccal tube is shaped so that the walls of these passages extend at a selected longitudinal inclination to the rear wall, so that the passages themselves may have a desired rotation-angle inclination, for the purposes described above.

The body portion **13** of the buccal tube **14** may, for example, have a uniform size for a wide variety of applications, and it is adapted to receive one of a plurality of inserts **40**. The inserts **40** may have different sizes to form different sized passages in conjunction with the body portion **13**. The insert **40**, as illustrated particularly in FIGURE *4a* has a wedge-shaped configuration, and it serves to complete the definition of the inclined passages in the body portion **13**, as shown in FIGURE *4b*. The insert **40** is usually inserted into the body portion **13** in essentially coaxial relationship therewith, and it is soldered or welded to the body portion to hold it in place.

When the body portion **13** and the insert **40** are assembled in the manner shown in FIGURE *4b*, the resulting combination buccal tube assembly defines passageways which are inclined to its mounting wall **30** and to the buccal surface of the tooth band **18** to which it is attached. The inclinations of the passageways define selected angles for the upper jaw, as mentioned above in conjunction with FIGURE 2.

The lower buccal tube **15** of FIGURE 3 may be formed of one integral piece of sheet metal **30** (FIGURE 11), and it may have the configuration shown in FIGURES 5–10.

The passageway in the lower buccal tube **15** as noted above, is usually constructed to define a rotation angle of the order of 5 degrees with the buccal side of the tooth to which it is attached. The illustrated unit defines a rectangular passageway to receive the lower buccal arch wire.

The lower jaw buccal tube of FIGURE 5 includes a pair of strips **50** and **52** which are integral with the body portion **54**, as shown, and which are bent to conform with the tooth or tooth band to which the tube is attached. The body portion **54** has the illustrated shape to define the walls of the rectangular passageway which receives the ends of the lower buccal arch wire. This

passageway, as illustrated and as mentioned above, extends at a preselected rotation angle to the side of the tooth to which the tube is attached. The tube **15** may be attached to a tooth band by welding or soldering the strips **50** and **52** to the band. A distal extension or hook, as indicated in FIGURES 5 and 7, is provided at the forward end of the body portion **54**. This hook is convenient for use by the orthodontist for elastics, coil springs, tie wires, and the like. A similar hook is shown in the forward end of the wall of the buccal tube **14** in FIGURE 4*a*.

The buccal tube assemblies of the invention may be fitted to different patients in such a manner that the arch wires may be inserted therein without any need to bend the ends of the arch wires. This, as mentioned above, facilitates to a large extent the ease with which the orthodontic equipment can be fitted to the jaw of the patient and also renders the face bow assembly which may be used in conjunction with the buccal arch, more efficient.

The invention provides, therefore, an improved buccal tube assembly for use in orthodontic practice which is constructed in an improved and unique manner so as to facilitate the fitting of the orthodontic equipment and to render the operation thereof more efficient.

What is claimed is:

1. An orthodontic appliance including: a body portion having a tubular configuration and defining a mounting wall and further defining an opposite wall having a longitudinally inclined relationship with said mounting wall, and a wedge-shaped insert member received in said body portion, said member having a recessed surface to define therewith at least one arch wire receiving passage through said body portion, said passage having an axis inclined at an angle in a plane through both said walls.

2. An orthodontic appliance to be mounted on the surface of a tooth band including: a body portion formed of sheet metal having an open ended tubular configuration and defining a mounting wall adapted to face the surface of the tooth band on which the appliance is to be mounted and further defining mounting tabs in essentially co-planar relationship with the mounting wall and to be attached to the surface of the tooth band and further defining an opposite wall having a longitudinally mesial-distal inclined relationship with said mounting wall, and a wedge-shaped insert portion supported in and by said body portion in substantially coaxial relationship therewith and defining with said body portion at least one arch wire receiving passage having an axis inclined at a rotation angle to intersect the plane of said mounting wall.

3. An orthodontic appliance adapted to be mounted on the buccal surface of a tooth band including: a body portion formed of sheet metal having an open-ended tubular configuration and defining a mounting wall adapted to face the surface of the tooth band on which the appliance is to be mounted and further defining mounting tabs in essentially co-planar relationship with the mounting wall and to be attached to the surface of the tooth band and further defining an opposite wall having a mesial-distal inclined relationship with said mounting wall, said body portion defining at least one substantially fully enclosed and symmetrical arch wire receiving passage inclined at a rotation angle with respect to said mounting wall, such that the axis of said passage will interset the plane of said mounting wall.

4. An orthodontic appliance comprising: a bracket having side mounting means lying in a plane and adapted for attachment to a tooth band; said bracket formed with internal wall surfaces defining a substantially fully enclosed and symmetrical socket; said socket having a longitudinal axis spaced from said plane and having an orientation such that extension thereof would intersect said plane of said mounting means; a removable insert residing in said socket, said insert having at least one wall recess adapted jointly with said internal wall surfaces of said socket to define a through wire receiving passageway.

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