July 1, 1969 I. S. DE WOSKIN 3,452,436

ORTHODONTIC APPLIANCE AND METHOD

Filed Feb. 2, 1967

FIG. 1.

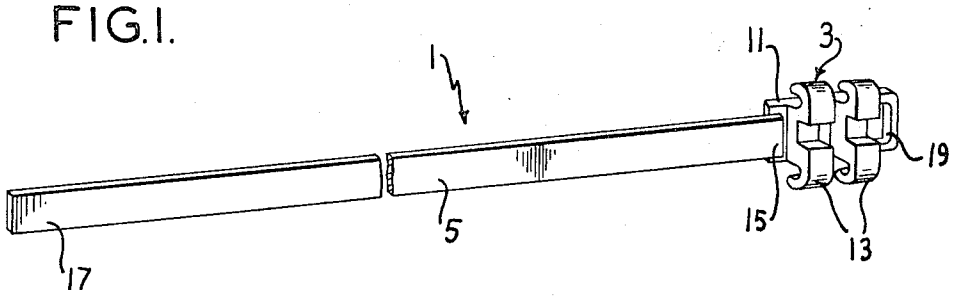



FIG. 2.

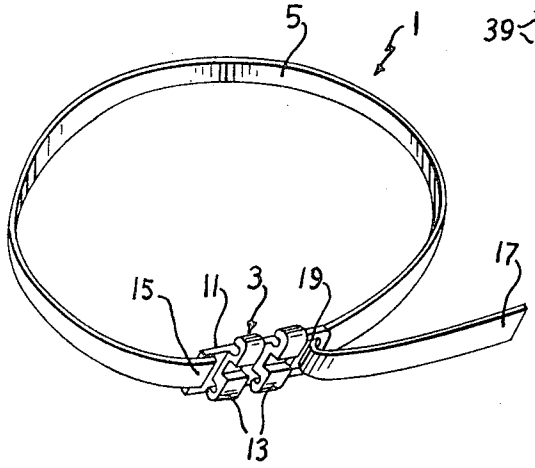



FIG. 4.

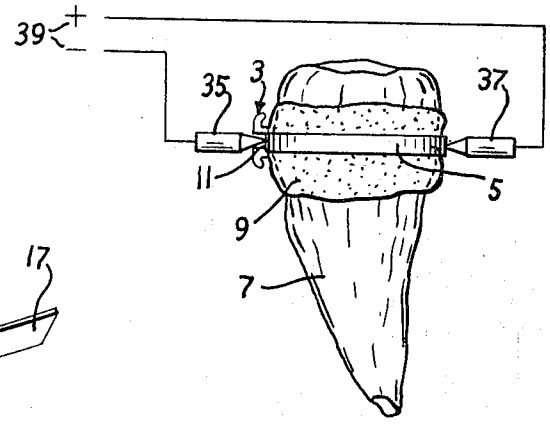
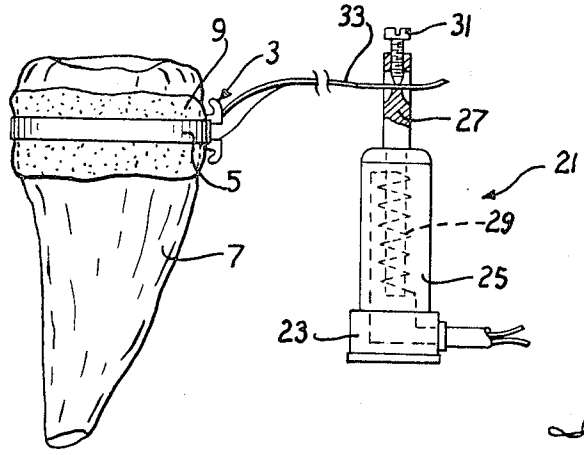



FIG. 3.




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# ORTHODONTIC APPLIANCE AND METHOD

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## ABSTRACT OF THE DISCLOSURE

An orthodontic appliance, such as a bracket, a buccal tube or a hook, has a flexible metal band extending from one end and an eye at the other end. The appliance is attached to a tooth by threading the band through the eye to form a loop, coating the band and the tooth with an adhesive, slipping the looped band over the tooth, and pulling on the band to draw it taut around the tooth. The adhesive is then cured by applying heat, either by contacting the band with a heater or by passing an electric current through the band.

### *Background of the invention*

The invention is in the field of orthodontia, and involves an orthodontic appliance, which may be a bracket, a buccal tube, a hook, or other type of orthodontic appliance and a method of attaching the appliance to a tooth.

Certain orthodontic techniques require the attachment to teeth of various types of appliances, such as brackets, buccal tubes, hooks, etc. for application of extraoral and intra-oral devices for applying traction to the teeth. Heretofore conventional practice has involved attachment of such an appliance to a tooth by means of a metal band having a tight fit around the tooth, the band being preformed before application to the tooth and the appliance being welded to the band. This practice has required stocking of various types and sizes of bands, and has been tedious and time-consuming, frequently involving discomfort to the patient, due to the problem of fitting the band to the tooth. Also, the use of such bands may promote tooth decay under and adjacent the bands.

### *Summary of the invention*

The present orthodontic appliance is comprised of a fixture having a base and at least one element projecting outward from one side of the base for interengagement by an arch wire or the like. A thin, narrow flexible band is secured to the base and extends from one end thereof, the base having an eye adjacent its other end. The band is narrower than the eye and is adapted to be passed through the eye from the other side of the base to form a loop. The loop is adapted to be placed around a tooth with the element on the outside and then drawn relatively taut. In applying the appliance to a tooth, the band is embedded in adhesive on the tooth, the adhesive being cured in situ on the tooth with the band embedded in the adhesive. The appliance is thus bonded to the tooth, rather than being held by mechanical grip on the tooth, the band serving not only as means for convenient initial placement of the appliance on the tooth, but also as a reinforcement for the adhesive after the latter has set. The present invention, therefore, eleminiates the stocking of various types and sizes of bands heretofore required,



and reduces the time, tediousness and patient discomfort in attaching the appliance to a tooth. In addition, the present band is sealed to the tooth, thereby preventing decay of the surfaces adjacent and under the band. Other objects and features will be in part apparent and in part pointed out hereinafter.

### *Brief description of the drawings*

FIG. 1 is a perspective of an orthodontic appliance of the present invention;

FIG. 2 is a perspective of the appliance of FIG. 1, showing the band looped for application to a tooth;

FIG. 3 is a side elevation of the appliance seated on a tooth, illustrating a first mode of heating the adhesive for curing; and

FIG. 4 is a side elevation similar to FIG. 3, illustrating a second mode of heating.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

### *Description of the preferred embodiment*

Referring now to the drawings, the present orthodontic appliance **1** generally comprises a fixture **3** and a band **5**, the fixture being adapted for inter-engagement by an arch wire or the like. The appliance **1** is attached to a tooth **7** by forming the band in a loop (see FIG. 2), by applying an adhesive **9** to the appliance and/or the tooth, by applying the band to the tooth **7**, and by applying heat to cure the adhesive **9**. The heat may be applied either by thermal conduction, as illustrated in FIG. 3, or by passing an electric current through the band, as illustrated in FIG. 4.

More particularly the fixture **3** consists of a base **11** having an element or elements **13** projecting outwardly from one side thereof. The elements **13** may comprise, for example, a twin edgewise bracket, as illustrated or a buccal tube or a hook etc. The band **5** is formed of a thin, narrow flexible strip of metal, such as stainless steel, having an end **15** secured as by welding to one end of the base **11**, and a free end **17**. The other end of the base **11** extends beyond the element **13** and is provided with an aperture or eye **19** having a width greater than that of the band **5**.

To attach the appliance **1** to the tooth **7**, the free end **17** of the band is threaded through the eye **19** from the side of the base **11** opposite the elements **13** to form a loop. The base **11** may be formed with a slot leading into the eye for insertion of the band in the eye via the slot, and the term "eye" is intended broadly to cover such a construction. An adhesive **9** is then applied to the tooth and the loop and the latter is slipped over the tooth with the fixture **3** positioned on a face of the tooth. The band **5** is then tightened by applying moderate tension to draw it taut around the tooth and the adhesive **9** is cured in situ firmly to attach the appliance to the tooth. It should be noted that the band **3** is not tensioned tightly to clamp the band and fixture to the tooth, but merely sufficiently to hold the appliance in place while the adhesive is curing. Thereafter, the band serves as a reinforcement for the adhesive analogous to a reinforcing rod or wire in a concrete structure.

The adhesive **9** may be an epoxy resin type adhesive consisting of a mixture of a resin sold under the trade designation Epon 125 by Shell Chemical Corporation, and a resin sold under the trade designation Versamid

828 by General Mills, Inc., in proportions of from two parts Epon and one part Versamid to one part Epon and two parts Versamid. In addition, one part of white silica powder may be added. The resultant adhesive is nontoxic, sets in a relatively short time and is soluble in isopropyl alcohol and various ketones.

To avoid the discomfort and inconvenience to a patient of a long setting time, curing of the adhesive may be accelerated in the mouth by heating. FIGS. 3 and 4 illustrate two methods of accomplishing this. In FIG. 3, a heater **21** consisting of a base **23**, an upstanding cylindrical portion **25**, a heating element **27**, and an electric heating coil **29** is clamped by a set screw **31** to a strip of metal **33** connected to the band **5**. The strip **33** is formed of a metal or alloy such as gold or silver having a high thermal conductivity for conducting heat from the element **27** to the band **5**. If desired, the free end **17** of the band may itself be clamped to the element **27** by set screw **31** for conducting the heat to the band. In this case, it may be desirable to form the band of a more highly thermally conductive material, such as a silver alloy.

In FIG. 4, a second method of heating the adhesive to cure the same is illustrated. In this embodiment, a pair of electrodes **35**, **37** are connected to a low voltage electrical supply, indicated at **39**, and brought into contact with the band **5** at spaced locations for effecting the heating, the band acting as an electrical resistance heater for this purpose. The electrical supply **39** may consist of a one-half to one volt direct current source at one ampere. For example, a type 300 or 400 stainless steel band of the approximate dimensions required to encircle a tooth has approximately one ohm resistance and would produce a temperature of 90–180° F. upon the application of one volt D.C. It is also possible to use A.C. The electrodes **35**, **37** may be mounted in a resilient C-clamp (not shown) which may be clamped around the tooth **7** so that the electrode **35** contacts the base **11** and the electrode **37** contacts the band **5** on the opposite side of the tooth. Alternatively, one of the electrodes may be connected to the free end **17** of the band. When the current has been applied for an appropriate time, the clamp and electrodes may be removed. The resulting bond is of sufficient strength to prevent accidental dislodgment. The free end **17** of the band **5** may be removed with a wire cutter, although it is preferred to retain the free end to hold the band in position until the adhesive sets. A pulsating current may be used to minimize heating of the tooth.

A contemplated third method of accelerating the curing of the adhesive in situ in the mouth is by application of ultrasonic energy to the adhesive, as by application of an ultrasonic contact to the band.

It is contemplated that, further to reduce the curing time in the mouth, the adhesive may be precured for an appropriate time prior to application of the adhesive to the band and the tooth. For example, the above-described adhesive may be precured by heating it for about five minutes to a temperature of from 90–180° F.

With the present invention it is no longer necessary to stocka variety of types and size of bands. Since the adhesive cures in a relatively short time, patient discomfort and anxiety is eliminated and an inconspicuous yet secure bond is obtained. The appliance may be removed by the application of one of the aforementioned solvents and slight mechanical force. Since the adhesive seals the band to the tooth, decay under and adjacent the band is eliminated.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions and methods without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.



What is claimed is:

**1.** An orthodontic appliance comprising a fixture for application to a tooth, said fixture having a base and at least one element projecting outward from one side of the base for interengagement by an arch wire or the like, a thin, narrow flexible band having one end secured to the base and extending from one end of the base, said base having an eye adjacent its other end, said band being narrower than said eye and adapted to be passed through said eye from the other side of the base to form a loop adapted to be placed around a tooth with said element on the outside, after which the loop is adapted to be drawn relatively taut around the tooth.

**2.** An orthodontic appliance as set forth in claim **1** wherein the band is attached to said one end of the base.

**3.** An orthodontic appliance as set forth in claim **2** wherein the base, at its said other end, extends beyond said element and the eye is located between said element and said other end of the base.

**4.** The method of securing an orthodontic appliance on a tooth, said appliance having a base and at least one element projecting outward from one side of the base for interengagement by an arch wire or the like, a thin, narrow flexible band having one end secured to the base and extending from one of the base, said base having an eye adjacent its other end, said band being narrower than said eye and adapted to be passed through said eye, comprising passing the band through said eye from the other side of the base to form a loop, applying the loop to a tooth and drawing the band taut around the tooth, while embedding the band in an adhesive on the tooth, and curing the adhesive in situ on the tooth with the band embedded in the adhesive.

**5.** The method of claim **4** wherein heat is applied to the adhesive after the band has been drawn taut around the tooth to cure the adhesive.

**6.** The method of claim **4** wherein both the band and the tooth are coated with an adhesive prior to application of the loop to the tooth.

**7.** The method of securing an orthodontic appliance on a tooth, said appliance having a base and at least one element projecting outward from one side of the base for interengagement by an arch wire or the like, a thin, narrow flexible band having one end secured to the base and extending from one end of the base, said base having an eye adjacent its other end, said band being narrower than said eye and adapted to be passed through said eye, comprising passing the band through said eye from the other side of the base to form a loop, applying the loop to a tooth and drawing the band taut around the tooth, while embedding the band in an adhesive on the tooth, and curing the adhesive in situ on the tooth with the band embedded in the adhesive by applying heat to the adhesive after the band has been drawn taut around the tooth, the heat being applied by passing an electric current through the band, the band acting as an electrical resistance heater for this purpose.

**8.** The method of securing an orhtodontic appliance on a tooth, said appliance having a base and at least one element projecting outward from one side of the base for interengagement by an arch wire or the like, a thin, narrow flexible band having one end secured to the base and extending from one end of the base, said base having an eye adjacent its other end, said band being narrower than said eye and adapted to be passed through said eye, comprising passing the band through said eye from the other side of the base to form a loop, applying the loop to a tooth and drawing the band taut around the tooth, while embedding the band in an adhesive on the tooth, and curing the adhesive in situ on the tooth with the band embedded in the adhesive by applying heat to the adhesive after the band has been drawn taut around the tooth, the heat being applied by contacting the band

with a heated element, the band being thermally conductive for this purpose.

9. The method of securing an orthodontic appliance on a tooth, said appliance having a base and at least one element projecting outward from one side of the base for interengagement by an arch wire or the like, a thin, narrow flexible band having one end secured to the base and extending from one end of the base, said base having an eye adjacent its other end, said band being narrower than said eye and adapted to be passed through said eye, comprising passing the band through said eye from the other side of the base to form a loop, applying the loop to a tooth and drawing the band taut around the tooth, while embedding the band in an adhesive on the tooth,



and curing the adhesive in situ on the tooth with the band embedded in the adhesive by applying heat to the adhesive after the band has been drawn taut around the tooth, the heat being applied by applying ultrasonic energy to the adhesive.

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