

[54] **ORTHODONTIA DEVICE**

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**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 850,854, Aug. 18, 1969, Pat. No. 3,533,163.

[52] U.S. Cl. .... **32/14 D**

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

[58] Field of Search .... 32/14 D, 14 B, 71; 128/2

[56] **References Cited**

**UNITED STATES PATENTS**

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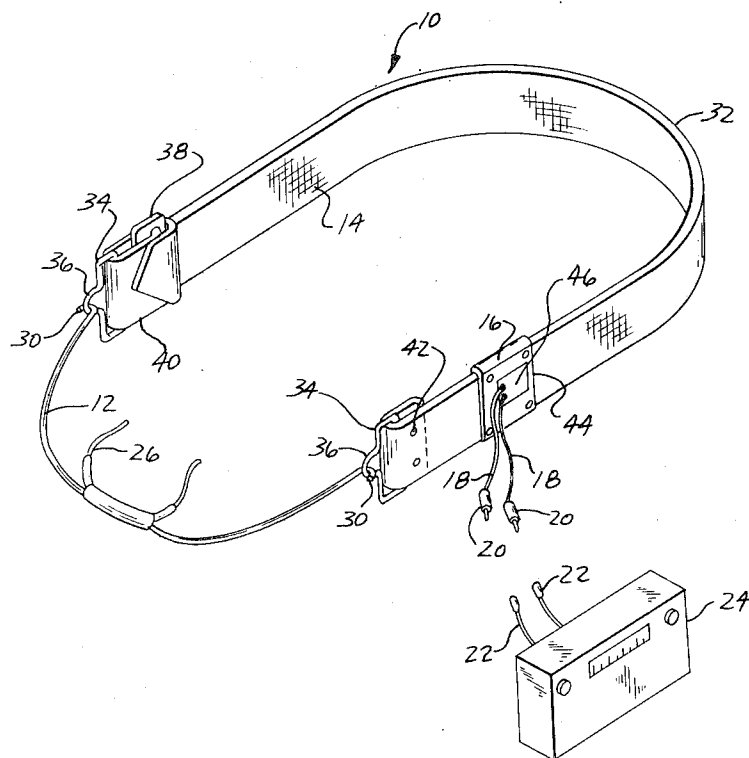
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[57] **ABSTRACT**

An orthodontia appliance is provided including a mouth brace and elastic-retaining band designed to exert a predetermined force on the brace when the brace is positioned in the mouth of a patient. The band is provided with an adjusting clamp and an integral strain gauge which, when connected to a suitable readout device gives an indication of the force exerted on the brace by the band and therefore the force exerted on the patient's teeth.

**3 Claims, 2 Drawing Figures**



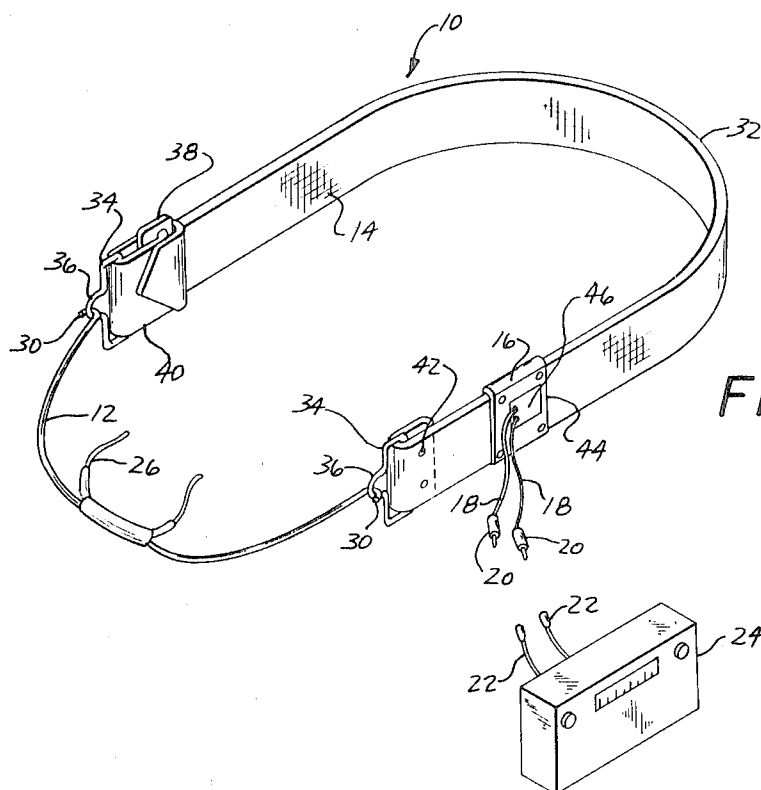


FIG. 1

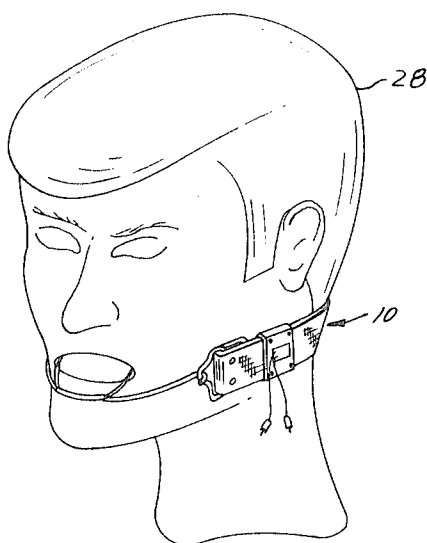


FIG. 2

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## ORTHODONTIA DEVICE

## CROSS-REFERENCE TO OTHER APPLICATIONS

The present application comprises a continuation-in-part of my presently pending application Ser. No. 850,854 filed Aug. 18, 1969 and now U.S. Pat. No. 3,533,163 issued Oct. 13, 1970 for an Orthodontia Device.

## BACKGROUND OF THE INVENTION

During the initial phase of treatment of an orthodontia patient, a mouth brace is used for some period of time. In the final phase of treatment, the mouth brace is removed and a head brace, which is generally only used during sleeping hours, is substituted therefor.

As the orthodontia treatment progresses, the force which the brace must apply to the patient's teeth must be varied—usually increased. A patient undergoing a typical representative orthodontia treatment may, for example, be required to wear a brace exerting a tension of 4–6 ozs. during the initial phases of treatment. After 6–8 weeks, the tension may be increased to about 1 lb. Then, after a period of about 6 months this may be increased to 18 ozs. or so for a period of up to 2 years. Of course, it should be realized that the actual tension which the orthodontist will prescribe in any particular instance, depends upon the specific details of any particular patient and may, in fact, be either increased or decreased.

During the course of the orthodontia treatment, it is necessary for the patient to visit his orthodontist periodically to insure that the brace is exerting the required tension. At these visits, adjustment of the brace may be required either because the patient has advanced to a new stage of treatment or because the brace, for some reason, has drifted from the previously set value. Heretofore, at such visits it was necessary for the orthodontist to remove the brace from the patient's head, apply a tension gauge to measure the exerted force on the mouth bow, adjust the brace band as indicated by the measured force, remeasure the force and so on until the required tension is attained. In this manner, it is virtually impossible for the orthodontist to be certain that the brace, once in position on the patient's head, will be exerting the required force on the patient's mouth.

In view of the above, it is the principal object of the present invention to provide an improved orthodontia device of the head brace type which enables an orthodontist to make in situ measurement and adjustment of the tension exerted on the mouth brace by its associated elastic band.

## SUMMARY OF THE INVENTION

The above and other beneficial objects and advantages are attained in accordance with the present invention by providing an improved orthodontia device comprising a face bow and elastic-retaining band. The face bow includes a mouth brace adapted to be positioned within the mouth of an orthodontia patient and to engage certain teeth of the patient. The bow is further provided with band lugs on both sides of the mouth brace adapted to remain outside the patient's mouth when the brace is in use. An elastic band, adjustable by means of an adjusting clamp extends between the band lugs. The resiliency of the band is such as to cause the mouth brace to impart a predetermined force on the patient's teeth when the brace is positioned within the patient's mouth. A strain gauge is provided in line with the stretch axis of the elastic band. The strain gauge may, for example, comprise a piezoelectric element provided with suitable leads for connection to an appropriate readout device.

## BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing:

FIG. 1 is a perspective view of an orthodontia device in accordance with the present invention; and

FIG. 2 is a perspective view illustrating the orthodontia device as used by a patient.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is illustrated in the accompanying drawing wherein similar components bear the same reference numeral throughout both views. Reference is now made to the drawing and to FIG. 1 in particular wherein an orthodontia device 10 in accordance with the present invention is illustrated as including a face bow 12, a retaining strap 14 and a strain gauge assembly 16 securely mounted to strap 14. The strain gauge assembly 16 is further provided with leads 18 which extend from opposite sides of the transducer element of the strain gauge assembly 16. Each of the leads 18 is provided with a suitable connector 20, such as a phonojack, for connection with a mating connector 22 of a readout assembly 24.

The face bow 12 consists of an elongated metallic frame, usually formed of stainless steel, having a mouth brace 26 between its ends. Mouth brace 26 is designed to alleviate and help cure the orthodontic problem of a particular patient and hence, the details of its construction will vary from patient to patient. However, generally speaking, the mouth brace 26 is designed to exert a constant rearward pressure on certain teeth of the patient and to this end, is designed to fit in the mouth of the patient and engage those teeth. The orthodontia appliance is worn by the patient 28 in the manner illustrated in FIG. 2.

The ends of face bow 12 are spaced apart sufficiently to wrap around the cheeks of the patient and the face bow terminates in hooked lugs 30 at each end. The retaining strap 14 comprises an elastic band or harness 32 which has at its ends bucklelike connectors 34, each of which includes an outwardly projecting portion 36 adapted to engage with the hooked lugs 30.

The overall length of the elastic band 32 is adjustable and to affect this, an adjustable clamp 38 is provided at at least one end of the band. The adjustable clamp 38 may, for example, be in the form of a takeup roller which, in cooperation with one of the buckles 34 serves to vary the double section portion 40 of band 32 and hence, the overall length of the band. Rivets 42 serve to secure the other end of band 32 to its buckle.

In use, the orthodontia device is positioned in the patient's mouth with the band 32 in a stretched condition. The natural tendency of the elastic band to relax causes the mouth brace to apply the desired force to the patient's teeth. It should be obvious that the tension exerted on the patient's mouth may be varied by altering the position of clamp 38.

As was previously mentioned, periodic adjustment of the orthodontia device is required as treatment progresses. In accordance with the present invention, a strain gauge assembly 16 is provided which enables a reading of such adjustment to be made while the orthodontia device is in position by permitting the orthodontist to obtain a direct reading of the tension exerted by band 32 while the brace is being worn. The tension being directly proportional to the strain experienced by the gauge.

The strain gauge assembly 16 includes a relatively stiff backing member 44 to which a commercially available strain gauge 46 is bonded. In a successful practice of the present invention a type SR-4 strain gauge distributed by BLH Electronics, Inc. was utilized. The gauge 46 was bonded to a backing sheet 44 of fiber glass epoxy using Eastman type 910 acrylic base contact pressure curing cement. The backing sheet 44 in turn was secured by rivets to elastic band 32 with the strain gauge 46 oriented along the stretch axis of the band.

In the above-mentioned successful practice, the strain gauge 46 was of the piezo electric type. Accordingly, the associated readout 24 comprises essentially a Wheatstone bridge with the leads 22 adapted to suitably connect gauge 46 to form one leg of the bridge. As the elastic band 32 is stretched, the backing member 44 is deflected and the deflection is proportional to the amount of stress applied. This deflection is transmitted to the strain gauge where it causes a change in the resistance of the piezoelectric element. A measure of the resistance of the element is thus directly propor-

tional to the applied stress so that by suitably calibrating the readout device 24, an accurate measure of the tension applied by elastic band 32 may be directly obtained.

Thus, in accordance with the above disclosure an orthodontist may adjust the tension of the improved orthodontia device of the present invention in situ by varying the position of clamp 38 while observing the deflection of readout device 24. It will thus be seen that the aforementioned object is most effectively attained.

Although only one specific embodiment of my invention has been described and illustrated herein, various changes will become evident to one skilled in the art. Therefore, it should be understood that modifications may be made in the illustrated and described embodiment of my invention without departing from the invention as set forth in the accompanying claims.

Having thus described my invention what I claim is:

1. An improved orthodontia appliance comprising: a face bow, said bow including a mouth brace adapted to be positioned within the mouth of an orthodontia patient and to engage certain teeth of the patient and band lugs on both sides of said brace adapted to remain outside the mouth of the patient when the bow is in use; an elastic band extending between said

band lugs, the resiliency of said band being such as to cause said mouth brace to impart a predetermined force on said certain teeth when said brace is positioned in the mouth of the patient and the band is positioned about the head of the patient; means for adjusting the overall length of said band between said band lugs; and force determining means having at least one electrical characteristic which varies in predetermined fashion in response to the force exerted by said band on said teeth through said brace, said force determining means including a strain gauge rigidly coupled to said elastic band and aligned along the stretch axis of said band.

2. The invention in accordance with claim 1 wherein said strain gauge includes a piezoelectric element.

3. The invention in accordance with claim 2 further comprising a first connector extending from a first terminal of said piezoelectric element and a second connector extending from a second terminal of said piezoelectric element whereby the electrical resistance across said connectors is proportional to the force exerted by said band and Wheatstone bridge means adapted for coupling to said connectors for determining the resistance of said element.

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