# United States Patent [19]

**Broussard et al.**

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[54] **ORTHODONTIC DEVICE**


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

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

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



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*Primary Examiner*—Robert Peshock

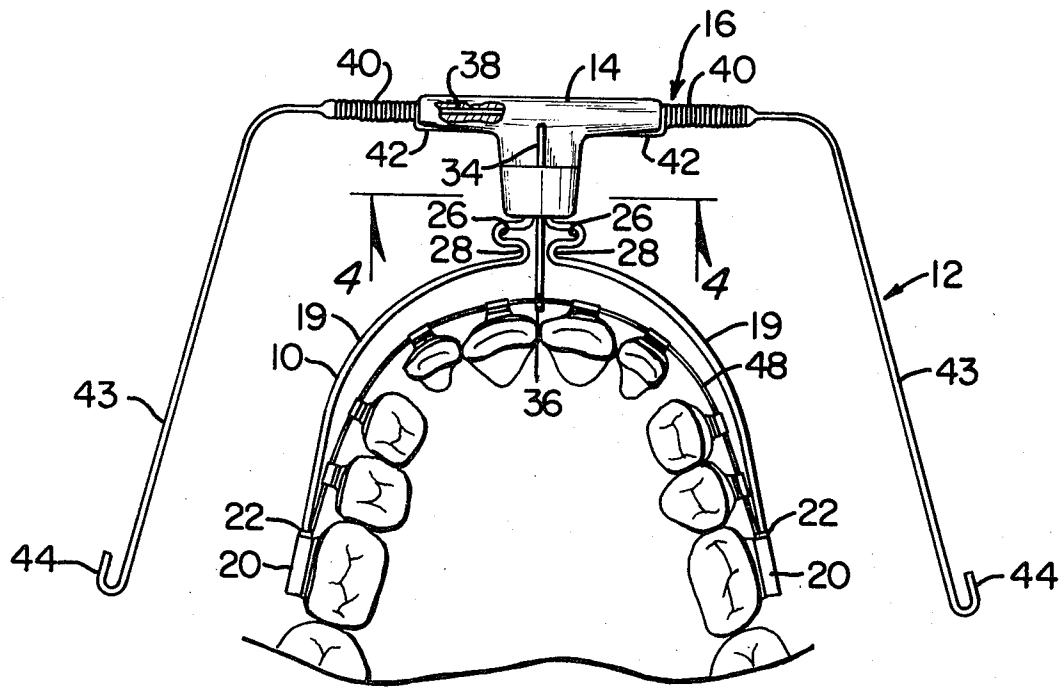
*Attorney, Agent, or Firm*—Sheridan, Ross & Fields



[57] **ABSTRACT**

Orthodontic device of the extra-oral and intra-oral bow type characterized by a pivotal connection between the bow wires and resilient means for applying torque forces to the intra-oral bow in addition to traction forces thereto. Direction of torque may be selected and non-symmetrical force may be applied to the intra-oral bow.


**10 Claims, 5 Drawing Figures**



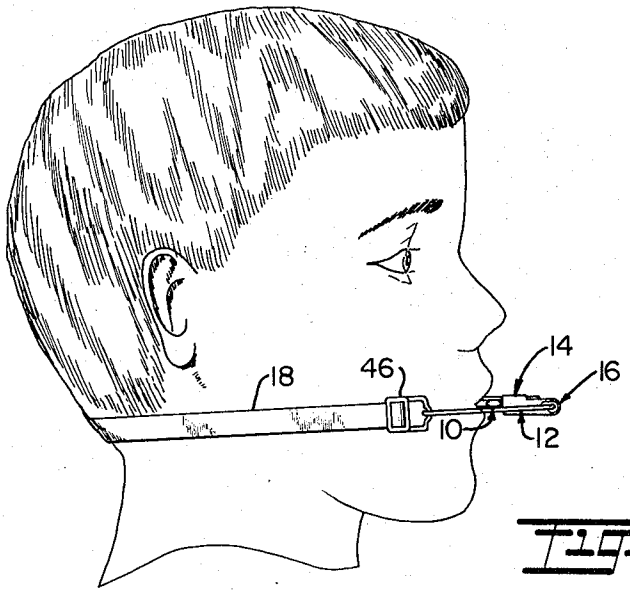



FIG. 1

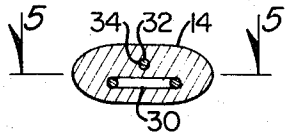



FIG. 4

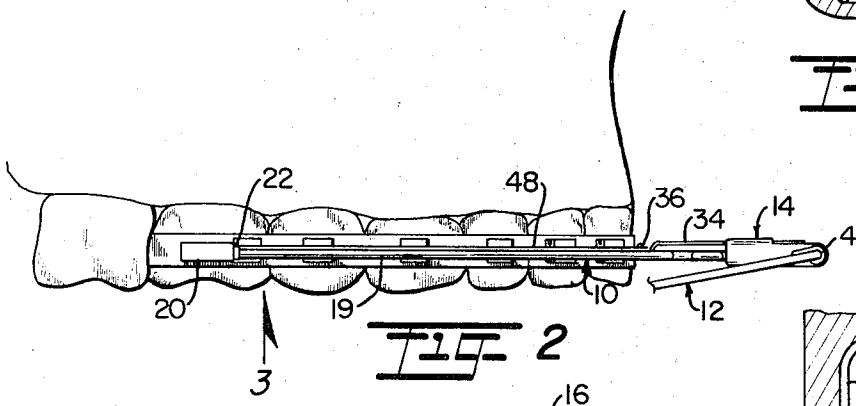



FIG. 2

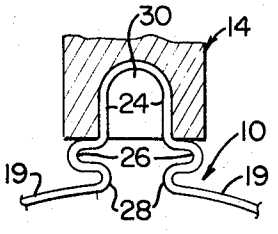



FIG. 5

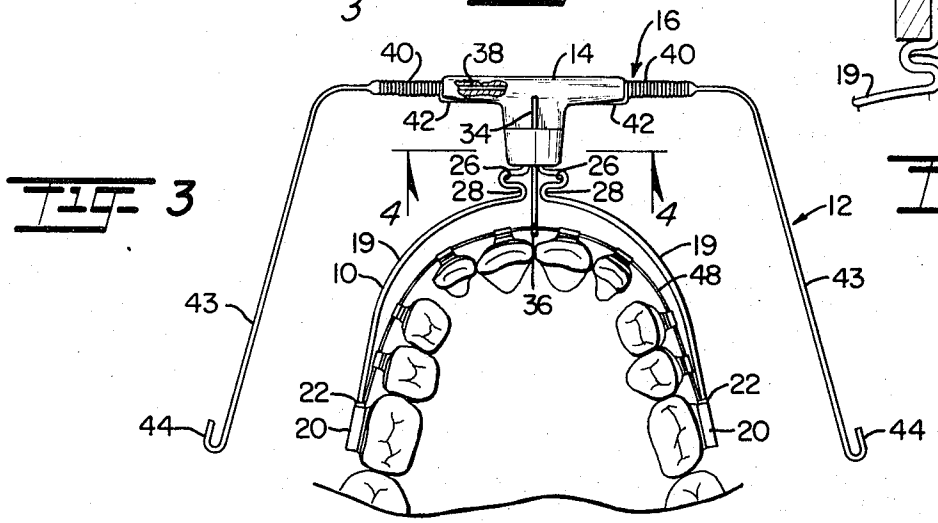



FIG. 3

# ORTHODONTIC DEVICE

## BACKGROUND OF THE INVENTION

In the art of correcting malocclusions of the teeth, one of the techniques employed by orthodontists is the use of a face bow which comprises an inner, intra-oral, or buccal bow wire affixed to the teeth which is connected at its midpoint to an outer or extra-oral bow having legs which extend around the cheeks, their ends being connected to headgear, such as a neck or occipital band or a high pull head gear, which applies torsional and/or tractional forces to the teeth. Such devices are exemplified by the patents to Case U.S. Pat. No. 862,881; Rubin U.S. Pat. No. 3,429,044; Mathews U.S. Pat. No. 3,458,934 and others.

While devices of the foregoing type have certain recognized advantages over other devices, they lack versatility in that an optimum control of the forces on an entire dental arch or certain teeth of an arch cannot be attained since the force applied to the inner bow is essentially a plan force in a selected direction with respect to the plane of the outer bow.

## SUMMARY OF THE INVENTION

In accordance with this invention an orthodontic device is provided which forms a part of an orthopedic force-control head gear for applying both tractional and torsional forces to selected teeth. The device comprises an inner bow having spaced ends connectable to buccal attachments on posterior teeth, an outer bow having spaced ends connectable to the head gear and means connecting the inner bow to the outer bow at the center of each so that the inner bow is pivoted with respect to the outer bow. In addition, resilient means can form part of the connecting means for interconnecting the inner and outer bows for applying a torsional force to the posterior teeth when the ends of the inner bow are connected to the buccal attachments and the ends of the outer bow are connected to the head gear.

More specifically, the orthodontic device includes an inner bow lying in a first plane and having spaced ends connectable to buccal attachments on posterior teeth. The inner bow includes means for attaching the inner bow at the center thereof to a connector comprising first and second spaced S-shaped segments extending from the attaching means and first and second arcuate segments extending respectively from the S-shaped segments to the ends, the arcuate segments being curved to extend around the teeth so that the ends are connectable to the buccal attachments, the S-shaped segments providing means for distorting the inner bow so that the arcuate segments do not lie in a common plane to apply unequal torque to the buccal attachments. In addition, the S-shaped segments make it possible to spread one or both legs of the inner bow in or out to apply an inwardly or outwardly pressure on the teeth to correct cross bite. Conveniently, the connector is rotatably mounted about an axis on the outer bow, which normally lies in a second plane. The axis is illustrated as being at the intersection of the first and second planes and has ends extending outwardly from the center of the outer bow. In addition, there is means on the connector intermediate the ends thereof for detachably connecting the inner bow to the outer bow and first and second coil springs around the other bow at opposite ends of the connector, each spring having one end



fixedly connected to the outer bow and each having second ends interconnecting each other by an integral bridge wire engageable by the connector so that by rotating the connector about the outer bow a torsional force is applied by the coil springs to the connector and the inner bow. In addition, an anterior clip having a first end attachable to the connector can be provided at the center thereof so that the clip extends in the direction of the ends of the inner bow and intermediate thereof and has a second end for attachment to the center of an arch wire attached to the teeth. Advantageously, the foregoing described apparatus provides a versatility heretofore unknown. With the anterior clip removed, the device can be used to either extend or depress posterior teeth by means of the torsional forces applied through the spring. With the anterior clip in position, and if adjusted so that all forces are applied by the spring through the hinge connection between the inner bow and outer bow, the torsional forces applied by the spring can be used to extend both posterior and anterior teeth or to depress both posterior and anterior teeth depending on the orientation of the device on the patient, as described more fully below. On the other hand, if the device is adjusted so that the inner bow pivots about the connection between the anterior clip and the arch wire the device can be used to extend the posterior teeth and depress the anterior teeth or conversely to depress the posterior teeth and extend the anterior teeth. In addition, a torsional force can be applied through the anterior clip to the anterior teeth to cause either an inward or outward movement thereof.

Finally, the particular structure of the anterior bow, as described above, can be used to cant the posterior teeth or to widen or narrow the arch as will be more fully described below.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation showing the orthodontic device of this invention in position on a patient;

FIG. **2** is an enlarged side elevation showing the connection of the inner bow of the invention to a tooth arch;

FIG. **3** is a bottom plan as viewed in the direction of arrow **3** of FIG. **2** showing further details of the invention;

FIG. **4** is a section taken on line **4—4** of FIG. **3** showing the connection of the inner bow and the anterior clip; and

FIG. **5** is a section taken on line **5—5** of FIG. **4** showing further details of the inner bow attachment.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the drawing, the components of the invention comprise, briefly, an inner bow **10**, an outer bow **12**, a connector **14** between the inner and outer bows, a spring **16** for producing a torque force between the outer and inner bows, and a neck or cervical band **18** for applying traction forces to the ends of the outer bow, each of which will be described in detail. Although the invention has been described as being applied to the upper teeth it will be understood that it can just as easily be applied to the lower teeth and although a cervical band has been illustrated it is readily apparent that any suitable head gear may be utilized. However, one of the important features of the invention is the fact that a great variety of tooth movements can be

accomplished without the necessity of employing a variety of head bands, and thus it is contemplated that the neck band would normally be used.

Inner bow **10** is arch shaped, having arcuate segments **19** with free ends which slideably telescope within buccal tubes **20.** Collars **22,** which may be welded or soldered to the bow, providing abutments for applying rearward forces on the front ends of the buccal tubes. The central portion of bow **10,** as best shown in FIGS. **3** to **5,** is provided with a U-shaped tongue **24,** the ends of the legs of which join lateral U-shaped bends **26,** the latter being joined to the arch wire by U-shaped bend **28** so that an S-shaped configuration is provided between the tongue **21** and each arcuate segment **10.** All parts of the arch wire normally lie in a plane but portions may be distorted out of the plane, when desired, as will subsequently appear.

Connector **14** is provided with a slot **30** which slideably receives tongue **24,** the connector abutting bends **26** for applying a rearward force to the inner bow. An aperture **32** slideably receives a rod **34** having a hook **36** at the inner end thereof, the purpose of which will be subsequently described. A transverse aperture **38** extends throuh the connector which rotatably receives the central portion of outer bow **12.**

Spring **16** comprises two coil springs **40,** the outer ends of which are secured to the outer bow by welds or solder, their inner ends being connected together by a bridge stop wire **42** which may engage the connector in two alternate positions as will subsequently be described. As will be apparent, spring **16** is a torsion spring for applying torque from the outer bow to the connector and the inner bow secured to the latter. The ends **43** of the outer bow are provided with hooks **44** for securing it to neck band **18.**

Neck band **18** is formed of resilient material, such as rubber, which carries a buckle **46** at each end thereof, the buckles preferably being of the conventional slideably adjustable type which may be positioned at desired positions on the band to thereby adjust band tension. As will be apparent, the buckles engage hooks **44** on the outer bow. It is understood that it is not necessary for the entire neck band **18** to be made of resilient material but only the end portions thereof need be so made or the neck band could be connected to outer bow **12** by resilient means, such as rubber bands, which would replace buckles **46** as is well understood by one skilled in the art.

If the device is to be used to apply an upwardly or depressing force on the posterior teeth, the inner bow is inserted in the buccal tubes **20.** Then the connector is attached to the inner bow by sliding slot **30** over tongue **24.** The connector is oriented so that bridge **42** of spring **16** abuts the bottom surface of the connector and the outer bow **12** is in an approximate horizontal position and extending outwardly from the inner bow at approximately 180° thereto. The outer bow then is rotated downwardly and rearwardly about 160° to 180° to the position shown in FIG. **1** and its hooks are attached to the neck band buckles **46.** Assuming that anterior clip **34** is not in place and is not attached to tooth bridge wire **48,** forces are applied soley to buccal tubes **20.** These forces comprise a rearward traction force in the plane of inner bow **10** and also a torque due to torsion spring **16** to translate and also depress the posterior teeth. When clip **34** is in place and hook **36** is secrued to the insical side of the arch wire **48** the traction force is still in the plane of the inner bow but hook **36** will now apply an upward force to the arch wire to depress all the teeth to which the arch wire is connected. However, if the clip is turned upside down to reverse hook **36** so that it engages the gingival side of arch wire **19** and if sufficient tension is applied to outer bow **12** by bands **18,** the fulcrum of the device shifts from the pivot axis of the connector to the connection between hook **36** and arch wire **48.** In this case, a downward or extending force is applied to the anterior teeth by clip **34** and an upward or depressive force is applied to the posterior teeth.

If it is desired to reverse the forces exerted by the torsion spring, the connector is removed from tongue **24,** rotated 180° and reapplied thereto. Torsion spring bridge wire **42** will now be at the top of the connector. Outer bow **12** is rotated upwardly and rearwardly and attached to neck band **18,** as before. Now a downward or extending force is applied to the posterior teeth. When the outer bow is disposed in this position and anterior clip **34** is used and positioned in so that hook **36** engages the gingival side of arch wire **19,** hook **36** will normally apply a downward force to arch wire **48** causing all teeth attached thereto to be extended. If the tension is such that the device is to pivot about the connection between hook **36** and arch wire **48,** the clip is turned so that hook **30** engages the insical side of the arch wire so that an upward or depressive force will be applied to the anterior teeth while spring **16** still applies a downward or extending force to the posterior teeth. For this use of the invention a high pull head gear would be used. Obviously, the device can be used on the lower teeth as will be apparent to one skilled in the art.

As so far described, the forces applied to the buccal tubes are the same. In some instances it is desired to apply unequal forces to provide a canting action on the tooth bridge. To attain this, portions or all of wire assembly **24, 26, 28** may be axially twisted away from the plane of inner bow **10.** Since tongue **24** is non-rotatable in slot **30,** this applies a torque to the inner bow around its longitudinal central axis, effecting unequal torque forces on the buccal tubes. By looking at FIG. **3,** it can be seen that the spacing arcuate segments **19** can effect the direction of rearward movement of the posterior teeth to which buccal tubes **20** are attached. For example, if the arcuate segments **19** are squeezed closer together the effect would be to cause the posterior teeth to move backwardly and inwardly with respect to the arch to narrow the same. Conversely, if the arch wires are sprung outwardly the posterior teeth can be caused to move outwardly to widen the arch. Conveniently, the novel S-shaped connection between tongue **24** and arcuate segments **19** facilitates the bending or twisting of the arcuate wires to accomplish such result as well as the canting of the inner bow to provide unequal forces as described above or to apply either an inward or outward force on one or both sides by bending the ends of the inner bow inwardly or outwardly, respectively.

The traction force on the inner bow may be adjusted by moving the buckles on the neck band. The torque forces on the inner bow may be varied by choice of the spring constant of spring **16.** For example, if greater torque is desired, a spring of greater spring constant is employed.

From the foregoing it can be seen that by suitable positioning of an assembly of an outer bow, connector and inner bow when used in an orthopedic force-control head gear, selection of an appropriate torque spring constant in the connector, and proper selection of distortion of the central portion of the inner bow, various forces can be applied to the teeth to accomplish the following functions: tipping of the entire maxilla; depression of the anterior teeth and elongation of the posterior teeth at the same time; elongation of the anterior teeth and depression of the posterior teeth; and depression or elongation of the entire maxilla. Also, these various drives may normally be attained by cervical pull, only, obviating cumbersome head gear formerly employed for high pull, straight pull, etc. The inner bow may be constructed to one standard length and the sleeves thereon which abut the buccal tubes may be secured in desired initial position. As the teeth move back, for example, other sleeves may be added to the inner bow. The construction of the connector is also such that no irritating contact occurs at the corners of the mouth, which has previously occurred with some connectors.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but is will be understood that variations and modifications can be effected within the spirit and scope of the invention.

What is claimed is:

**1.** An orthodontic device for use with a head gear for applying both tractional and torsional forces to selected teeth, said device comprising:

an inner bow lying substantially in a first plane and having spaced ends connectable to buccal attachments on posterior teeth;

an outer bow lying substantially in a second plane and having spaced ends connectable to the head gear;

means pivotally connecting said inner bow to said outer bow at the center of each so that said inner bow is pivotal with respect to said outer bow about an axis lying in at least one of said first and second planes; and

resilient force-applying means connected between said inner and outer bows applying a torsional force about said axis to said inner bow and to the posterior teeth when the ends of the inner bow are connected to the buccal attachments and the ends of the outer bow are connected to the head gear.

**2.** An orthodontic device, as claimed in claim **1**, wherein:

said resilient means is a spring.

**3.** An orthodontic device, as claimed in claim **1**, wherein said connecting means further includes:

a connector rotatably mounted on said outer bow about said axis and having ends extending outwardly from the center of said outer bow along said axis;

means on said connector intermediate said ends for detachably connecting said inner bow to said outer bow; and said resilient means comprises:

first and second coil springs around said outer bow at opposite ends of said connector, each spring having one end fixedly connected to said outer bow and each having second ends interconnected with each other by an integral bridge wire engageable by said connector so that by rotating said connector about said outer bow on said axis a torsional force is applied by said coil springs to said connector and said inner bow.

**4.** An orthodontic device, as claimed in claim **1**, wherein said inner bow comprises:

means for attaching said inner bow at the center thereof to said connecting means;

first and second spaced S-shaped segments extending from said connecting means and lying substantially in the first plane; and

first and second arcuate segments also lying substantially in the first plane and extending, respectively, from said S-shaped segments to said ends, said arcuate segments being curved to extend around said teeth so that said ends are connectable to the buccal attachments, said S-shaped segments providing means for distorting said inner bow to apply additional forces to the buccal attachments.

**5.** An orthodontic device for attachment between a head gear and buccal attachments on posterior teeth, said device comprising:

an outer bow having ends connectable to a head gear; and

an inner bow lying substantially in a plane which includes:

means at the center thereof connecting said inner bow to the center of said outer bow;

first and second spaced S-shaped segments extending from said connecting means and lying substantially in the plane; and

first and second arcuate segments lying substantially in the plane and extending, respectively, from said S-shaped segments to said ends, said arcuate segments being curved to extend around said teeth so that said ends are connectable to the buccal attachments, said S-shaped segments providing means for distorting said inner bow to apply additional forces to the buccal attachments.

**6.** In an orthodontic device having an outer bow lying substantially in a first plane with ends connectable to a head gear and an inner bow lying substantially in a second plane and connected at its center to the center of said outer bow, said inner bow having spaced ends connectable to buccal attachments on posterior teeth for applying torsional and tractional forces thereto, the improvement comprising:

means for pivotally connecting the center of said inner bow to the center of said outer bow for rotation of said inner bow with respect to said outer bow about an axis lying in at least one of said first and second planes; and

resilient force-applying means connected between said inner and outer bows applying a torsional force about said axis to said inner bow and to the posterior teeth when the ends of the inner bow are connected to the buccal attachments and the ends of the outer bow are connected to the head gear.

**7.** In an orthodontic device, as claimed in claim **6**, wherein:

said resilient means is a spring.

**8.** In an orthodontic device, as claimed in claim **6**, said connecting means further including:

a connector rotatably mounted on said outer bow about said axis and having ends extending outwardly from the center of said outer bow along said axis;

means on said connector intermediate said ends for detachably connecting said inner bow to said outer bow; and said resilient means comprises:

first and second coil springs around said outer bow at opposite ends of said connector, each spring having one end fixedly connected to said outer bow and each having second ends interconnected with each other by an integral bridge wire engageable by said connector so that by rotating said connector about said outer bow a torsional force is applied by said coil springs to said connector and said inner bow.

**9.** In an orthodontic device, as claimed in claim **6**, the improvement in said inner bow further comprising:

means for attaching said inner bow at the center thereof to said connecting means;

first and second spaced S-shaped segments extending from said connecting means and lying substantially in said second plane; and

first and second arcuate segments also lying substantially in said second plane and extending, respectively, from said S-shaped segments to said ends, said arcuate segments being curved to extend around said teeth so that said ends are connectable to the buccal attachments, said S-shaped segments providing means for distorting said inner bow to apply additional forces to the buccal attachments.

**10.** An orthodontic device for use with a head gear for applying both tractional and torsional forces to selected teeth, said device comprising:

an inner bow lying substantially in a first plane and having spaced ends connectable to buccal attachments on posterior teeth;

an outer bow lying substantially in a second plane and having spaced ends connectable to the head gear;

a connector rotatably mounted on said outer bow about an axis lying in at least one of said first and second planes and having ends extending outwardly from the center of said outer bow along said axis;

means on said connector intermediate said ends for detachably connecting said inner bow to said outer bow;

first and second coil springs around said outer bow at opposite ends of said connector, each spring having one end fixedly connected to said outer bow and each having second ends interconnected with each other by an integral bridge wire engageable by said connector so that by rotating said connector about said outer bow on said axis a torsional force is applied by said coil springs to said connector and said inner bow; and

an anterior clip having a first end attachable to said connecting means at the center thereof so that said clip extends in the direction of the ends of the inner bow and intermediate thereof and has a second end for attachment to the center of an arch wire attached to the teeth.

* * * * *