June 1, 1965

S. ASHER

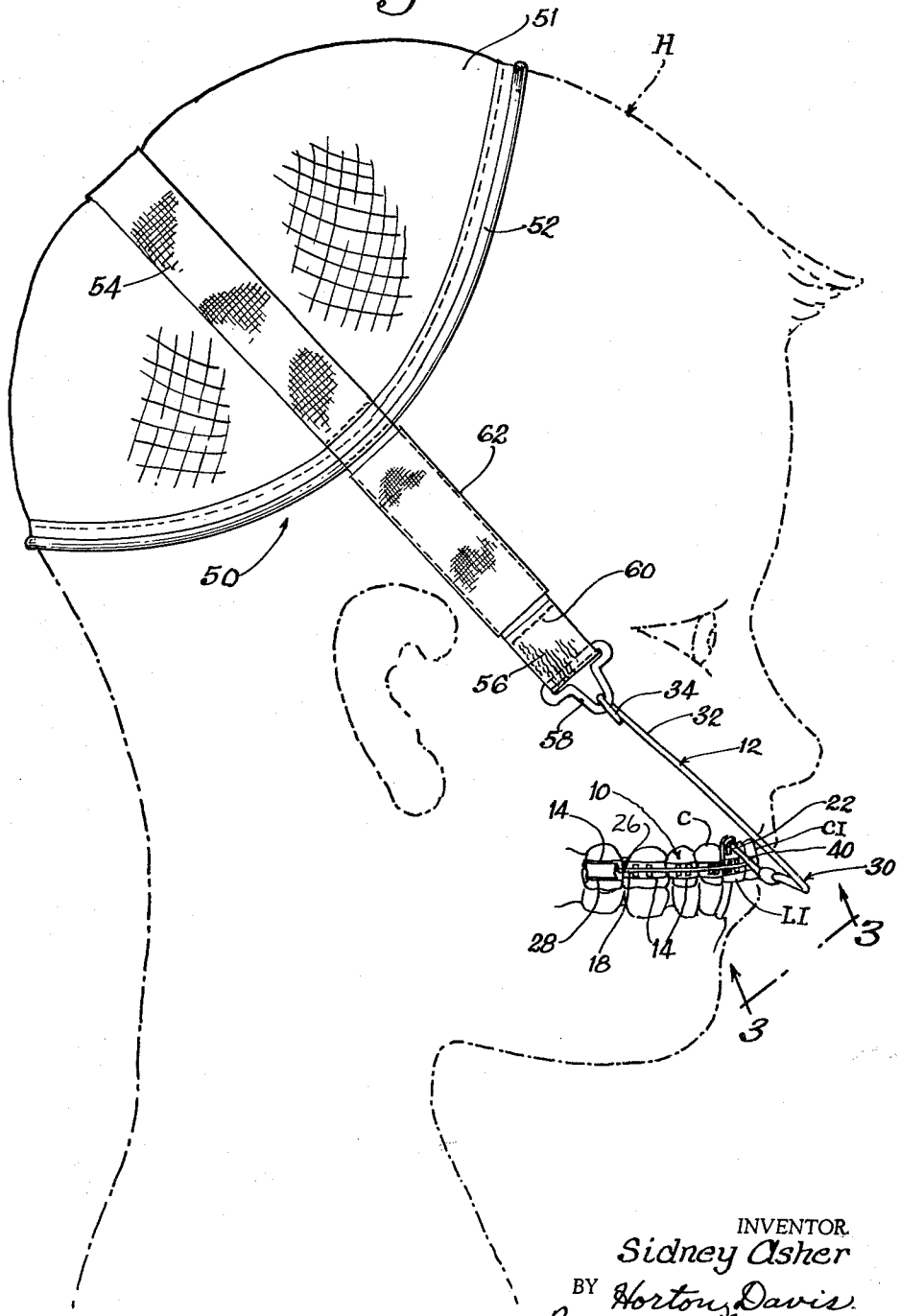
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ORTHODONTIC FORCE SYSTEM UTILIZING A FACE-BOW AND ARCH WIRE HOOKS

Filed June 20, 1962

2 Sheets-Sheet 1

Fig. 1



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Fig. 2

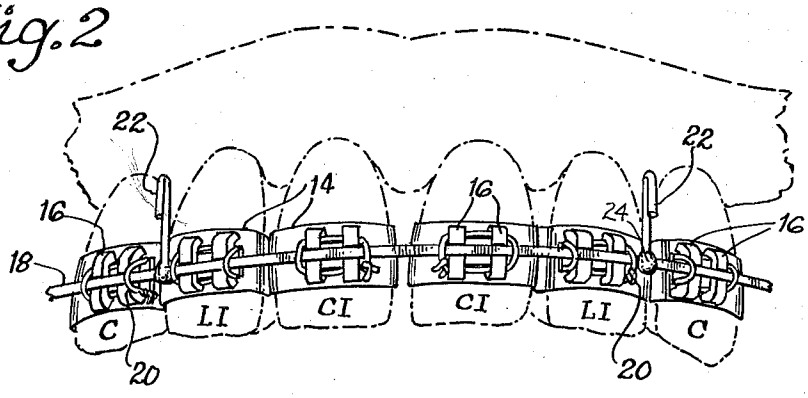


Fig. 3

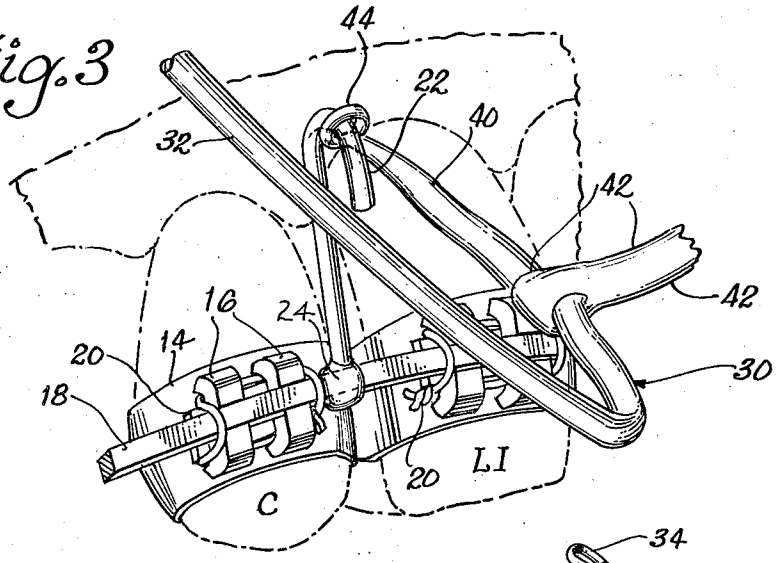


Fig. 4

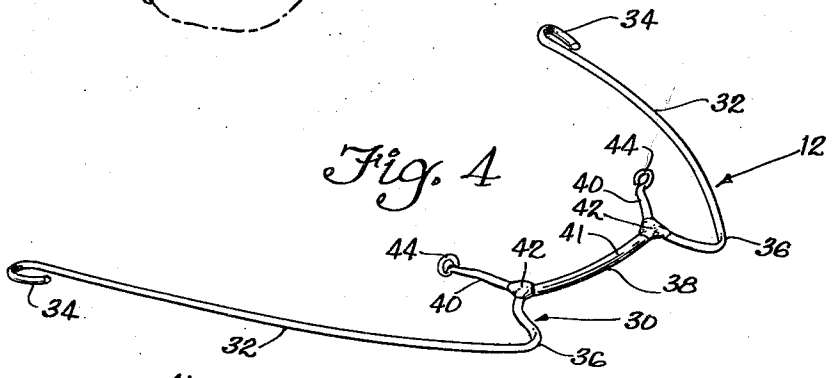
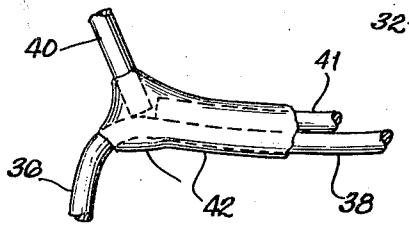


Fig. 5



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United States Patent Office 3,186,089 Patented June 1, 1965

3,186,089

ORTHODONTIC FORCE SYSTEM UTILIZING A FACE BOW AND ARCH WIRE HOOKS

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Filed June 20, 1962, Ser. No. 203,853
8 Claims. (Cl. 32—14)

This invention relates to novel and improved orthodontic methods and means for correcting and finishing the alignment and positioning of the upper teeth at the beginning, during or at the end of orthodontic treatment.

For many years orthodontic arches, colloquially known as "braces," have been applied to patients' teeth by orthodonists and by dentists to correct a variety of conditions. By making adjustments in selected parts of the arches and by using various supplemental tools and appliances, orthodonists and dentists have been able to effect changes in patients' mouths when changes are necessary from a functional viewpoint or desirable from a cosmetic or aesthetic point of view.

This invention contemplates the use of a novel "face-bow" designed to bring about dramatic changes in a number of types or classes of malocclusion.

A face-bow can be described generally as a device which is adjusted periodically by an orthodontist and which is readily and easily attachable to, and removable from, an orthodontic arch by the patient himself. A face-bow is constructed so that it extends outside of the patient's mouth and is fastened around the patient's neck or the back or top of the patient's head where it is activated by a neck strap or a head harness. In most cases a face-bow is used at night and in the privacy of a patient's home. In severe cases the face-bow can be worn around-the-clock, particularly the first three to six months of treatment.

One of the principal corrective techniques with which this invention is concerned is that of correcting cases of deep overbite, such a maxillary protrusion cases, commonly known as "buck teeth."

Another primary technique with which this invention concerns itself is that of flattening the occlusal plane where a patient's occlusal plane is pitched steeply downwardly. By a steep downward pitch is meant the fact that the plane in which a patient's teeth occlude is one which is angled sharply downwardly from the posterior to the anterior regions of the patient's mouth. By reducing the downward slope of the plane of occlusion the final occlusion achieved by various corrective techniques tends to be more stable and more permanent as well as providing a more aesthetic occlusion.

Additionally, by following the teachings of this invention, distal driving (the rearward driving of crowns and roots of the teeth) may also be accomplished.

By using the novel means described herein it is possible to secure more effective, more uniform, more positive and more permanent correction of a deep overbite case than has been possible in the past. In part this is because stronger forces may be employed to bring about a change and modification of the maxillary bone structure achieving orthopedic-orthodontic results.

It is therefore an object of this invention to provide novel, more effective means for repositioning the teeth and relocating the occlusal plane in cases of deep overbite and in maxillary protrusion cases.

It is a further object of this invention to provide novel and more effective means for realigning and flattening the occlusal plane where it is pitched steeply downwardly.

Further within the purview of the invention is the provision of novel means which may provide distal driving either alone or in combination with other corrective techniques, such as the correction of cases of deep overbite and cases of maxillary protrusion.

Yet another object of this invention is to provide a unitary face-bow connectable to an orthodontic arch at two spaced points, through which face-bow strong, vigorous forces may be transmitted through the roots of the teeth to the maxilla, the upper jaw-bone, whereby the maxillary bone structure may be modified and structurally changed to assist in bringing about a more permanent and a better ultimate occlusion, and a more aesthetic appearance of the teeth and jaws.

Another object of this invention is to provide a novel method of torquing the roots of the upper anterior teeth lingually.

A further object of this invention is the provision of a novel method of correcting malocclusion and of physically changing the maxillary bone structure. That method contemplates the transmission of strong, vigorous forces through a face-bow to the teeth of a patient wearing an orthodontic arch whereby the shape of the maxilla is structurally modified.

Still further objects and advantages of this invention will become apparent from the following description and drawings of which:

FIG. 1 is a side elevational view of a presently preferred embodiment showing the face-bow of this invention in operative relationship to an orthodontic arch;

FIG. 2 is a partial enlarged front perspective view of a portion of the orthodontic arch;

FIG. 3 is an enlarged fragmentary perspective view of a portion of FIG. 1 taken generally in the direction indicated by line 3—3;

FIG. 4 is a preferred embodiment of the face-bow of this invention which is suitable for use in combination with an orthodontic arch and a neck strap or head harness for exerting forces against a patient's teeth to correct various types of malocclusion; and

FIG. 5 is an enlarged fragmentary plan view of a portion of the face-bow of FIG. 4.

Referring first to FIG. 1, a patient's head H, in phantom, is shown as having the face-bow of this invention fitted thereto. For convenience of illustration and description, the six upper anterior teeth have been designated (in FIG. 2) by the letters CI (central incisors), LI (lateral incisors) and C (canines).

FIG. 1 includes generally an orthodontic arch **10** and the face-bow **12** of this invention. Orthodontic arch **10** includes a plurality of tooth bands **14** secured to the teeth. Each of the bands **14** is provided at its front with a bracket **16**. Brackets **16** includes upper and lower outwardly extending bracket elements each of which elements is divided into two horizontally spaced segments.

The orthodontic arch wire (arch wire) **18** is disposed between the upper and lower bracket elements of brackets **16**. The arch wire illustrated is rectangular in cross-section and is proportioned with respect to the brackets **16** so that it fits snugly between the upper and lower bracket elements. The facing surfaces of the forwardly extending bracket elements, that is, the opposed surfaces against which arch wire **18** is disposed are generally flat and parallel to each other to assist in maintaining a snug fit between the bracket elements and the arch wire. However, round arch wires may be used for certain techniques and particularly at the beginning of treatment.

In fact with most techniques it is desirable to initiate treatment with round arch wires. After an initial leveling off of the teeth and after the brackets of the teeth are generally coplanar so that bracket engagement is easily made with rectangular arch wires, a rectangular arch wire may be substituted where techniques such as torquing and reshaping of the maxilla are employed. A round wire may be used throughout treatment where just distal driving or leveling of the teeth is desired. As will become apparent when light round wires are employed, lighter forces

are used. With rectangular wires and with heavy round wires, heavier forces than those presently used may be employed.

To retain arch wire 18 between the bracket elements, it is tied to each bracket 16 by a tie wire 20. Tie wires 20 are looped around the arch wire and tied to brackets 16 in a conventional manner readily discernible from FIGS. 2 and 3.

At each side of arch wire 18 an upwardly extending hairpin hook 22 is provided. As shown in FIG. 1, hooks 22 are located generally between the lateral incisors and canines in the vestibule of the mouth. Hooks 22 are soldered to arch wire 18 by silver solder 24 which provides a rigid joint between the arch wire 18 and the hooks 22. If it is necessary, bends in the upstanding arms of the hairpin hooks 22 may be made to insure the seating of hooks 22 in the vestibule of the mouth.

At tooth bands 14 on two of the molar teeth, the ends of the arch wire are provided with stops such as bayonet bends in the arch wire which prevent posterior movement of the arch wire with respect to molar tubes 28 which are connected to those bands in any conventional manner. The very ends of the arch wire, the portions disposed rearwardly of the stops, are slidably disposed within the molar tubes.

Face-bow 12 of this invention comprises a continuous frame 30. Frame 30 consists of several portions including two rearwardly extending arms 32 having hooks 34 at their ends. Frame 30 also includes two U-shaped segments 36 connected through central portion 38. Near the intersection of the U-shaped segments 36 and central portion 38 face-bow levers 40 are located. Between face-bow levers 40 and adjacent central portion 38 a length of reinforcing wire 41 is provided. That wire 41, the central portion 38 and levers 40 are welded to each other, the levers having their ends connected adjacent the intersections of the U-shaped segments and the central portion. The levers additionally are brazed at the central portion with silver solder 42. In addition to providing the medium for brazing levers 40 adjacent central portion 38, silver solder 42 which extends across the entire central portion, functions to stiffen and assist reinforcing wire 41 in reinforcing central portion 38 so that that portion will not bend when forces substantially greater than those ordinarily used in orthodontic corrective techniques are exerted against it.

Each lever 40 terminates in a tapered portion of gradually diminishing diameter. Most of that tapered portion is utilized to form a loop 44 at the very end of the lever. Although it is apparent from FIG. 4 that the reinforced central portion 38 is not exactly straight, it can be said that loops 44 lie in a plane generally parallel to the axis of the central portion 38 and generally normal to the plane in which levers 40 lie. The configuration of loops 44 is best seen in FIGS. 3 and 4, and as there shown loops 44 are constructed to engage and remain in engagement with hairpin hooks 22. It is through hooks 22 that the forces exerted by the face-bow are transmitted to the arch wire, thence to the teeth and their roots and on to the maxilla where desired.

To support and hold face-bow 12 in a predetermined operative relationship with respect to the arch wire 18, and to activate the face-bow a head harness 50 is provided.

Head harness 50 includes a cap 51 fabricated of a loose mesh or netting such as a nylon netting. Piping 52 surrounds the perimeter of cap 51 to finish it. Adjacent the center of the cap and extending laterally and across the cap and connected thereto is a narrow strip 54 of stout non-stretchable material such as a 1" strip of grosgrain. Strip 54 terminates at each side adjacent the perimeter of the cap and provides the main force bearing portion of the head harness. The cap portion serves to assist in maintaining predetermined positioning of the strip 54.

Strip 54 also provides the means for connecting elastic tension exerting straps 56 to the head harness. Each strap 56 is sewn to strip 54 and extends downwardly as is seen in FIG. 1. The lower ends of tension exerting straps 56 are connected to strap hooks 58. The length of the straps 56 may be varied as desired to give the indicated degree of tension or pull. When the proper length has been determined portions of the elastic straps 56 will overlie other portions and may then be connected to each other such as by stitching 60 or stapling. Satin sleeve 62 disposed to surround straps 56 are slidably mounted on those straps and are utilized as the portions of the head harness which bear against the sides of the face and which prevent abrasion of the face by straps 56.

Strap hooks 58 provide the medium for connecting hooks 34 of face-bow 12 to the head harness for exerting tension in the arch wire. The degree of tension desired may be varied by increasing or decreasing the lengths of straps 56 in the manner described. Substantial strong, vigorous forces may be used when modification of and change in the configuration of the maxilla itself is desired, while lesser forces may be used to secure some of the other types of correction discussed herein. However, the threshhold of pain limits the amount of force which may be used. At no time should there be any pain with the use of the face-bow of this invention.

Although the orthodontic arch has been described in some detail, the arch used in the practice of this invention need not be identical to that shown. A variety of arches may be used and may be fitted in any manner familiar to those of ordinary skill in the art. While the embodiment illustrated has an arch wire rectangular in cross-section, round arch wires may also be used at various stages of treatment or with other techniques.

The forces necessary to carry out the corrective techniques described herein are imparted to the teeth through a suitably adjusted face-bow 12. A face-bow embodying the principles of this invention is shown in FIG. 4 and is fabricated from a 304 stainless steel 0.061" frame wire 30, 304 stainless steel 0.050" levers 40, a 304 stainless steel 0.045" reinforcing wire 41, and silver solder 42 to assist in connecting the elements and to aid in reinforcing the central portion 38. The tapered ends of levers 40 are formed into loops 44 providing openings large enough to receive and accommodate hooks 22.

A denist or orthodontist desiring to correct a case of deep overbite, wishing to flatten a steeply pitched occlusal plane, desiring to modify the maxillary bone structure or desiring to torque the roots of the upper anterior teeth, in accordance with this invention, after fitting a patient for an orthodontic arch, should make certain that hairpin hooks 22 are connected to the arch wire 18, preferably between the lateral incisors and the canines, and that those hooks are disposed in the vestibule of the patient's mouth where they do not adversely affect the patient's gums, lips, or teeth. Since the forces exerted against the hairpin hooks 22 will be of some magnitude, the larger their diameter and the stronger the material from which they are made, the more useful they will be and the less will be the chance that they will be distorted. Stainless steel 304 wire having a diameter of from about 0.030" will be satisfactory for this purpose.

Having prepared the orthodontic arch itself, the dentist or orthodontist should then secure a face-bow embodying this invention. Once such a face-bow has been obtained, it will be necessary to make certain final adjustments in it so that it may be fitted to an individual patient. The orthodontist should take into consideration, among other things, the shape of a patient's mouth, the size of his head, the shape and dimensions of the patient's lips and the size and spacing of his teeth. Additionally, for example, because the spacing between hooks 22 is relatively fixed, it may be necessary to adjust the spacing between loops 44 so that loops 44 and hooks 22 will engage each other. That may be accomplished by spreading or by bringing together slightly the loop ends of levers 40. Or, for example, it may be desirable to alter the angular

relationship between the lever axes and the planes in which the loops **44** lie.

The nature of the changes to be made will be apparent from the description herein, and depend in part upon the techniques practiced and the results desired.

The corrective techniques, those of correcting deep overbites and flattening steeply pitched occlusal planes, with which this invention is particularly concerned requires a vertical component of force to be exerted against hooks **22**. That vertical component tends to drive the upper teeth, particularly the anterior teeth, upwardly.

As will be appreciated from the foregoing description, a horizontal component of force is also exerted against the teeth by the face-bow. The horizontal component drives the teeth distally, that is rearwardly and also affects torquing of the upper anterior teeth.

When a "high-pull" is used, that is a pull which exerts substantial vertical and horizontal components of force against the crowns and roots of the teeth through the arch wire, both distal and upward driving of the teeth is accomplished. Torquing also occurs.

If the orthodontist wishes to utilize the face-bow of this invention to assist in torquing he should first make compensatory torquing bends in a rectangular arch wire just distal of the upstanding hairpin loops, then insert the arch wire and finally tie it into the brackets. Then by utilizing the face-bow with a high-pull and very light tension, torquing can be accomplished efficiently in one-third the time usually required with known methods and appliances.

With previous "high-pull" techniques and with known appliances for bringing about high-pull, it has not been possible to exert effective pressures in excess of a few ounces. With the face-bow described herein, strong, vigorous forces, that is forces in excess of one pound, may be applied. By using the teeth and their roots as levers, and by using forces of such magnitudes, the orthodontist is enabled to exert pressures sufficient to alter and to physically modify the maxillary bone structure so that the shape of the maxilla is gradually and permanently changed.

Because the face-bow of this invention embodies a rigid reinforced central portion and incorporates stout rearwardly extending levers which are relatively immobile with respect to the central portion, the orthodontist is enabled to treat the entire maxilla as a unit to facilitate its permanent reshaping and modification whereby a more permanent correction of malocclusion and a more aesthetic appearance is obtained.

By permanently altering the maxilla, it is frequently possible to bring about permanent and complete correction in very deep overbite cases, something very difficult or almost impossible with prior corrective appliances and techniques. Of course, the younger the patient involved, the greater the degree to which, and the speed with which, structural changes in the maxilla may be made. Patients of from eight to eleven years of age will respond most rapidly.

While the upper six anterior teeth, in accordance with this invention, are acted upon most directly, when they are relocated or when structural changes are made in the maxilla, so also is the location and orientation of the upper posterior teeth affected. Usually at least some distal driving of the posterior teeth is brought about by the pressure exerted against those teeth by the anterior teeth as they are moved rearwardly during the period of correction.

The magnitude of the vertical component of force with respect to the horizontal component of force may be varied in several ways. First of all, the angle of pull of tension-exerting straps **56** in part determines the angle at which loops **44** push against hooks **22**. Thus, the steeper the slope of straps **56**, the greater will be the vertical component, and vice versa. So also can be angle of divergence between the plane in which levers **40** and

the plane in which frame **30** lies be altered to vary the relative magnitudes of the two components of the resultant. It is for the orthodontist or dentist to decide just how much upward driving with respect to the degree of distal driving he desires in any given patient's case and then to determine the most efficacious manner of exerting those forces through the face-bow of this invention.

The unitary face-bow of this invention has a reinforced central portion which prevents that portion from buckling and the attendant disengagement of loops **44** from hooks **22**. The face-bow combines simplicity of operation with stability, and makes possible dramatic correction simply not possible with orthodontic appliances presently available. It provides means for accurately controlling the relative amounts of distal and upward driving an orthodontist wishes to induce, something which head harnesses utilizing separate tension-inducing arms cannot duplicate or provide.

The face-bow is far more comfortable than previously known orthodontic appliances for correcting cases of deep overbite and for flattening deeply pitched planes of occlusion because the U-shaped segments are mounted on a rigid and reinforced center and as such can be oriented and molded so that the corners of the patient's mouth are not compressed by the appliance. And, with but minor adjustments, the face-bow of this invention may be disposed so that the portions adjacent the patient's lips come out between the lips without either elevating or displacing the lips.

The face-bow head harness used in the practice of this invention may be a simple reinforced cap-like structure, far simpler than the more complicated and elaborate head harnesses required by conventional appliances which must be used to practice corrective techniques similar to those which may be practiced in accordance with this invention. The simpler elastic straps usable with this invention are capable of exerting, and are used to exert, substantially greater forces than it was possible to exert with ordinary rubber bands conventionally used with the complex head harnesses of the prior art.

In the embodiment illustrated and described, techniques utilizing both vertical and horizontal components of force have been discussed. In accordance with this invention, where indicated, distal driving alone may be accomplished. That may be done by substituting for head harness **50**, a neck strap, one that passes around a patient's neck rather than his head, and by orienting levers **40** so that substantially all of the force transmitted by them to the arch wire is exerted in a plane generally normal to the axes of the teeth. Distal driving may be accomplished through the medium of the hairpin hooks **22** shown in the illustrative embodiment and loops **44** at the ends of the face-bow levers. Similarly it is also possible to utilize hooks like hooks **22**, but which are attached to the arch wire in a downwardly extending position, to drive the teeth distally. In such a case a neck strap will be used to activate the face-bow.

Likewise distal driving of the teeth of the lower jaw, when an orthodontic arch is suitably connected to those teeth, may be provided through the face-bow described herein by affixing upstanding hooks, also similar to hooks **22**, to the lower arch wire. They then are adapted to engage loops **44** of a suitable adjusted face-bow of this invention. Again the face-bow would be activated by a neck strap. By utilizing the face-bow of this invention, distal driving may be accomplished more simply, more effectively, more comfortably and much more rapidly than with conventionally used devices.

The foregoing description of my invention will make obvious to others skilled in the orthodontic arts the fact that various changes may be made in the embodiments illustrated and described without departing from the spirit and scope of this invention.

I claim:

1. In a face-bow for transmitting horizontal and ver-

tical components of force to a patient's teeth through an orthodontic arch having hook elements connected thereto, a frame including two rearwardly extending arms each terminating in a hook at one end, U-shaped segments at the other ends of said arms, and an elongated rigid central portion connected to the U-shaped segments, spaced levers connected to the frame adjacent the central portion of said frame and extending rearwardly from said central portion, each of said levers being bent at its free end to form an unobstructed open loop, said loops lying in a plane substantially parallel to the axis of said central portion and substantially normal to the plane in which said levers lie, said loops being adapted to engage said hook elements.

2. The face-bow of claim 1 wherein the free ends of said levers gradually diminish in diameter.

3. The face-bow of claim 1 wherein the loops lie in planes angularly disposed with report to the axes of the levers.

4. In a unitary face-bow for transmitting horizontal and vertical components of force to a patient's teeth through an orthodontic arch having hook elements connected thereto, a unitary frame including two rearwardly extending arms each terminating in a hook at one end and an elongated reinforced central portion, spaced levers connected to the frame adjacent the reinforced central portion and extending rearwardly therefrom, each of said levers being bent at its free end to form an unobstructed open loop, said loops lying in a plane substantially parallel to the axis of said central portion and substantially normal to the plane in which said levers lie, said loops being adapted to engage said hook elements.

5. The face-bow of claim 4 wherein the loops lie in planes angularly disposed with respect to the axes of the levers.

6. An orthodontic appliance for relocating the teeth of a patient comprising an orthodontic arch having an orthodontic arch wire, hairpin hook elements connected to said orthodontic arch wire, unitary face-bow means having a reinforced central portion and having rearwardly extending lever members attached to said face-bow adjacent said central portion, said lever members terminating in loops at their free ends engaging said hairpin hook elements for exerting vertical and horizontal components of force against said hairpin hook elements, and means adapted to extend around the rear of the patient's head and releasably connected to said face-bow for exerting tension in said face-bow and for maintaining said face-bow in its operative hairpin hook element engaging position, whereby after an extended period of time the teeth of a patient utilizing the orthodontic appliance may be relocated.

7. The orthodontic appliance of claim 6 wherein the hairpin hook elements are vertically disposed with respect to the occlusal plane.

8. An orthodontic appliance for correcting malocclusion comprising an orthodontic arch including bands on a patient's teeth, an orthodontic arch wire connected to said bands, hook means connected to said orthodontic arch wire at two spaced points adjacent the upper anterior teeth, and a face-bow engaging said hook means for exerting horizontal and vertical components of force against the teeth, said face-bow comprising a frame including two rearwardly extending arms each terminating in a hook at one end, U-shaped segments at the other ends of said arms and an elongated reinforced central portion connected to the U-shaped segments, spaced levers connected to said frame adjacent the central portion thereof and extending rearwardly from said central portion, a loop at the free end of each lever, said loops lying in planes angularly disposed with respect to the axes of the levers and engaging said hook means, and means adapted to extend around the rear of a patient's head and connected to the frame hooks for exerting tensile force against said orthodontic arch and for maintaining said face-bow in its operative hook means engaging relationship with respect to said orthodontic arch, whereby after an extended period of time malocclusion may be corrected.

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RICHARD A. GAUDET, *Primary Examiner.*