

[54] **ORTHODONTIC TRACTION APPARATUS AND METHOD**

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

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

[58] **Field of Search**..... 32/14 D; 128/75

[56] **References Cited**

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Primary Examiner—Robert Peshock

Attorney—Irving Powers et al.

[57] ABSTRACT

Orthodontic traction apparatus for applying traction to the teeth of a patient, including tensioning means for attachment to an orthodontic instrumentality on the teeth adapted to be stretched to apply traction, a neckband or headgear worn by the patient for anchoring the tensioning means after it has been stretched, and fabric fastening material for securing the tensioning means to the neckband or headgear while maintaining a desired traction force on the tensioning means, and the method of utilizing this comprising connecting the tensioning means to the orthodontic instrumentality, pulling on the tensioning means with a force-indicating gage until a desired traction force as measured by the gage is applied, and then securing the tensioning means to the neckband or headgear by means of the fabric fastening material while maintaining the pull on the tensioning means.

13 Claims, 12 Drawing Figures

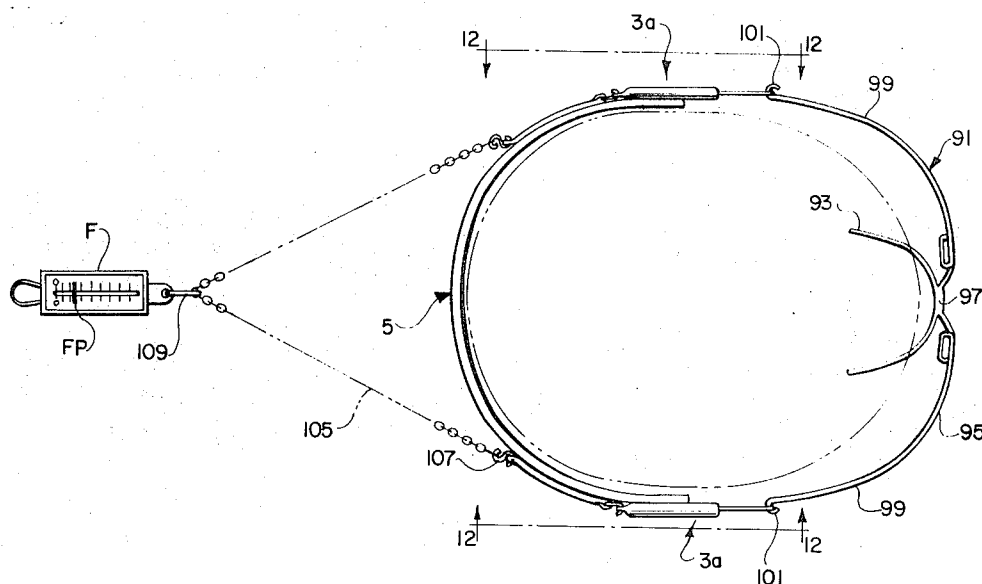


FIG. 1

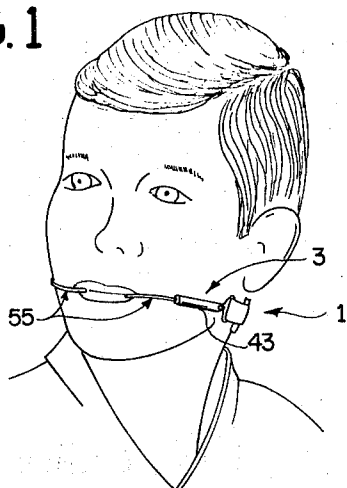


FIG. 2

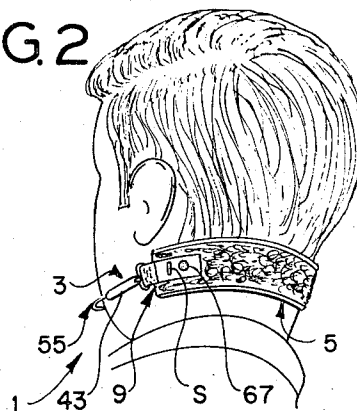


FIG. 3

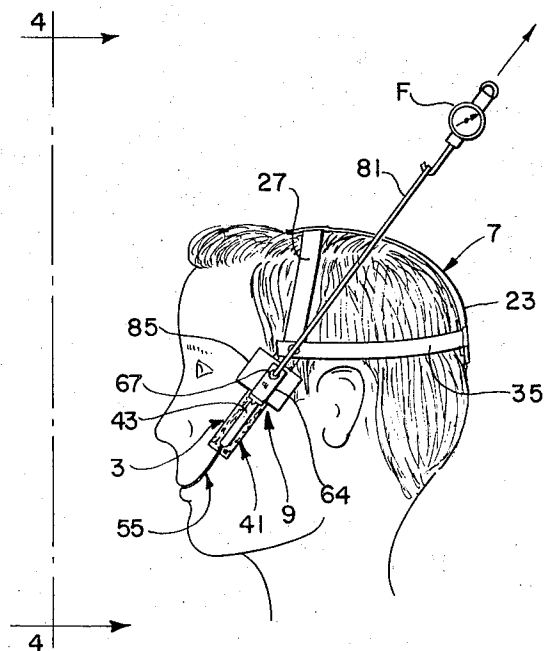


FIG. 9

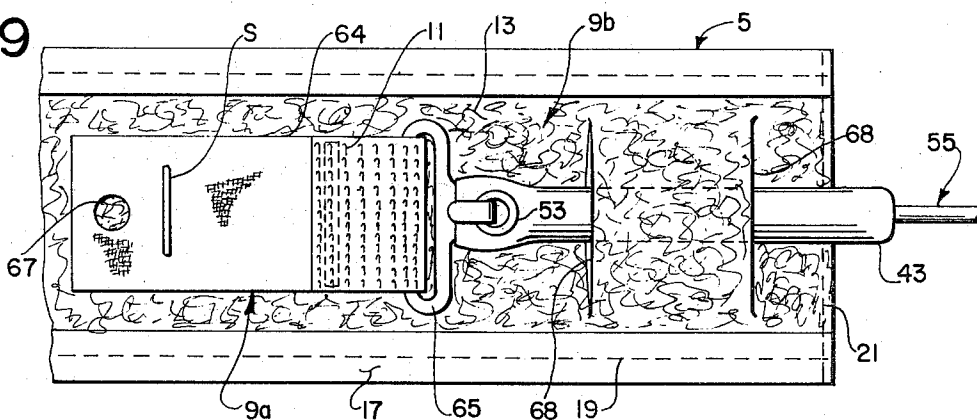


FIG. 8

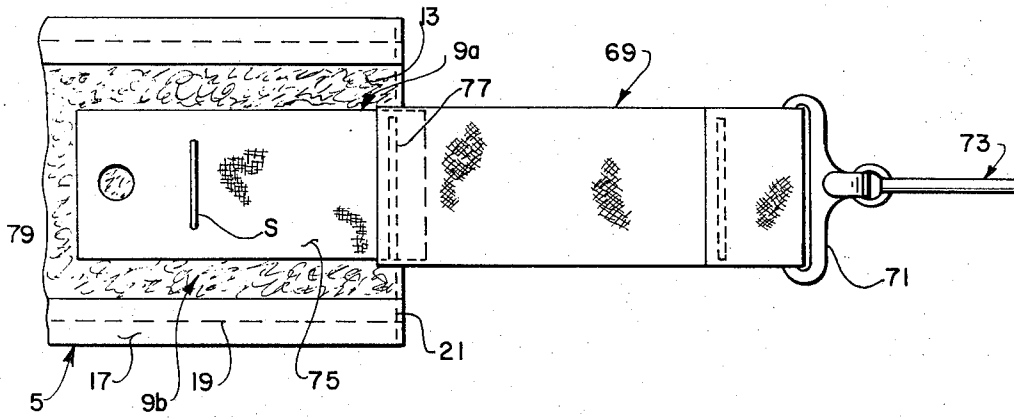
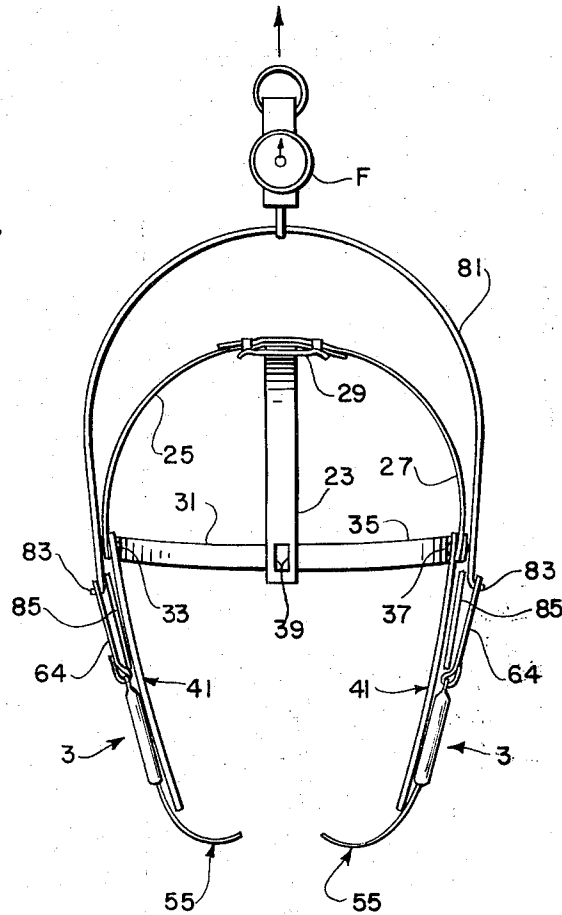


FIG. 4



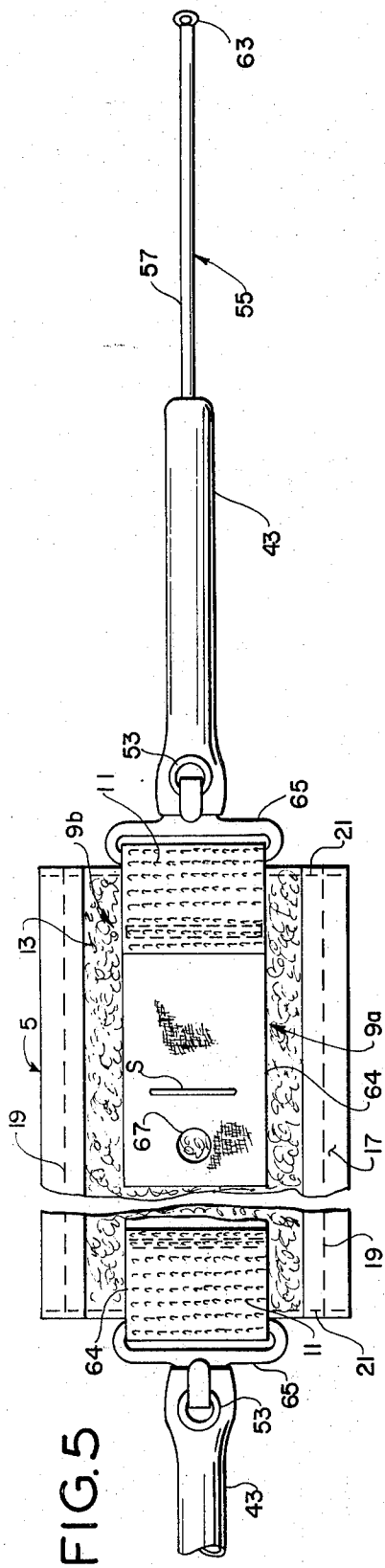
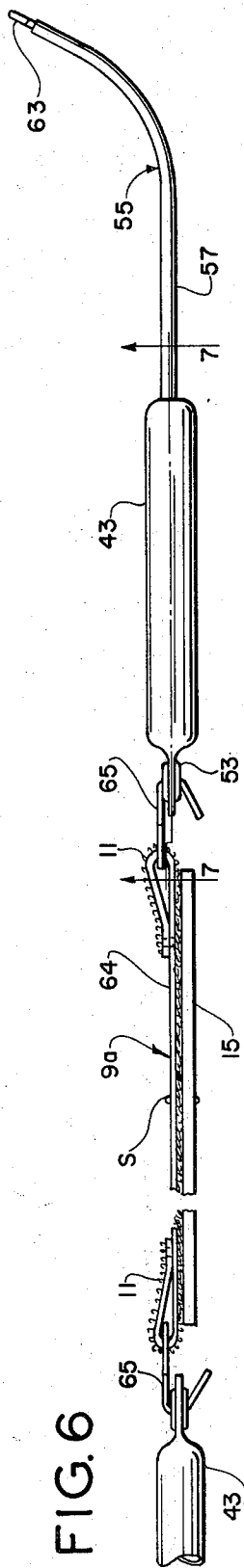
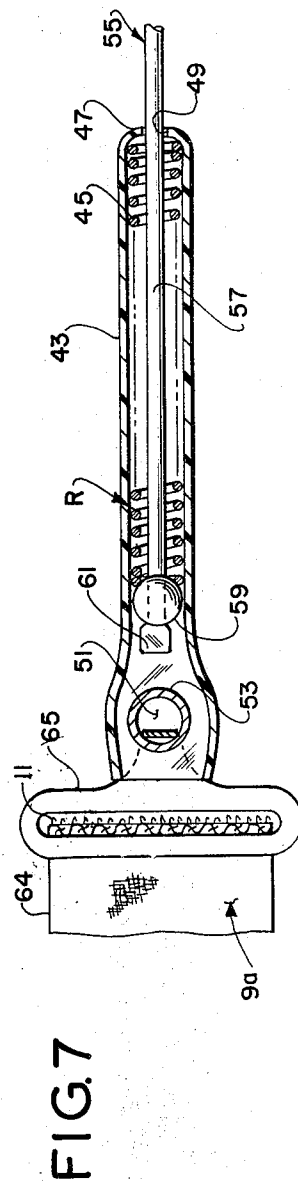


FIG. 10

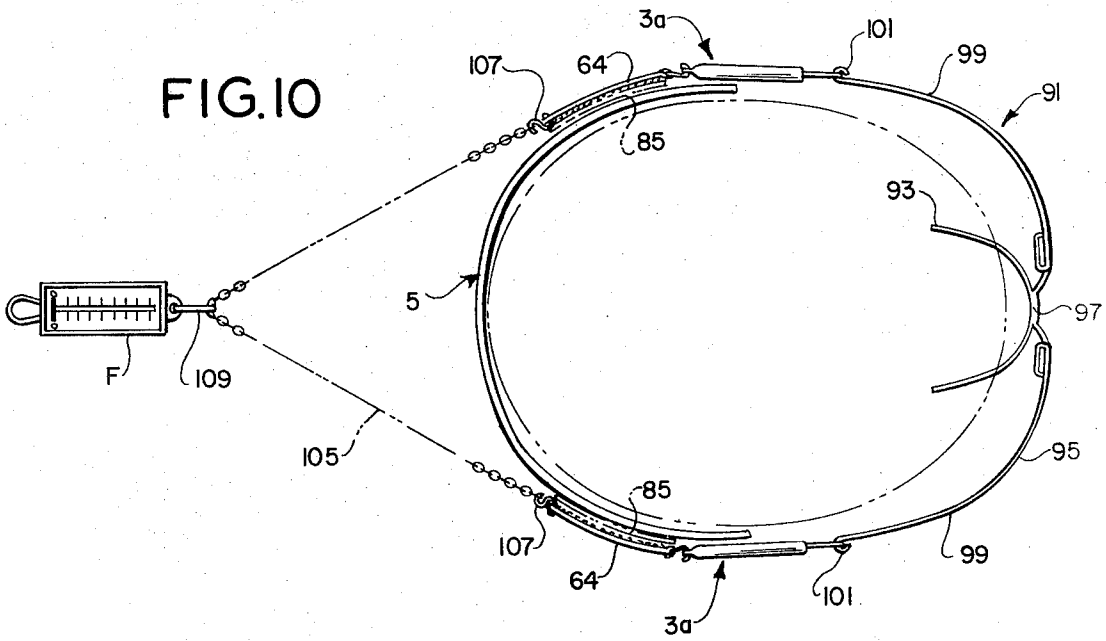


FIG. 11

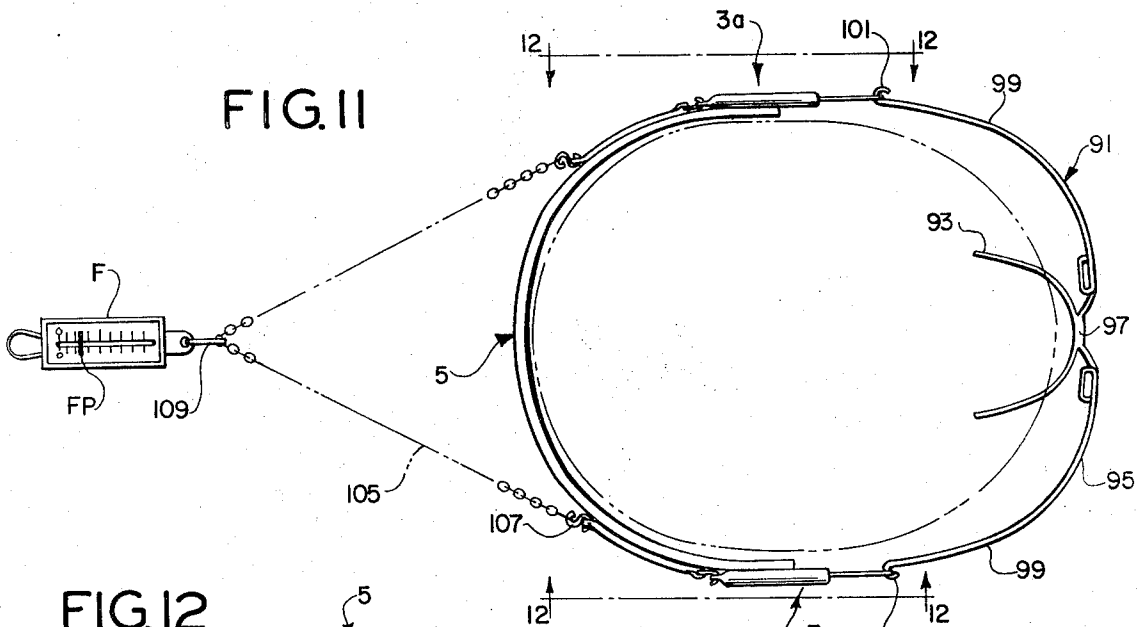
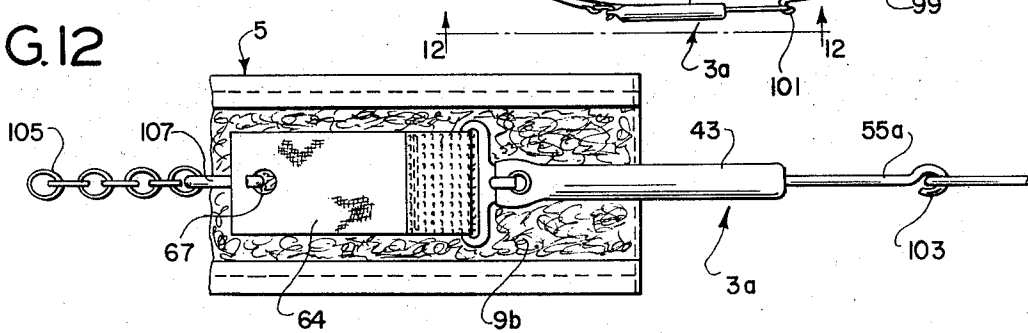


FIG. 12



ORTHODONTIC TRACTION APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

This invention relates to orthodontic appliances or instrumentalities, and more particularly to orthodontic traction apparatus for applying a desired traction force to a patient's teeth, and to a method of applying metered traction to the teeth.

This invention is particularly concerned with extra-oral traction devices, i.e., devices for applying traction to the teeth via orthodontic instrumentalities installed on the teeth. The orthodontic instrumentality may be what is referred to as an arch wire, which may be a maxillary arch wire or a mandibular arch wire, or it may involve buccal tubes on the teeth for receiving what is called a face bow. In either case, the instrumentality is attached via tensioning means (e.g., rubber bands, springs, elastic fabric, etc.) to a retainer or anchoring means (e.g., a neckband or a headgear) worn by the patient for applying traction to the teeth. Reference may be made to such U.S. Pats. Nos. as 2,874,468, 2,968,097, 3,203,099, and 3,571,390 showing typical orthodontic traction apparatus in the general field of this invention.

Generally, the above-mentioned prior art traction apparatus are adjustable by the orthodontist to apply a desired traction force on the patient's teeth by adjusting the neckband or headgear to stretch the tensioning means of the traction apparatus an appropriate amount to exert the desired traction force, or by changing the tensioning means (e.g., rubber bands).

SUMMARY OF THE INVENTION

Among the several objects of this invention may be noted the provision of traction apparatus which includes tensioning means adapted to be stretched to apply a desired traction force to an orthodontic instrumentality on a patient's teeth and which may be readily attached to anchoring means (e.g., a neckband or headgear) worn by the patient while maintaining the desired tension on the tensioning means; the provision of such apparatus in which the tensioning means may be readily secured to the anchoring means in such manner as infinitely to vary (within a specified range) the traction applied to the teeth; the provision of such apparatus which is easy to use and which is of economical construction; and the provision of a method of applying metered orthodontic traction with infinite variation (at least throughout a predetermined range) in which an accurate force-indicating gage is used to apply the desired traction force to the tensioning means and in which the tensioning means may be readily secured to the anchoring means worn by the patient while maintaining the proper traction force on the tensioning means.

In general, orthodontic traction apparatus of this invention comprises tensioning means for attachment to an orthodontic instrumentality for the teeth adapted to be stretched to apply traction to the teeth. The tensioning means has means for attachment thereto of means for stretching it after it has been attached to said orthodontic instrumentality and for indicating the force thereby applied to the teeth. The patient wears means (e.g., a neckband or headgear) for anchoring the tensioning means to hold it stretched. Means is provided for fastening the tensioning means to the anchoring

means worn by the patient after the tensioning means has been attached to the orthodontic instrumentality and stretched to apply a selected traction force to the teeth while maintaining said force, this fastening means comprising cooperable fabric fastening elements, one on the tensioning means and the other on the anchoring means, one of said elements having a multiplicity of hook-like pile elements projecting therefrom and the other having a plush-like pile surface for interengagement with the hook-like pile elements for detachably securing said elements together. The method of the invention, which effects application of metered orthodontic traction to the patient's teeth, comprises the steps of connecting the tensioning means to the orthodontic instrumentality for the teeth, pulling on the tensioning means with a force indicating gage until the desired traction force as measured by the gage is applied to the teeth, securing the tensioning means in its stretched condition to the anchoring means (e.g., the neckband or headgear) worn by the patient while maintaining the pull on the tensioning means, and then removing the gage. Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view from the front illustrating orthodontic traction apparatus of this invention including a neckband as worn by the patient, for applying traction via an arch wire on the teeth;

FIG. 2 is a view from the back of FIG. 1;

FIG. 3 is a side elevation illustrating orthodontic apparatus of this invention including a headgear as worn by the patient, and illustrating the method of applying and calibrating the apparatus;

FIG. 4 is an enlarged view on line 4—4 of FIG. 3 without the head;

FIG. 5 is an enlarged side elevation showing part of the orthodontic traction apparatus illustrated in FIG. 1;

FIG. 6 is a bottom plan of FIG. 5;

FIG. 7 is a section on line 7—7 of FIG. 6;

FIG. 8 (sheet 2) is a view showing a modification of the apparatus of FIG. 5;

FIG. 9 (sheet 1) is a view similar to FIG. 5 showing a modification of its neckband;

FIG. 10 is a view showing a modification of the apparatus of this invention particularly for applying traction via a face bow, showing the apparatus as initially applied and before tensioning;

FIG. 11 is a view similar to FIG. 10 showing the apparatus after tensioning; and

FIG. 12 is an enlarged partial side elevation of FIG. 11 on either of lines 12—12 of FIG. 11.

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

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, first more particularly to FIGS. 1 and 2, orthodontic traction apparatus of this invention, indicated in its entirety at 1 is shown to include tensioning means generally indicated at 3 for attachment to an orthodontic instrumentality, e.g., an arch wire, on the teeth in the patient's mouth. The arch wire may be a maxillary arch wire or a mandibular arch wire. The tensioning means, which is adapted to be stretched to apply traction to bands, teeth, includes a

resilient member R (e.g., a spring or an elastic web) for this headgear) Generally, two such tensioning means are provided, one for each side. The patient is fitted with a Pat. 5 (as shown in FIGS. 1 and 2) or a headgear 7 (as shown in FIG. 3) serving as an anchoring means to anchor or secure the tensioning means after it has been attached to the orthodontic instrumentality and stretched to apply traction to the teeth. Tensioning means 3 may be detachably secured to the neckband or to the headgear while maintaining a traction force on the teeth by means of cooperable fabric fastening elements as generally indicated at 9. These elements involve fabric fastening material available commercially under the trademark VELCRO, such as shown in de Mestral U.S. Pat. No. 2,717,437, issued Sept. 13, 1955. One element or piece of the fabric fastening material, as indicated at 9a, has a multiplicity of hook-like pile elements 11 (see FIGS. 5, 6 and 8) which project outwardly away from the material, and another element or piece of the fabric fastening material, as indicated at 9b, has a plush-like loop pile surface 13 for interengagement with the hook-like pile elements 11. These elements or pieces of the fabric fastening material are adapted to be secured together by placing them in overlapping relation and pressing the hook-like pile elements 11 into the pile surface 13, and may be separated by peeling one of the pieces of fabric fastening material away from the other.

Neckband 5 is used when it is desired to apply traction to either a maxillary or a mandibular arch wire in a generally horizontal direction. The neckband is usually of such length as to extend around the back of the patient's neck (the cervix) from ear-to-ear and, accordingly, is frequently called a low-pull cervical neckband. As shown in FIGS. 5, 6 and 8, neckband 5 comprises a strip of fabric fastening material 9b with its plush-like surface 13 facing outwardly, and a backing strip 15 of suitable fabric somewhat wider than the strip of fabric fastening material. The latter is placed on top of strip 15 and marginal portions 17 of strip 15 are folded over the side edges of the fabric fastening material 9b to overlie the margins thereof. Lines of stitching 19 at the side margins of the fabric fastening material stitch down the folded-over marginal portions 17. The ends of the fabric fastening material are over-stitched to strip 15 as indicated at 21.

Headgear 7 is used to apply traction to a maxillary arch wire, for example, in a generally upward and rearward direction, and accordingly the headgear is usually referred to as a high-pull headgear. Headgear 7, as illustrated, is similar to the adjustable headgear shown in my U.S. Pat. No. 3,571,930. More particularly, it has an occipital strap 23 adapted to extend from the back of the head (the occiput) of the patient upward to the top of the head. A right side strap 25 extends from the right side of the head to the top area of the head, and a left side strap 27 extends from the left side of the patient's head upward to the top of the head. A top adjustment piece 29 adjustably secures the upper ends of the occipital strap, the right side strap, and the left side strap at the top of the patient's head. The forward end of a right side back strap 31 is secured as by riveting to the lower end of right side strap 25, as indicated at 33, and the forward end of the left side back strap 35 is riveted to the lower end of left side strap 27, as indicated at 37. The rear ends of back strap 31 and 35 pass through slits 39 in the lower end of the occipital strap

23. Rivets 33 and 37 each secure a pad generally indicated at 41 to the headgear. Each of these pads has a strip of fabric fastening material 9b sewn thereon with its plush-like pile surface 13 facing outwardly. The construction of these pads is generally similar to the construction of neckband 5. The pads may be rotated about the rivets to be in proper position along the sides of the patient's face to receive tensioning means 3. After the various straps of the headgear have been adjusted so that the headgear fits the patient, the straps may be stapled to one another to prevent slippage.

As shown in FIGS. 1-7, tensioning means 3 corresponds to that disclosed in my copending U.S. patent application, Ser. No. 164,250, filed July 20, 1971. It comprises an elongate tubular member 43 (see FIG. 7) of heat-sealable plastic such as fluoropolyethylene. An elongate coil compression spring 45 is housed in the tube 43 extending lengthwise thereof, this spring constituting resilient member R. Tube 43 has one end thereof formed into an inwardly extending integral flange 47 constituting a closure for the tube at one end. This flange bounds a central opening 49 at the end of the tube and provides an abutment for spring 45. The tube is closed at its other end by being pinched flat, and by having its opposed walls in the pinched-flat portion heat-sealed together. An opening or eye 51 is formed in the pinched-flat portion and the latter is reinforced around the opening by means of a metal grommet or eyelet 53 secured in the opening. A tensioning member 55 having a straight shank portion 57 extends through opening 49 into tube 43. The tensioning member has a sliding fit in opening 49 whereby the opening is at least partially closed by the tensioning member. Shank 57 extends through spring 45 and has a ball 59 rotatably secured to its free end. The diameter of the ball corresponds substantially to the inside diameter of tube 43 and the ball is adapted to bear against the end of the spring, being held on the shank portion by flattening the ends of the shank as indicated at 61. Tensioning member 55, as shown, is of J-shape with an eye 63 at its outer end (constituting its forward end) for attachment to an arch wire.

A strip 64 of fabric fastening material 9a having hook-like pile elements 11 projecting from one side thereof is attached to the tube 43 at the end of tube 43 which constitutes its rearward end by means of a hook 65 secured by stitching to one end of the strip, the hook being hooked into grommet 53 in the tube. A hole or eyelet 67 is provided in the rear end portion of strip 64 for purposes as will appear. Strip 64 may be reinforced around hole 67 by a metal grommet (not shown). The tensioning means 3 as above described may be used with either neckband 5 or headgear 7. A modification of the neckband 5 is shown in FIG. 9 involving the provision of a pair of slits, each indicated at 68, in the plush material 13 of the neckband. These slits extend transversely of the neckband and are spaced apart from one another to provide a pocket between the strip 15 and the plush material 13. This pocket is adapted to have tube 43 inserted therethrough for holding the tube relative to the neckband prior to and subsequent to the fastening of the piece 64 of fabric fastening material to the plush material 13 of the neckband. Slits 68 permit limited angling movement of the tube 43 (e.g., plus or minus 10° from the position shown in FIG. 9) relative to the neckband. It will be understood that slits similar

to slits 68 may be provided in the plush material of pad 41 of headgear 7.

A variation of the above-described tensioning means is shown in FIG. 8 to comprise a length of narrow elastic fabric 69 having a hook 71 is secured on one end thereof for attaching it to a face bow 73 connected to the orthodontic instrumentality on the patient's teeth. A piece 75 of fabric fastening material 9a having the hook-like pile elements 11 thereon is sewn to the other end of the strip of elastic fabric 69 by the lines of stitching 77. A hole or eyelet 79 is provided in the rear end of strip 75 for purposes as will appear. The fabric fastening material around hole 79 may be reinforced by a metal grommet (not shown) if it is so desired.

FIGS. 3 and 4 illustrate how a high-pull occipital headgear 7 having a pair of tensioning means 3 at the sides thereof is applied and set, and it is to be noted that the same procedure is used in connection with a neckband 5. With the orthodontic instrumentality fitted in the patient's mouth, and with headgear 7 properly adjusted to fit the patient's head, tensioning means 3 (one on each side of the patient's mouth) are attached to the orthodontic instrumentality by applying the eye 63 at the forward end of each tensioning member 55 to the orthodontic instrumentality. The headgear is placed on the patient's head, and a bridle 81 formed of stiff wire having hooks 83 at its ends is attached to both tensioning means 3 by placing the hooks in the holes 67 in the rear ends of pieces 64 of the fabric fastening material. The bridle extends back clear of the patient's head and permits a tensioning force to be simultaneously applied to springs 45 of both tensioning means to exert equal traction on both sides of the orthodontic instrumentality. A force-indicating gage F (e.g., a spring scale) is attached to the mid-portion of bridle 81 so that the traction force applied to the tensioning assemblies via the bridle can be accurately determined by the orthodontist. As shown in FIG. 3, guards 85, which may simply be cards, are held between pads 41 of the headgear and pieces 64 of fabric fastening material on the tensioning means 3 to prevent interengagement of the hook pile elements 11 on pieces 64 with the plush pile surface 13 of the pads accurate prior to the time the orthodontist wishes to secure the fabric fastening pieces together. The orthodontist pulls on force-indicating gage F (rearward and upward as shown by the arrow in FIGS. 3 and 4) until the desired tension on the tensioning means is attained. Then he removes the guards 85 from between the pieces of fabric fastening material and presses the pieces of fabric fastening material together to secure the tensioning means to the headgear while maintaining the desired tension thereon. The force-indicating gage F and bridle 81 may then be removed from the tensioning assemblies. The tensioning means are then positively secured to the headgear by stapling the pieces 64 of fabric fastening material to pads 41 of the headgear, these staples being indicated at S in FIGS. 2, 5, 6 and 8.

It will be understood that the above stated method may be used to connect tensioning means 3 to a modified neckband 7 such as shown in FIG. 9 by inserting tubular members 43 through slits 68 prior to attaching the face bows to the orthodontic instrumentality in the patient's mouth.

By pulling on the tensioning means 3 with an accurate force-indicating gage F, the actual traction applied to the teeth may be readily seen by the orthodontist.

The use of fabric fastening material 9 to detachably secure the tensioning means 3 to the neckband 5 or to headgear 7 permits the tensioning means to be fastened at any position along the neckband or on pads 41 of the headgear to provide for infinite adjustment of the traction force applied to the teeth. The use of the fabric fastening material also permits the tensioning means to be secured to the neckband or to the headgear at any angle thus making it easier to position the neckband or the headgear on the patient.

FIGS. 10-12 show a modification of the invention for applying traction to teeth via a face bow 91 of a conventional type having an inside wire bow 93, the ends of which are inserted into buccal tubes on the teeth, and an outside bow 95. The two bows are joined together at their center as indicated at 97. The sides 99 of the outside bow, spaced to straddle the patient's cheeks, have hooks 101 at their rear ends. Tensioning means substantially identical to the tensioning means 3 with the same cooperable fabric fastening elements indicated at 9 are used. The tensioning means shown in FIGS. 10-12 is designated 3a to distinguish it from means 3, and the parts thereof identical to parts of means 3 are given the same reference characters. The difference is that the tensioning members, designated 55a in FIGS. 10-12, instead of being J-shaped members, are relatively short straight wires bent at their outer ends to form eyes 103 for attachment to the hooks 101 of the face bow. Otherwise, means 3a and means 9 used with 3a are identical to means 3 and 9 as previously described.

FIG. 10 illustrates a face bow 91 with the ends of the inside bow inserted in buccal tubes on the teeth (neither these tubes nor the teeth being shown), and a pair of the tensioning means 3a applied to the hooks 101 at the rear ends of the sides 99 of the face bow. It also illustrates a neckband 5 in place around the back of the neck, and the cards 85 between the plush-like material 9b on the neckband which faces outward adjacent its ends and the strips 64 of the fabric fastening material 9a having the hook-like pile elements 11 which face inward. Instead of the bridle 81, a chain 105 is used, the ends of the chain having hooks 107 which are hooked into the holes 67 in strips 64. The scale has a hook 109 hooked to the chain at the center of length of the chain.

FIG. 10 shows the initial set-up before the gage F is pulled back to tension the tensioning means 3a, and FIG. 11 shows the gage F pulled back to apply tension via the chain (note the position of the pointer FP of the gage in FIG. 11). FIG. 11 also shows the cards 85 removed and the strips 64 about to be pressed in toward the neckband to secure the strips to the neckband while maintaining the desired tension. Then the gage and chain are removed, the neckband with the tensioning means 3a secured thereto are removed from the head, and the strips 64 stapled to the neckband as before. Then, when the neckband is subsequently placed around the neck and the members 55a attached to the face bow 91, the pre-set tension is duplicated.

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 without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying draw-

ings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Orthodontic traction apparatus for applying traction to the teeth in a patient's mouth via an orthodontic instrumentality associated with the teeth, comprising tensioning means having means at one end thereof constituting its forward end for attachment to said instrumentality, and adapted to be stretched to apply traction to the teeth via said instrumentality, means worn by the patient for anchoring the tensioning means to hold it stretched, a fabric fastening element on said anchoring means, and a second fabric fastening element comprising a strip of fabric secured at one end constituting its forward end to the rearward end of said tensioning means and extending rearwardly therefrom, said tensioning means being adapted to be pulled in rearward direction to stretch it, after it has been attached to said instrumentality, by means including a force gauge for indicating the force thereby applied to the teeth, one of said elements having a multiplicity of hook-like pile elements projecting therefrom and the other having a plush-like pile surface for interengagement with the hook-like pile elements after the tensioning means has been stretched and while maintaining said selected traction force on the teeth thereby to secure said elements together with said tensioning means applying said selected traction force on the teeth, after which said elements may be permanently secured together as by stapling.

2. Orthodontic traction apparatus as set forth in claim 1 wherein said strip has means adjacent its rearward end for attachment of said stretching means.

3. Orthodontic traction apparatus as set forth in claim 2 wherein said attachment means comprises an eyelet in the strip.

4. Orthodontic traction apparatus as set forth in claim 1 wherein said tensioning means comprises an elongate tubular member, an elongate coil compression spring housed in said member and extending lengthwise thereof, a closure at one end of the tubular member providing an abutment for engagement by a respective end of the spring, said closure having an opening therein, a tensioning member engageable at one end with the other end of the spring and extending through the spring and said opening in said closure for connection to said orthodontic instrumentality, said strip being attached to the other end of said tubular member.

5. Orthodontic traction apparatus as set forth in claim 4 wherein said tubular member has its other end flattened and provided with an eyelet and said strip is provided with a hook at its said one end hooked into said eyelet.

6. Orthodontic traction apparatus as set forth in claim

4 wherein said strip has slits for receiving said tubular member.

7. Orthodontic traction apparatus as set forth in claim 1 wherein said tensioning means comprises a length of narrow elastic fabric.

8. Orthodontic traction apparatus as set forth in claim 1 wherein said anchoring means is a cervical neckband, and said apparatus has a pair of tensioning means one for each end of the neckband, said neckband having a strip of material with the plush-like pile surface on the outside thereof, each tensioning means having a said strip thereon with the strip having said hook-like pile elements.

9. Orthodontic traction apparatus as set forth in claim 1 wherein said anchoring means is a headgear, and said apparatus has a pair of tension means, one for each side of the headgear, said headgear having strips of material with plush-like pile surface thereon at each side, each tensioning means having a said strip thereon with the strip having said hook-like pile elements.

10. The method of applying metered orthodontic traction to a patient's teeth comprising the steps of connecting tensioning means to an orthodontic instrumentality for applying traction to the teeth, said tensioning means being adapted to be stretched to apply traction to the teeth, pulling on said tensioning means with a force-indicating gage until the desired traction force as measured by the gage is applied to the teeth, securing the tensioning means in its stretched condition to an anchoring means such as a neckband or headgear worn by the patient while maintaining the pull on the tensioning means, and then removing the gage.

11. The method of claim 10 wherein said tensioning means is secured to said anchoring means by cooperable fabric fastening elements, one on the tensioning means and the other on the anchoring means, one of said elements having a multiplicity of hook-like pile elements projecting therefrom and the other having a plush-like pile surface for interengagement with the hook-like pile elements for detachably securing said elements together, and wherein the method further comprises pressing together said elements to secure said tensioning means to said anchoring means while maintaining the desired force on said tensioning means.

12. The method of claim 11 further comprising placing a guard between said elements to prevent said hook-like pile elements from engaging said pile surface prior to attaining the desired force on said tensioning means, and removing the guard to secure said elements together.

13. The method of claim 12 further comprising stapling together said elements after they have been pressed together permanently to secure said tensioning means to said anchoring means.

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