United States Patent [19]

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[11] 3,772,789

[45] Nov. 20, 1973

[54] **ORTHODONTIC TENSIONING ASSEMBLY**

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[21] Appl. No.: **164,250**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 854,869, Sept. 3, 1969, abandoned.

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

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

[58] **Field of Search** ..... 32/14 A, 14 D

[56] **References Cited**

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[57] **ABSTRACT**

A tensioning assembly for orthodontic instrumentalities comprising a coil compression spring housed in a tube and a tensioning member, e.g., a hook, adapted to compress the spring to apply traction to the teeth via an orthodontic instrumentality such as a face bow.

5 Claims, 21 Drawing Figures

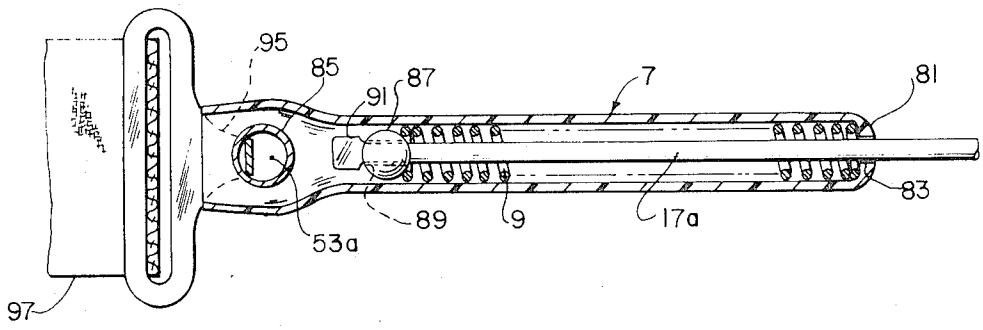


FIG. 1

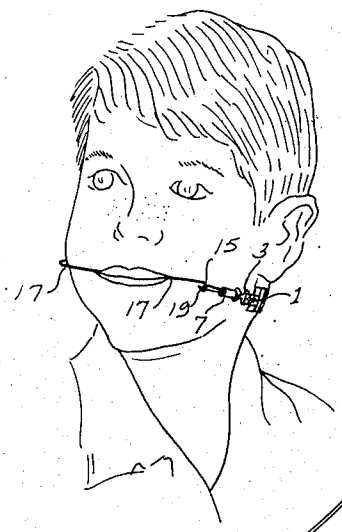


FIG. 3

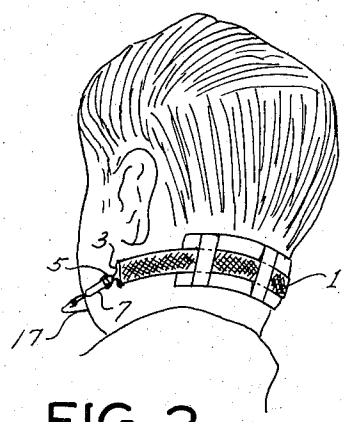


FIG. 2

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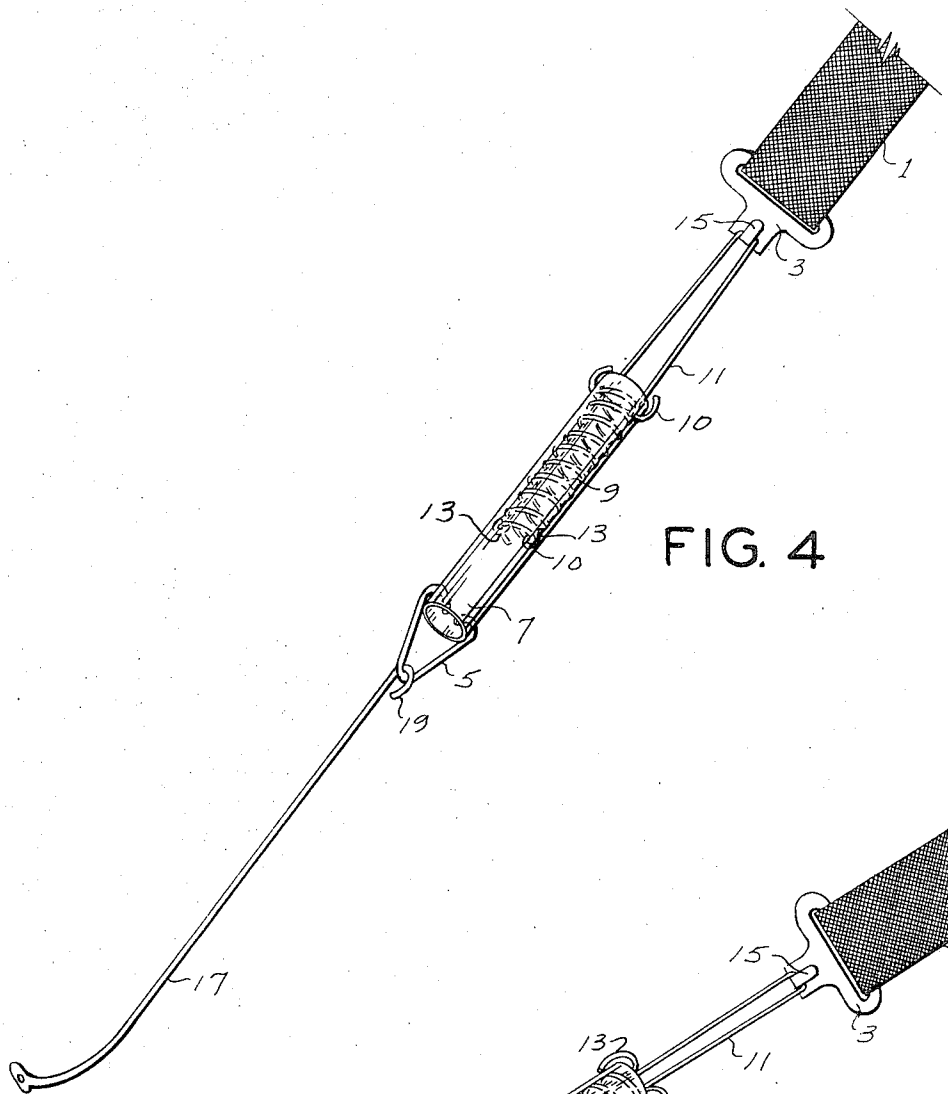


FIG. 4

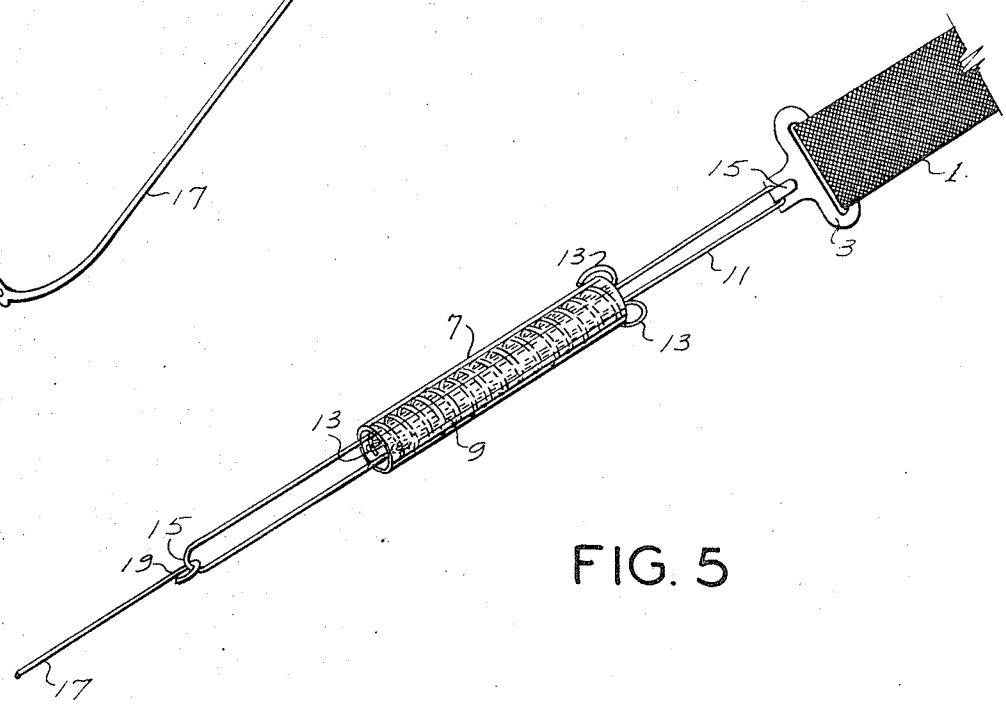


FIG. 5

FIG. 6

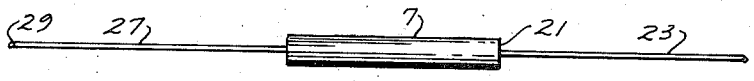


FIG. 7

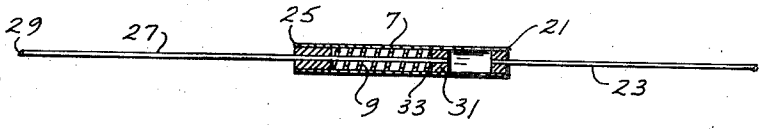


FIG. 8

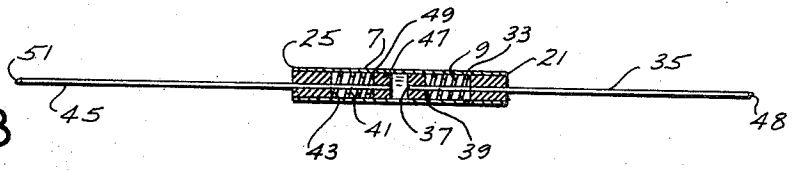


FIG. 9

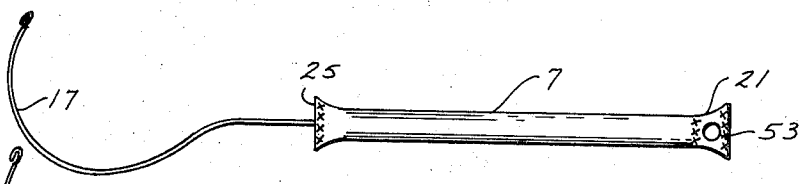


FIG. 10

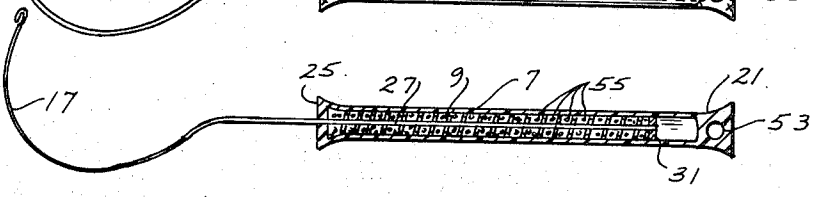


FIG. 11

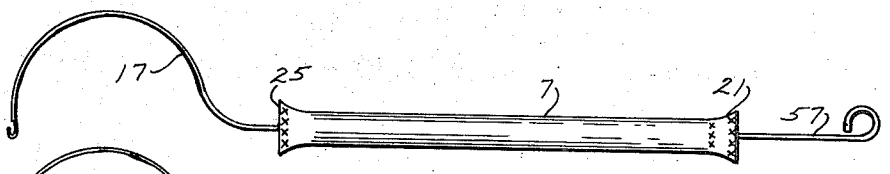


FIG. 12

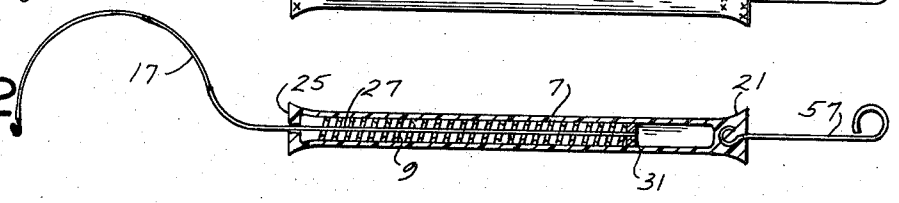


FIG. 13

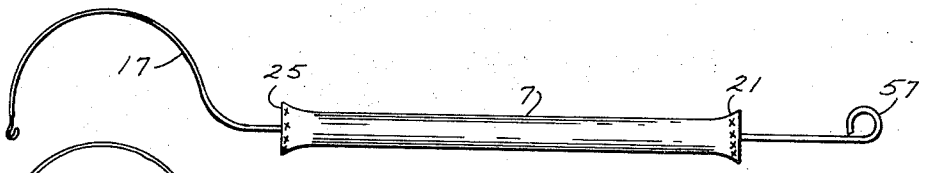


FIG. 14

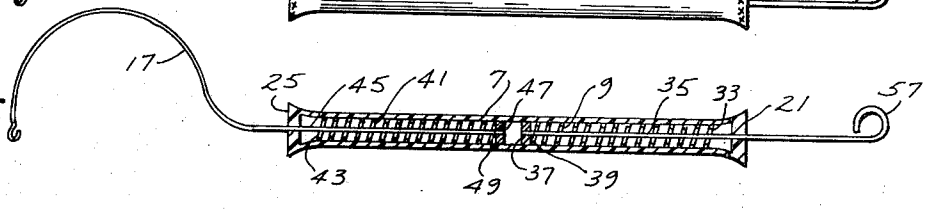


FIG.15

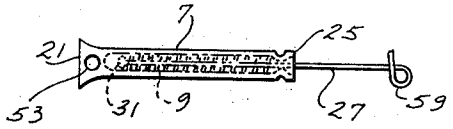


FIG.16

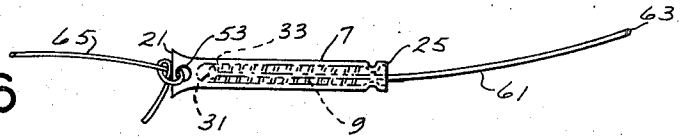


FIG.17

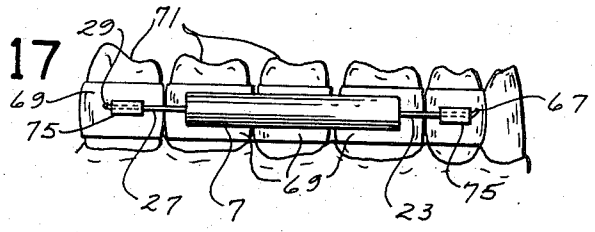
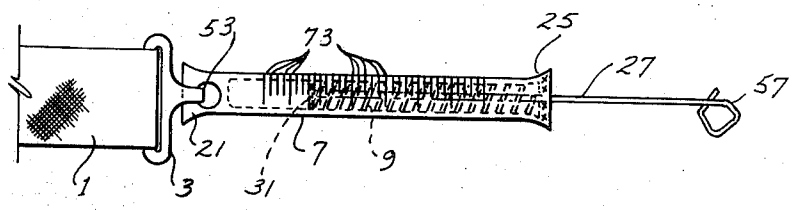


FIG.18



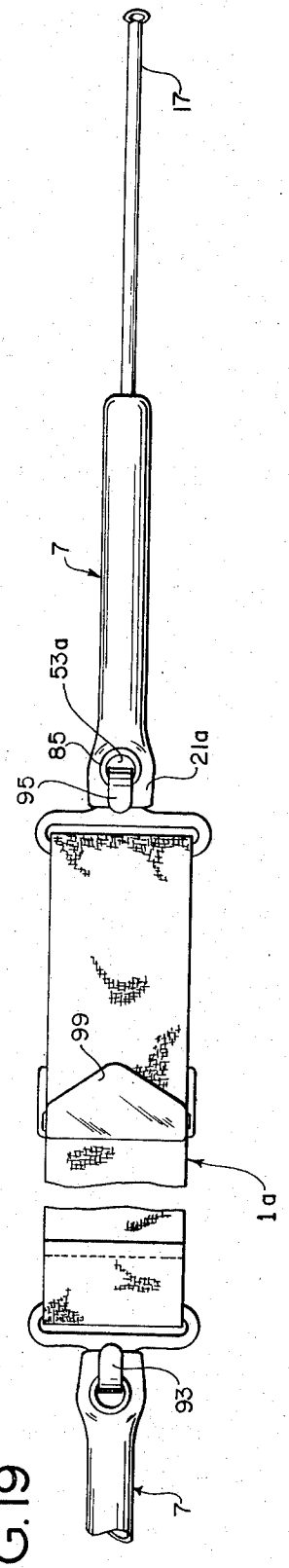


FIG. 19

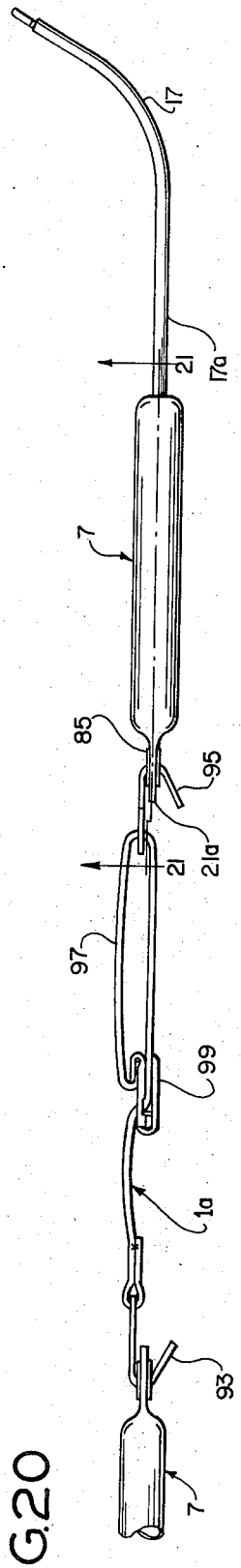


FIG. 20

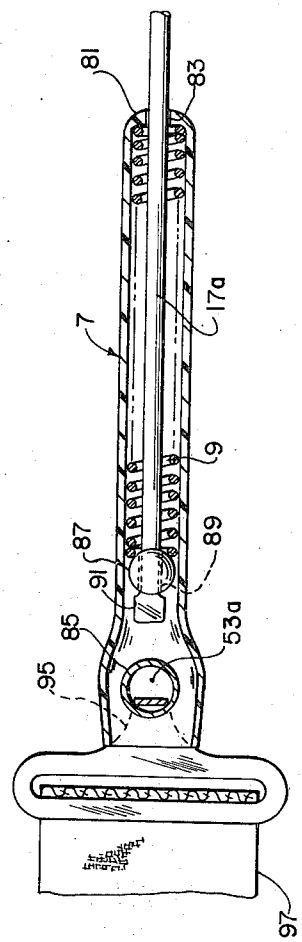


FIG. 21

ORTHODONTIC TENSIONING ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my copending application Ser. No. 854,869, filed Sept. 3, 1969, and now abandoned entitled Orthodontic Tensioning Assembly.

BACKGROUND OF THE INVENTION

This application is directed to orthodontic appliances or instrumentalities and more particularly to devices for applying tension to orthodontic devices which need to be placed under traction. These devices may be divided into two general classes, intra-oral devices and extra-oral devices.

Extra-oral devices are normally of the type in which the teeth are placed in traction via through tensioning means connected to a neck band or head band worn on the human neck or head. Traction is applied to the teeth via a maxillary arch band or a mandibular arch band for example. The tensioning means may include one hook or two, one on each side of the mouth. The hooks extend back on the sides of the face and are secured to the neck band or head band by the tensioning means. If the neck band extends around the back of the neck from ear to ear it is referred to as a cervical strap. If the head band extends around the back or the head from ear to ear, it is usually called an occipital strap. In the past the tensioning device used to connect the hook to the neck band or head band has commonly been an elastic band arrangement.

In intra-oral devices, ligatures, tension springs or rubber bands are usually attached to a group of teeth to apply traction thereto. The ends or the ligatures or springs are normally attached to metal bands attached to the outermost group of teeth being placed under traction. When rubber bands are used, they can be similarly attached to metal bands or they can be wound around the teeth themselves.

Use of an elastic band, i.e., a rubber band or other type of tension device has several disadvantages. It is difficult to precisely establish the desired amount of traction with such an assembly. Such an assembly can be pulled beyond the point of no return, in which case it no longer exerts traction, and it might even snap or break. In extra-oral devices, tension assemblies of this type have a tendency to catch on the hair of the patient. If a pad is provided on the device to provide greater comfort for the user, tension assemblies used in the past have had a tendency to catch and bind in the padding. Further, the amount of movement in the tension device required to develop a given amount of traction on the orthodontic appliance has frequently been unsatisfactory. The more traction required in such an assembly, the more the device must be stretched making it longer, and hence the head or neck band has to be taken up to compensate for this greater length. There is a tendency for the tension assembly in intra-oral devices to pick up contaminating food particles or irritate the oral tissues.

SUMMARY OF THE INVENTION

Among the several objects of the instant invention may be noted the provision of a tensioning assembly for orthodontic instrumentalities in which the traction is developed by compressing a member rather than by applying tension to it. It is an advantage of such a tensioning assembly that it cannot be pulled beyond its point of no return in developing traction. It is so constructed that it cannot catch on the hair of the patient, will not bind in padding and takes less movement than conventional devices to develop a given amount of traction. It is a further object of the instant invention to provide such a tensioning assembly which is completely encased so that when used intra-orally, it cannot pick up contaminating food particles or irritate the oral tissues. It is a further object of the instant invention to provide a tensioning assembly which will give a more precise and longer lasting traction than the orthodontic tensioning assemblies heretofore known.

The assembly includes a coil compression spring housed in a tube and a tensioning member, e.g., a hook, adapted to compress the spring to apply tension to an orthodontic instrumentality in the mouth of a patient.

Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front perspective illustrating an orthodontic device with a compression spring as it is worn on the human neck;

FIG. 2 is a back perspective of the device as worn in FIG. 1;

FIG. 3 is an enlarged side elevation of part of the orthodontic appliance;

FIG. 4 is a view of a variation of the appliance of FIG. 3;

FIG. 5 is a view of another variation of the appliance of FIG. 3;

FIG. 6 is a view of an embodiment of the instant invention useful in applying traction to an intra-oral orthodontic device;

FIG. 7 is a sectional view of the device of FIG. 6;

FIG. 8 is a sectional view of a variation of the device of FIG. 6;

FIG. 9 is a view of another embodiment of the instant invention useful in developing extra-oral traction;

FIG. 10 is a sectional view of the device of FIG. 9;

FIG. 11 is a view of a variation of the device of FIG. 9;

FIG. 12 is a sectional view of the device of FIG. 11;

FIG. 13 is a view of another variation of the device of FIG. 9;

FIG. 14 is a sectional view of the device of FIG. 13;

FIG. 15 is a view of another variation of the device for intra-oral use;

FIG. 16 is a variation of the device of FIG. 15;

FIG. 17 is a view of an intra-oral embodiment of the instant invention applied to teeth;

FIG. 18 is a view of another embodiment of the instant invention for extra-oral use;

FIG. 19 is a view in elevation of another embodiment;

FIG. 20 is a plan of FIG. 19; and

FIG. 21 is an enlarged longitudinal section on line 21—21 of FIG. 20.

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

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now particularly to FIGS. 1–3, a strap or neck band 1 may be seen extending around the back of

a human neck, from one side of the head to the other. In general, neck band 1 is of such length as to be capable of extending around the back of the neck (the cervix) from ear to ear. According, it constitutes, and is frequently referred to as, a cervical strap. A hook fastener 3 is shown attached to the end of neck band 1. Engaged in hook fastener 3 and extending therefrom is a clip 5 constituting a fastening means which is clipped to a guard tube 7. Tube 7 is positioned around and extends the length of resilient compression spring 9. The end of tube 7 opposite to that fastened to clip 5 is attached, as by staple 10, to compression spring 9. Tube 7 slidably supports compression spring 9. It will be observed that tube 7 (via staple 10) engages one end (the forward end) of the resilient compression spring 9 and extends past its other end so as to form a projection thereform.

Extending through the hollow of spring 9 is a doubled-over rod 11. The ends 13 of rod 11 are attached to the end of spring 9 adjacent neck band 1 (the rearward end of the spring). As shown, this can be done simply by bending the end 13 of rod 11 outwardly around spring 9. The rod 11 extends through the hollow of spring 9 forming a projection means and is fastened at its bight 15 to a fastening means constituted by closed hook 19 at the end of a connector 17. Each connector 17 (two being shown in FIG. 1) is formed in the shape of a hook and is adapted to be attached to, for example, an arch band for the maxillary arch (the upper teeth), not shown, within the mouth of the patient shown in FIG. 1. From the figures it can be readily seen that when the ends of tube 7 and the bight 15 of rod 11 are pulled in opposite directions the resilient compression spring 9 will be compressed applying tension to the orthodontic instrumentality, biasing hook 17 toward neck band 1 and placing the orthodontic appliance, the arch band, under traction.

FIG. 4 shows a variation of the FIG. 3 device. In this figure the fastening means for connecting hook 17 and neck band 1 to compression spring 9 have been reversed. That is, hook 17 is now connected to tube 7 and neck band 1 is now connected through hook fastener 3 to doubled-over rod 11 at its bight 15.

Fig. 5 shows still another variation of the FIG. 3 device. Here both the 17 and the neck band 1 are fastened to the bights 15 of a pair of doubled-over rods 11.

Referring now to FIGS. 6 and 7, an embodiment of the instant invention suitable for applying traction to intra-oral orthodontic devices may be seen. Here one end 21 of tube 7, formed of a suitable metal such as aluminum or steel, is affixed to a fastening means shown as rod 23. The other end 25 slidably supports the other projection means shown as rod 27. Rod 27 is adapted to be attached at one end 29 to a suitable fastening means. Second end 31 of rod 27 is enlarged and is positioned in force transferring relationship to an end 33 of spring 9.

FIG. 8 shows a variation of the device of FIGS. 6 and 7. As shown, tube 7 has first and second end closures 21, 25 each having a restricted opening therein. A first resilient compression spring 9 has one end 33 engageable with first end closure 21 and is adapted to react against it. A first tension member shown as rod 35 has one end 37 engageable with the other end 39 of first compression spring 9 within tube 7. Rod 35 extends lengthwise of first compression spring 9 through the restricted opening in first end closure 21. A second resilient compression member or spring 41 is positioned in the tube so as to have one end 43 engageable with second end closure 25 and is adapted to react against it. A second tension member in the form of rod 45 has one end 47 engageable with the other end 49 of second compression spring 41 within tube 7 and extends lengthwise of spring 41 through the restricted opening in second end closure 25. The ends 48 and 51 constitute means for fastening rods 35 and 45 to an orthodontic instrumentality on a patient so that the tension members or rods 35 and 45 are pulled in opposite directions whereby the resilient springs 9 and 41 are compressed applying tension to the orthodontic instrumentality.

Referring now to FIGS. 9 and 10, another embodiment of the instant invention may be seen. As shown in these figures, projection means or rod 27 is formed integrally with the hence is permanently fastened to face bow 17 which constitutes the means for fastening the projection means to the orthodontic appliance (the arch band). End 21 of tube 7 is closed and has an eye opening 53 therein for engagement with a fastening means, e.g., the hook fastener of a neck band. In this embodiment the tube 7 is made of a heat-sealable plastic such as fluoropolyethylene, and is sealed to itself at one end 21 with an eye opening 53 formed therein and sealed to itself at end 25 around the slidable projection formed by rod 27 to form a sliding seal with respect thereto. A lubricant such as grease 55 may be provided within tube 7 for lubricating spring 9.

The embodiment of FIGS. 11 and 12 is similar to that of FIGS. 9 and 10 except here end 21 of tube 7 is sealed and anchored to fastening means 57.

FIGS. 13 and 14 illustrate an embodiment of the invention which is similar to that shown in FIG. 8 and is suitable for use with extra-oral appliances. Whereas tube 7 is shown as formed of a metallic material in FIG. 8, it is formed of heat-sealable plastic in the embodiment shown in FIGS. 13 and 14. Fastening means 57 is attached to and integral with tension rod 35. Hook 17 is permanently fastened to rod 45 and hence the fastening means is an integral part of rod 45. The ends 21, 25 of tube 7 are heat sealed around rods 35 and 45 so that restricted openings for passage of rods 35 and 45 result which constitute sliding seals with respect thereto.

FIG. 15 shows a device similar to that of FIG. 9 suitable for use in connection with intra-oral orthodontic appliances. In this embodiment the fastening means is formed by the end of rod 27 being bent to form a loop fastener 59. Heat-sealable plastic is used to form tube 7 in this embodiment as compared with a metal such as aluminum or stainless steel to form tube 7 in the intra-oral embodiment shown in FIGS. 6 and 7.

FIG. 16 is of a device similar to that of FIG. 15 with the exception that the projection means is a ligature 61 having a first end 63 constituting a fastening means and extending through spring 9 to the end 33 thereof and having an enlarged second end 31 (for example, formed by a knot) in force transferring relationship to end 33 of spring 9. A second ligature 65 is shown as constituting a fastening means attached to eye opening 53 in end 21 of tube 7.

FIG. 17 shows a device such as that shown in FIGS. 6 and 7 in use. Ends 29 and 67 of rods 27 and 23 constitute fastening means for attaching the rods to metal bands 69 in any suitable manner, for example, by clamping, soldering or welding. In FIG. 17, ends 29 and

67 are shown attached by clamps 75 to bands 69. Metal bands 69 are affixed to the teeth 71 in a manner well known to practitioners of orthodontia. The arrangement of the device is such that the projection means constituted by rods 27 and 23 are pulled in opposite directions, compressing spring 9 (FIG. 7) which applies tension to the orthodontic instrumentality, i.e., bands 69, and hence places the teeth 71 under traction. It will be observed that since spring 9 is completely enclosed in tube 7, it cannot pick up contaminating food particles or irritate oral tissues.

FIG. 18 illustrates another embodiment of the instant invention. As shown, rod 27 has a fastening means 57 affixed to one end thereof. Tube 7 is formed of a transparent material and carries indicia or scribe marks 73 thereon. Means within the tube such as end 31 of rod 27 traverse the indicia or scribe marks 73 and indicate the force generated by spring 9 when the projections are drawn apart. This will facilitate establishing the desired amount of traction every time the device is placed into use in connection with the application of an orthodontic appliance to a patient.

FIGS. 19–21 illustrate still another embodiment of the invention similar to the embodiment of FIG. 9 wherein the elongate tubular member or tube is again designated 7, the spring 9, and the hook 17. The tube 7 in this instance is also made of a heat-sealable plastic such as fluoropoly-ethylene. The spring 9 again is an elongate coil compression spring and is housed in the tube 7 extending lengthwise thereof. The tube 7 has one end thereof which may be referred to as its forward end, formed into an inwardly extending integral flange 81 constituting a closure for the tube at this end. This flange or closure 81 bounds a central opening 83 at the end of the tube, and provides an abutment for the respective end of the spring 9. The tube 7 is closed at its other end which may be referred to as its rearward end, as indicated at 21a by being pinched flat, and by having its opposed walls in the pinched-flat end portion heat-sealed together. An opening or eye 53a is formed in the pinched-flat closure 21a and the latter is reinforced around the opening 53a by means of a metal grommet 85 secured in the opening.

The length of the spring 9 when uncompressed is somewhat less than the distance from the inner region of the pinched-flat closure 21a. Thus, with the forward end of the spring engaging closure 81, its rearward end is spaced from closure 21*a*. The hook 17 (which constitutes the tensioning member of the appliance) has a straight shank 17*a* which extends into the tube 7 through the opening 83, having a sliding fit in the latter whereby the opening 83 is at least substantially closed by the shank. The shank 17*a* extends through the spring 9 and has means indicated at 87 at its inner end having a sliding fit in the tube 7 and engaging the end of the spring 9 remote from closure 81. This means 87, as shown in FIG. 21, is constituted by a ball (which may be a bead of a bead chain, for example) seated in the end of the spring and having a diametrical passage 89 therethrough in which the shank 17*a* has a rotatable fit. The shank has a head 91 at its inner end engaging the ball 87 and extends generally axially through the spring and through opening 83 and out of the end 81 of the tube. The head 91 may be expeditiously provided simply by flattening the end of the shank.

FIGS. 19 and 20 show two of the tubes 7 secured to hooks 93 and 95 at the ends of a cervical band 1a similar to that indicated at 1 in FIGS. 1 and 2, the hooks 93 and 95 being hooked into the grommets 85 at the pinched-flat closures 21*a* of the tubes. As shown, the band is of adjustable length, having a loop 97 receiving the hook 95 and a clasp 99 adapted to be released for adjustment of the size of the loop, and then retightened. The traction applied by the two tube devices of FIGS. 19 and 20 to the teeth may be decreased or increased, with the capability of infinite adjustment within the overall range of adjustment, by lengthening or shortening the band 1*a*.

With particular regard to the device shown in FIGS. 19–21, it will be observed that the tube 7 is essentially wholly closed against entry of contaminants. The shank 17*a* of the hook 17 is maintained in accurate alignment, i.e., maintained coaxial with the tube within the spring 9 via its sliding fit in opening 83 and via the ball 87 which centers the inner end of the shank in the tube and has a sliding fit in the tube. There is low friction between the ball and the tube. On any rotation of the shank 17*a* on its axis, it simply rotates within the passage 89 in the ball, without twisting or imposing any torque on the spring, thus eliminating any possibility of variation in the traction force applied by the spring on account of rotation of the shank. With spring 9 being a compression spring, light wire may be used therefor; it cannot be distorted where a tension spring, by contrast, may be stretched beyond its elastic limit unless its stretch is limited. With the grommet at one end of the tube, the device is readily applicable not only to the cervical band type of appliance for downward pull, but also to high-pull and low-pull headgear.

It can readily be seen that the compression spring cannot be pulled beyond its point of no return to develop traction since it is not being placed in tension but only in compression. The arrangement is such that the spring is not likely to catch on the hair of the patient or to bind in other parts of the orthodontic appliance. A compression assembly according to the instant invention requires less movement to develop a given amount of tension or traction than conventional tensioning devices incorporating rubber bands. The compression members may be completely encased in either metallic or non-metallic tubes and hence cannot pick up contaminating food particles or irritate the oral tissues if used in connection with an intra-oral device, or the skin of the face if used in connection with an extra-oral device.

The instant invention can be incorporated in devices of various sizes. The invention can be made micro-miniature to be fitted between teeth intra-orally as a replacement for intra-oral ligatures or springs or wires. It may be sheathed in either plastic or metal tubes with either straight or arcuate forms.

The tension force on both the extra-oral and intra-oral tubes can be varied by the use of adjustable straps using adjustment buckles, slides and/or hooks. The tension will increase by shortening the length of the adjustment strap and lessened by increasing the length of the adjustment strap or holding member of the traction device.

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 can 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 drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A tensioning assembly for orthodontic instrumentalities comprising an elongate tube having a first end closure at one end constituting its forward end and a second end closure at its other end constituting its rearward end, said first end closure having a generally central opening therein, an elongate coil compression spring housed in the tube extending lengthwise thereof, said spring having one end constituting its forward end engaging the first end closure and extending back in the tube with its other end constituting its rearward end spaced from the second end closure, a tensioning member extending generally axially through the spring within the tube and extending out of the forward end of the tube through said opening and having a sliding fit in said opening, means on the tensioning member within the tube between the rearward end of the spring and said second end closure having a sliding fit in the tube and engaging the rearward end of the spring, and means at the rearward end of the tube for anchoring it in place for applying traction to the teeth via extension of said tensioning member from the forward end of the tube and resultant compression of the spring by the said means which engages the rearward end of the spring.

2. A tensioning assembly as set forth in claim 1 wherein the tube is formed of heat-sealable plastic material and the second end closure is formed by the rearward end of the tube having been pinched flat and heat-sealed.

3. A tensioning assembly as set forth in claim 2 wherein the pinched-flat end of the tube has an eye and a grommet in the eye constituting said anchoring means.

4. A tensioning assembly as set forth in claim 3 wherein said tensioning member comprises a hook having a straight shank extending through said opening and said spring, the shank extending rotatably through said spring-engaging means so as to be rotatable on its axis without twisting the spring, and having a head at its rearward end engaging said spring-engaging means.

5. A tensioning assembly as set forth in claim 4 wherein said spring-engaging means comprises a ball seated in the rearward end of the spring.

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