

[54] **ELASTIC ORTHODONTIC APPLIANCES**

[76] Inventor: **Melvin Wallshein**, 8645 Bay Parkway, Brooklyn, N.Y. 11214

[22] Filed: **Apr. 22, 1974**

[21] Appl. No.: **462,657**

Related U.S. Application Data

[63] Continuation of Ser. No. 310,574, Nov. 29, 1972.

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

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

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

[56] **References Cited**

UNITED STATES PATENTS

3,174,787	3/1965	Kolman.....	32/14 A
3,530,583	9/1970	Klein et al.	32/14 A
3,758,947	9/1973	Kesling	32/14 A

Primary Examiner—Robert Peshock

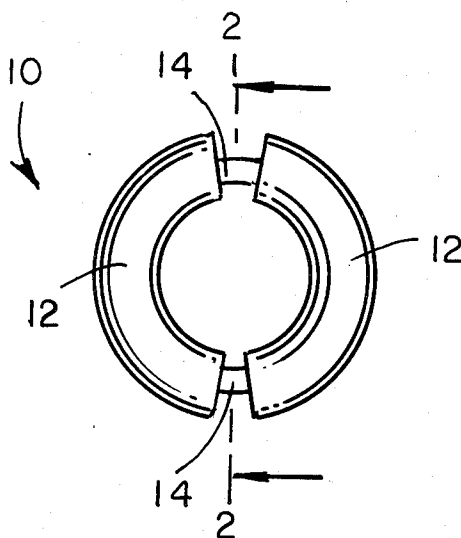
Attorney, Agent, or Firm—Flynn & Frishauf

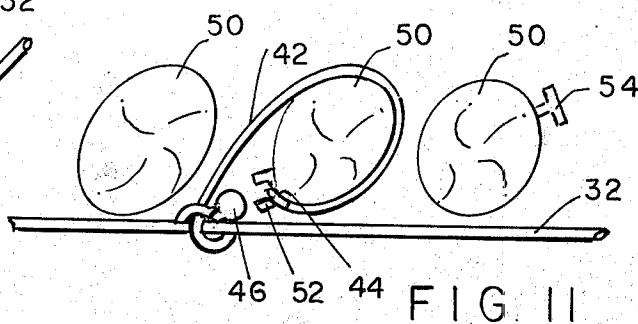
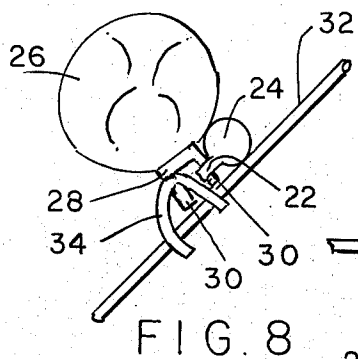
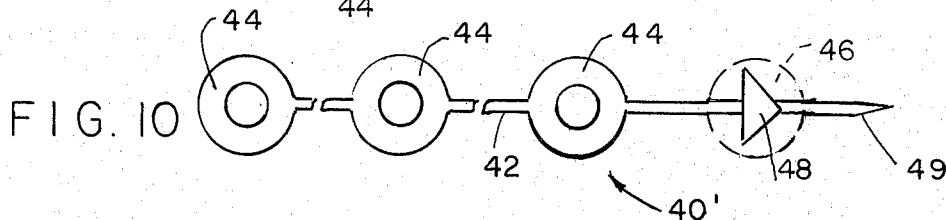
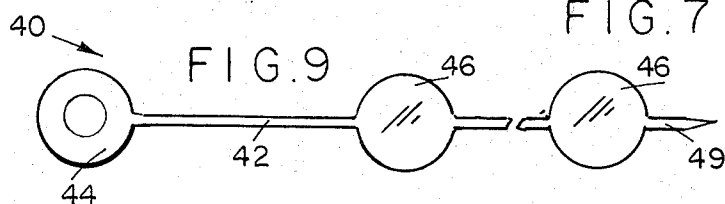
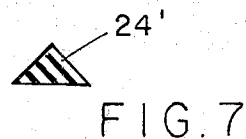
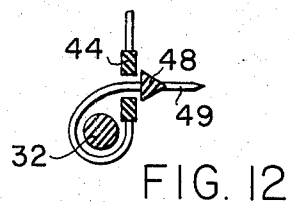
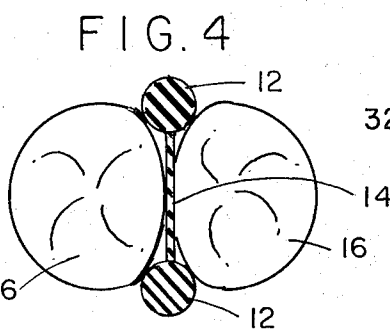
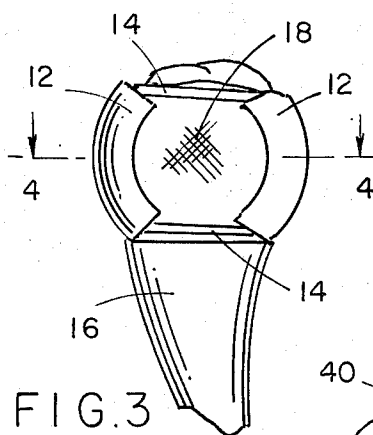
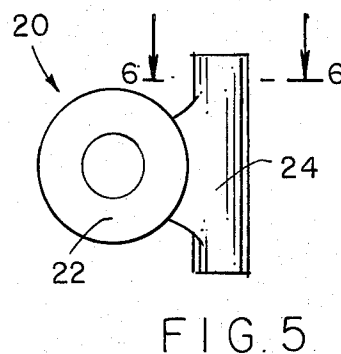
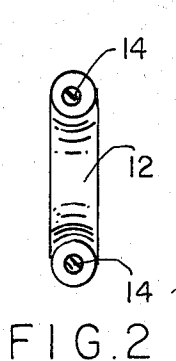
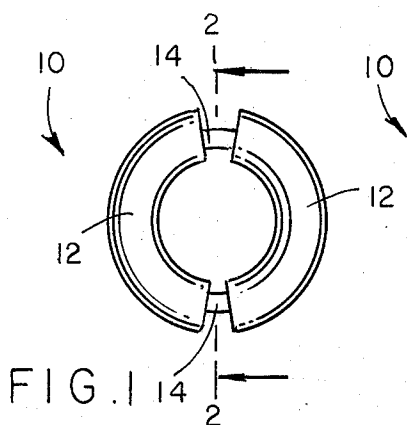
[57] **ABSTRACT**

Elastic orthodontic appliances are described which

separate, rotate and otherwise apply corrective forces to misaligned teeth. A separator, in the form of a torus is provided with at least one portion of reduced cross section which can be tensioned and made sufficiently thin to permit passage between two contacting teeth. The restoring forces in the portion of reduced area wedge the enlarged portions of the torus between two adjacent teeth and cause the latter to separate. A rotator includes a torus or ring with an elongate elastic protuberance at the periphery of the ring. With the ring engaged with the bracket and the elastic protuberance wedged between an arch wire and a tooth, the restoring forces in the protuberance cause the tooth to rotate with respect to the arch wire. Another orthodontic device is disclosed which is in the form of an elongate strand having a torus or ring at one end thereof suitable for engaging a bracket or a rotating button mounted on a tooth. Protuberances in the form of spheres preferably solid or the like are provided on the strand which are useful for tying the strands to a fixed anchor point such as an arch wire after the ring has been engaged with a bracket or button on a misaligned tooth.

25 Claims, 12 Drawing Figures





ELASTIC ORTHODONTIC APPLIANCES**CROSS REFERENCE TO RELATED APPLICATIONS**

The present invention is a continuation application of application Ser. No. 310,574, Filed Nov. 29, 1972, For: ORTHODONTIC ELASTIC APPLIANCE.

BACKGROUND OF THE INVENTION

The present invention generally relates to orthodontic appliances, and more particularly to elastic appliances which are simple in construction and which are suitable for rotating, separating and otherwise applying corrective forces to teeth.

The parent application discloses numerous elastic orthodontic appliances which are suitable for moving misaligned teeth. The present application discloses additional appliances as well as the ways in which such appliances can be used. While the devices of the present invention share many common features with those disclosed in the prior application, the devices to be described include new structural features which permit these to assume new functions not practically achieved with the devices of the prior art.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an orthodontic elastic appliance which does not possess many of the disadvantages of similar appliances known in the prior art.

It is another object of the present invention to extend the number and usefulness of the appliances disclosed in the parent application.

It is still another object of the present invention to provide elastic appliances of the type above described which are simple in construction and economical to manufacture.

It is yet another object of the present invention to provide an appliance of the type under discussion which are easily and quickly mounted on teeth and orthodontic brackets.

It is a further object of the present invention to provide elastic appliances which require minimal time and effort for mounting the same and incorporating the same in an orthodontic system within the mouth of a patient.

It is still a further object of the present invention to provide an orthodontic appliance which is simple in construction and which is suitable for separating two contacting teeth.

It is yet a further object of the present invention to provide an elastic appliance which includes means for connecting the same to a bracket and which includes a resilient or elastic protuberance positionable between a tooth and a fixed arch wire for rotating the tooth.

It is an additional object of the present invention to provide an orthodontic device which is in the form of an elastic strand provided with a ring at one end thereof suitable for engaging a bracket or rotating button on a tooth and provided with protuberances along the length thereof suitable for tying a knot and tying the other end of strand to a fixed anchor point such as an arch wire.

A tooth separator in accordance with the present invention comprises an elastic ring having a predetermined cross sectional area. The ring has at least one portion of reduced cross sectional area along its length

to form a connecting strand extending between enlarged portions of said ring. In this manner, tensioning said strand reduces the cross sectional dimensions thereof to permit the same to be forced through a contact area of two adjacent teeth. The enlarged portions are wedged between two adjacent teeth and when said strand seeks to become restored to the initial length thereof, said enlarged portions applying opposing forces to the two adjacent teeth which causes the same to separate.

A tooth rotator in accordance with the present invention is used with a bracket mounted on a misaligned tooth. The bracket has at least one post or projection and is adapted for use with an arch wire. The rotator comprises an elongate ring suitable for engaging a bracket projection. An enlarged elastic protuberance is provided and connected to a peripheral portion of said ring. Said protuberance is adapted to be wedged between a misaligned tooth and the arch wire in a compressed state. In this manner, the restoring forces in said protuberance cause the tooth to rotate to relative to the fixed arch wire.

An elastic appliance in accordance with the present invention suitable for applying corrective forces to teeth is in the form of an elongate elastic strand and similarly provided with a ring provided at one end of said strand. Protuberance means are here provided proximate the other end of said strand. The ring is dimensioned to engage a bracket or button on a tooth and said protuberance means is adapted to fix the other end of said strand to a fixed point such as an arch wire. In such a manner, a force can be applied to the tooth by tensioning said strand after the ends thereof are respectively connected to a tooth and a fixed point.

BRIEF DESCRIPTION OF THE DRAWINGS

With the above and additional objects and advantages in view, as will hereinafter appear, this invention comprises the devices, combinations and arrangements of parts hereinafter described by way of example and illustrated in the accompanying drawings of a preferred embodiment in which:

FIG. 1 is a front elevational view of a tooth separator in accordance with the present invention;

FIG. 2 is a cross section of the tooth separator shown in FIG. 1, taken along lines 2—2;

FIG. 3 is a side elevational view of a representation of a tooth, showing the manner in which the tooth separator is positioned relative to the contact area of two adjacent teeth;

FIG. 4 is a top plan view of the tooth and separator shown in FIG. 3, showing the tooth separator in cross section as taken through lines 4—4;

FIG. 5 is a front elevational view of a tooth rotator in accordance with the present invention;

FIG. 6 is a cross section of the enlarged elastic portion or protuberance forming part of the rotator shown in FIG. 5, taken along lines 6—6;

FIG. 7 is similar to FIG. 6 but showing a different cross section;

FIG. 8 is a top plan view of a tooth provided with a bracket cooperating with an arch wire, showing the manner in which the rotator of FIG. 5 is utilized to rotate a tooth;

FIG. 9 is a fragmented front elevational view of an elastic appliance useful for applying corrective forces to teeth misaligned from their desired positions;

FIG. 10 is an alternate embodiment of the appliances shown in FIG. 9;

FIG. 11 is a top plan view of a plurality of adjacent teeth, showing the manner in which the appliance of FIG. 9 may be utilized to rotate a tooth; and

FIG. 12 is a cross section showing the appliance of FIG. 10 in use with an arch wire.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

All the elastic appliances of the present invention incorporate elastic or resilient rings which facilitate the application of corrective forces to teeth, as will be described in connection with the FIGURES.

Referring to FIGS. 1 and 2, an elastic tooth separator is generally designated by the reference numeral 10. The separator 10 is in the form of a circular ring or torus. The separator rings includes sections of enlarged cross sectional area 12 as well as connecting strands or links 14 which exhibit reduced cross sectional area. An important structural feature of the tooth separator is that the ring is provided with at least one portion 14 of reduced cross sectional area along its length. The presently preferred embodiment shown in FIGS. 1 and 2 includes diametrically opposite narrowed portions 14.

In FIGS. 3 and 4, the manner in which the tooth separator 10 is utilized is shown. As well known to those skilled in the art, adjacent teeth having contact points must frequently be separated in order to mount bands and the like. However, because a zone of contact exists between the two teeth, it is not always possible to insert items which have any substantial thickness between two teeth. The separators of the prior art are generally bulky and difficult to pass through the contacting zone. On the other hand, the separator 10 can easily be mounted in position for applying tooth separating forces by elongating or tensioning the narrowed portions or links 14. These links are initially of reduced cross sectional area. However, when these links and strands are tensioned, they become sufficiently thin to permit passage between the two contacting teeth 16. Once one of the strands 14 has been passed between the two teeth, the separator is released and the enlarged portions 12 are permitted to become wedged between the contacting teeth 16 as shown in FIG. 4. The restoring forces which seek to return the links to their original lengths, draw the enlarged portions 12 together with resulting opposing forces being applied to the contacting teeth 16 which cause the same to separate.

While the specific shape of the separator 10 or the specific cross sectional configuration of the sections 12 or links 14 are not critical, the separator in accordance with the presently preferred embodiment is generally circular and in the shape of a torus. The cross sections of both the sections 12 as well as of the links 14 are similarly circular with the diameters of the links being substantially smaller than the diameters of the enlarged portions 12.

Advantageously, two links 14 are provided on diametrically opposing sides of the ring 10 to form two enlarged portions 12 each in the shape of a section of a torus. By providing two opposing links 14 as shown, it is easier to stretch the ring and separate the enlarged sections 12 to permit mounting as suggested in FIGS. 3 and 4. Additionally, the provision of two opposing links 14 permits symmetrical separation of the sections

12 and more uniform or symmetrical separating forces are applied to the teeth.

A tooth rotator shown in FIG. 5 is designated generally by the reference numeral 20 and likewise includes a ring or torus 22. The elastic ring 22 is dimensioned to be suitable for engaging a bracket or a wing or projection thereof. Connected to a peripheral portion of the ring 22 is a protuberance 24 which is generally elongate and cylindrical in shape. The protuberance 24 may have a round or triangular and wedge-shaped cross section, as respectively shown in FIGS. 6 and 7.

By making the protuberance or enlargement 24 relatively bulky, compression of the same between an arch wire and a tooth generates restoring forces which are applied to the tooth relative to the fixed arch wire. Referring to FIG. 8, a tooth 26 is shown on which a bracket 28 is mounted having wings or projections 30. In the use of the rotator 20, the ring 22 is slipped over one of the wings or projections 30 with the enlargement or protuberance 24 disposed between the tooth 26 and an arch wire 32. The protuberance 24 is advantageously disposed in the plane of and substantially tangentially to the periphery of the ring 22. Accordingly, the protuberance 24 in the wedged condition shown in FIG. 8 is suitable for applying restoring forces over a substantial axial length of the tooth. This enhances the rotating forces upon the tooth.

To further enhance the rotating action of the tooth, retaining means in the form of a tie wire 34 may be provided which is connected between the bracket 28 and the arch wire 30. In the presently preferred arrangement, the tie wire 34 is made of elastic material and draws the bracket 28 towards the arch wire 32. Since the protuberance 24 pushes the tooth away from the arch wire 32, the two forces generate a couple which is effective for producing a torque upon the tooth for rotating the latter.

Clearly, the rotator 20 shown in FIG. 5 need not be utilized with any particular or specific type of bracket. Any bracket which includes a portion or projection engageable with the ring 22 may be utilized. The ring 22 serves the function of maintaining the rotator 20 in the optimum position for continued application of rotational forces.

Rings 44 are further utilized in the elastic appliance shown in FIG. 9. Here the appliance includes an elastic strand 42 with a ring 44 provided at one end thereof. As with the ring 22, the ring 44 is dimensioned to engage a portion of a bracket or rotating button or cleat as shown in FIG. 11. Protuberance means in the form of geometrical forms 46 which are preferably solid are provided along the strand and extend towards the opposing end thereof. One or more solid nodules or balls 46 may be provided. Similarly, more than one ring 44 may be provided as suggested in FIG. 10. The last FIGURE also illustrates another form of solid geometrical protuberance 48 which may be utilized instead of the spherical type nodules. The protuberance 48 is wedge-shaped or conical with the apex thereof pointed in a direction away from the rings 44.

Advantageously, the strand 42 extends beyond the last solid protuberance 48 to form a threading lead for facilitating manipulation of the strand and for tying knots.

The devices 40 and 40' in FIGS. 9 and 10 are extremely versatile. For example, an end ring 44 may be engaged with a portion of a bracket as shown in FIG.

11, with the strand 42 being wrapped around a tooth 50. Tensioning of the strand 42 and tying the end thereof to a fixed arch wire 32 applies a moment to the tooth 50 about the axis thereof to result in a rotation of the tooth. Instead of engaging one of the rings 44 with a bracket wing or extension 52, the ring may also be engaged with a rotating button or cleat 54 as suggested above.

In addition to rotating a tooth, the devices 40 and 40' can also be utilized to tilt or upright a tooth or move the same transversely towards another tooth. The provision of nodules or protuberances 46 or 48 facilitates the formation of a permanent knot. Although the strand 42 may be wet and slippery, a knot formed by the locking of a protuberance or nodule 46 or 48, cannot open. For this reason, the appliances 40 and 40' are extremely useful and simple to use in many types of orthodontic procedures.

The appliances 40 and 40' are shown broken to indicate that the strand 42 may be as long as desired and may be provided with as many or as few rings 44 or protuberances 46 or 48. When more than one ring or protuberance is provided, the overall length of the appliance may be selected by cutting off as many or as few rings or solid nodules. A leader 49 is advantageously left extending beyond the last nodule. Such a leader facilitates tying a knot by threading the same through a loop formed by the strand 42 about an anchoring object such as an arch wire 32.

By selecting the dimensions of the nodules 46 or 48 to be slightly larger than the holes in the rings 44, the strands 42 may also be knotted subsequent to engagement with an anchoring point by slipping a nodule through a selected ring 44. The ring is temporarily enlarged to receive the nodule and the ring snaps over the latter. In the case of the wedge 48, the apex thereof is first passed through a selected hole as of a ring 44. After the ring is snapped over the wedge 48, as seen in FIG. 12 the rear surface of the wedge prevents passage of the nodule 48 through the selected ring 44. The nodule 46 may be spaced from associated rings 44 as closely as desired and may be reversed in position along the strand. Improved locking characteristics are achieved when the rings and nodules are positioned close to one another. The nodules are preferably solid and may also be integral with associated rings and be disposed anywhere along the periphery of the latter. Alternately, a ring may be attached to and project from the surface of a nodule.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of the invention which is for purposes of illustration only and is not to be construed as a limitation of the invention.

What is claimed is:

1. A tooth separator comprising an elastic ring, said ring having main portions of predetermined cross sectional area, and having at least one strand portion of cross sectional area along its length which is reduced relative to said predetermined cross sectional area to form a connecting strand extending between said main portions of said ring, whereby tensioning said strand further reduces the cross sectional dimensions thereof to permit the same to be forced through a contact area between two adjacent teeth, said main portions being wedged between non-contacting portions of two adja-

cent teeth when tensioning of said strand is released and said strand seeks to become restored to the initial length thereof, said main portions of said ring applying opposing forces to the two adjacent teeth which cause the same to separate.

2. A tooth separator as defined in claim 1, wherein said ring is generally in the shape of a torus.

3. A tooth separator as defined in claim 1, wherein said main portions and said strand have substantially circular cross sections, the diameter of said strand being substantially smaller than the diameter of said main portions.

4. A tooth separator as defined in claim 1, wherein said ring is substantially circular, and wherein two strand portions of reduced cross-sectional area are provided on diametrically opposing sides of said ring to form two opposing main portions each in the shape of a section of a torus.

5. A tooth rotator for use with a bracket means mounted on a misaligned tooth, the bracket means having at least one post projecting from the tooth, said tooth rotator being adapted for use with an arch wire, the rotator comprising an elastic ring having means for engaging a bracket post; and an enlarged elastic protuberance extending from a peripheral portion of said ring, said protuberance being adapted to be wedged between a misaligned tooth and a fixed arch wire in a compressed state, so that the forces in said protuberance tending to restore it to its original shape cause the tooth to rotate relative to the fixed arch wire.

6. A tooth rotator as defined in claim 5, wherein the bracket means includes an edgewise bracket and said ring is dimensioned to snap over and engage at least one of the posts of the bracket means.

7. A tooth rotator as defined in claim 5, wherein said protuberance is elongate and cylindrical in shape.

8. A tooth rotator as defined in claim 7, wherein said protuberance has a substantially round cross section.

9. A tooth rotator as defined in claim 7, wherein said protuberance has a substantially triangular, wedge-shaped cross section.

10. A tooth rotator as defined in claim 7, wherein said protuberance is disposed in the plane of and substantially tangentially to the periphery of said ring.

11. A tooth rotator as defined in claim 5, further comprising retaining means for connecting the bracket means to the arch wire, whereby said retaining means prevents linear movements thereof in the direction of the restoring forces away from the arch wire and said protuberance causes rotation of the associated tooth.

12. A tooth rotator as defined in claim 11, wherein said retaining means comprises an elastic tie wire.

13. An elastic appliance comprising an elongate elastic strand; a ring provided at one end of said strand; and substantially solid protuberance means provided proximate the other end of said strand, said ring being adapted to engage an anchor point on a tooth, said strand being adapted to be tensioned and looped about a fixed point, and said protuberance means being adapted to cooperate with the strand loop to fix the other end of said strand to said fixed point to maintain said strand under tension, whereby a force can be applied to a tooth by the tension in said strand after the ends thereof are respectively connected to said anchor point on a tooth and to said fixed point.

14. An elastic appliance as defined in claim 13, wherein a series of severable rings are provided on said

strand, whereby the length of said strand can be modified by cutting off at least one of said rings.

15. An elastic appliance as defined in claim 13, wherein said protuberance means is substantially spherical.

16. An elastic appliance as defined in claim 13, wherein said protuberance means is substantially conical with the apex thereof pointed in a direction away from said ring.

17. An elastic appliance as defined in claim 13, further comprising a short strand portion extending beyond said protuberance means and forming a threading lead for facilitating manipulation of said other end of said strand.

18. An elastic appliance as defined in claim 17, wherein said threading lead is provided with a tapered free end.

19. An elastic appliance as defined in claim 13, wherein a series of severably protuberance means are provided on said strand, whereby the length of said strand can be modified by cutting off at least one of said end protuberance means.

20. An elastic appliance as defined in claim 13, in

combination with a bracket means having a projection adapted to engage said ring.

21. An elastic appliance as defined in claim 13, in combination with a rotating button means mounted on a tooth adapted to engage said ring.

22. An elastic appliance as defined in claim 13, comprising an elastic further ring at said other end of the strand proximate said protuberance means, said further ring being dimensioned to snappingly receive said protuberance means when said further ring is stretched and said protuberance means is forced therethrough, whereby said protuberance means or said further ring can be wrapped around the fixed point and snappingly engaged to lock the position of said other end to the fixed point.

23. An elastic appliance as defined in claim 22, wherein said protuberance means is solid.

24. An elastic appliance as defined in claim 13, wherein said protuberance means is solid.

25. An elastic appliance as defined in claim 5, wherein said protuberance is integrally formed with said ring.

* * * * *

25

30

35

40

45

50

55

60

65