

[54] **ORTHODONTIC BIASING DEVICE**

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[22] Filed: **Nov. 29, 1972**

[21] Appl. No.: **310,573**

[52] **U.S. Cl.**..... **32/14 A**
[51] **Int. Cl.**..... **A61c 7/00**
[58] **Field of Search**..... 267/180; 32/14 A

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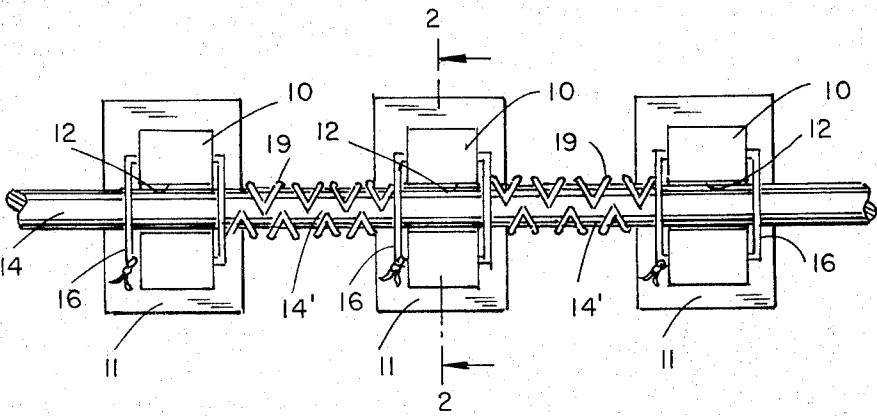
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[57] **ABSTRACT**

An orthodontic biasing device is in the form of an

elongated spring or sleeve having an elongated peripheral opening suitable for the passage of an arch wire therethrough. A spring is described which is formed by bending a continuous wire in the form of a repeating triangular pattern having two opposing sets of alternating peaks so that the peaks, when brought adjacent to one another and the wire, subsequent to bending of the same, substantially define a cylindrical surface with an elongated opening formed by the spaced adjacent peaks. According to another embodiment, a spring is formed by bending a helical coil along one of its axial edge portions so as to indent the turns of the helical coil along the axial edge portions substantially into closed C-shaped turns to thereby form a cylindrical cavity interiorly of the C-shaped turns which is suitable for receiving an arch wire. The springs are easily mounted on arch wire sections extending between two adjacent brackets – the springs forming a biasing device on the arch wire for either pushing the brackets away from one another or drawing them towards one another. A sleeve, advantageously apertured or in the form of a bellows, is described which functions similarly to the spring.

11 Claims, 16 Drawing Figures



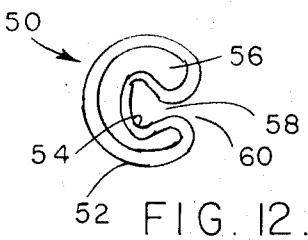
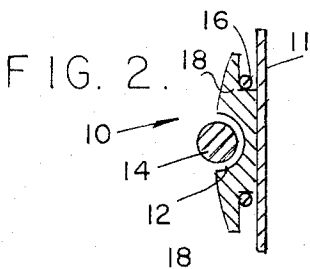
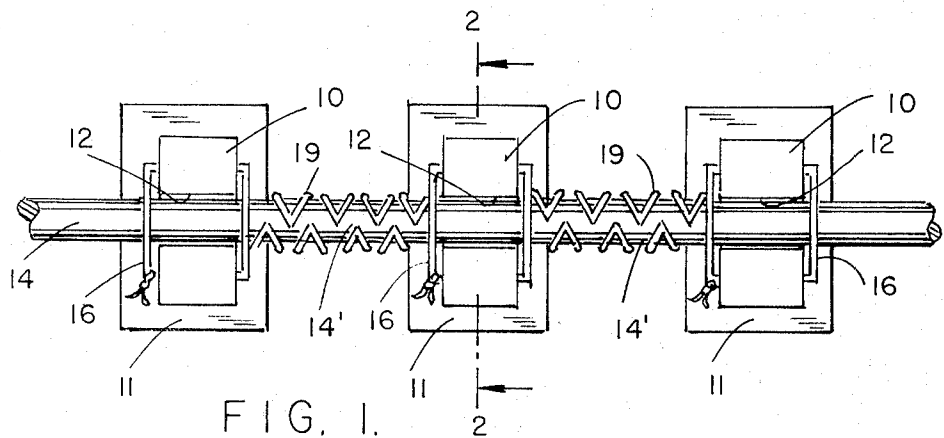
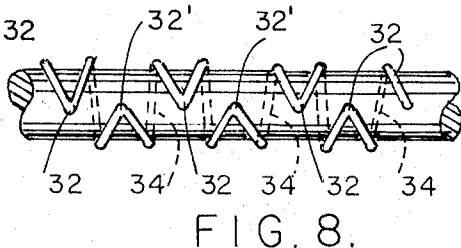
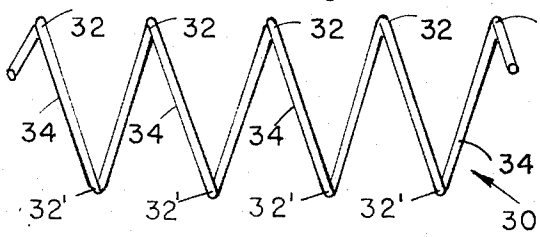
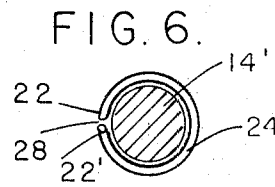
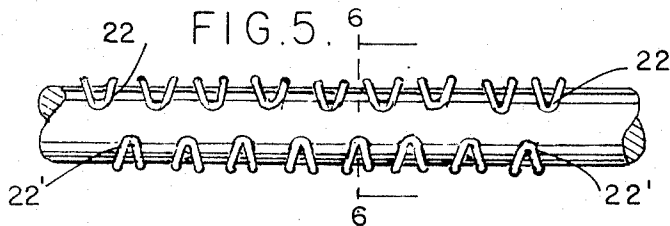
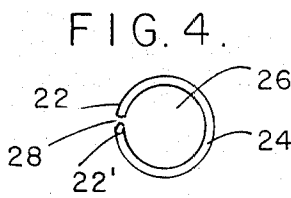
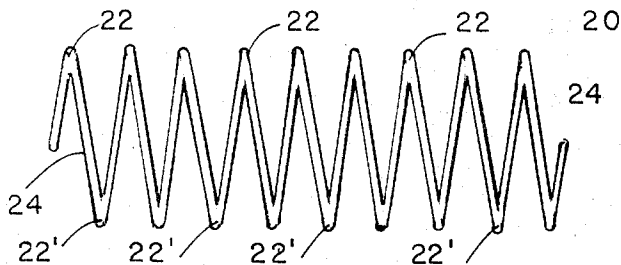


FIG. 3.



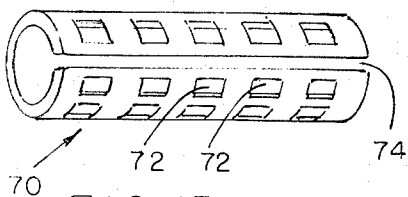


FIG. 15.

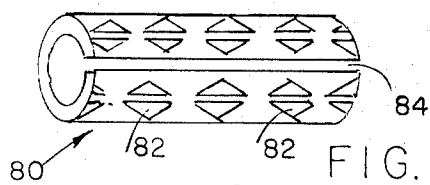


FIG. 16.

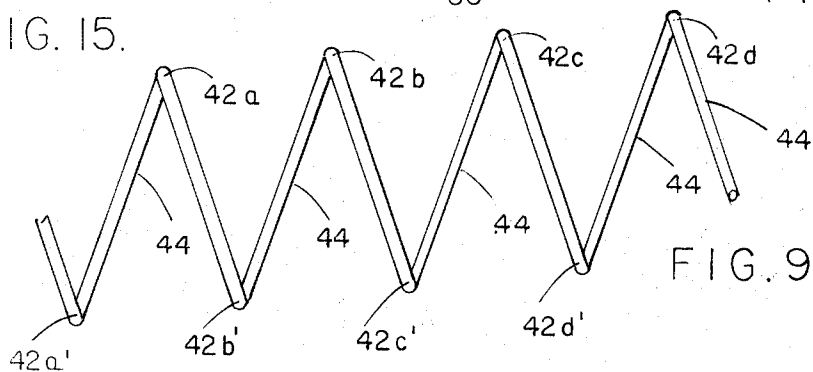


FIG. 9.

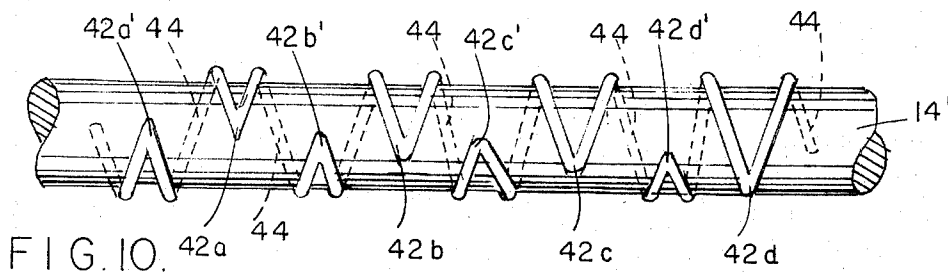


FIG. 10.

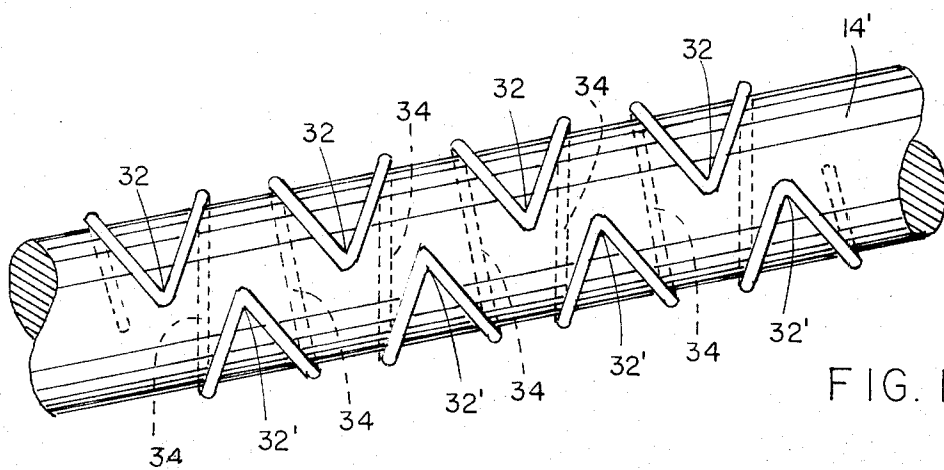


FIG. 11.

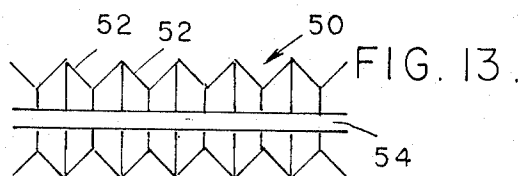


FIG. 13.

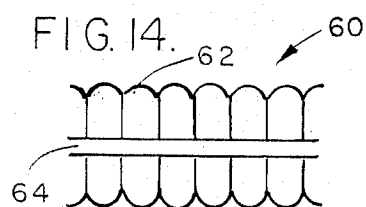


FIG. 14.

ORTHODONTIC BIASING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to orthodontic biasing devices, and more particularly to an orthodontic spring and sleeve which have elongated lateral openings which can be enlarged for passage therethrough of an arch wire section.

The use of springs as well as other elastic and/or resilient devices in the field of orthodontics is well known. However, the springs which have been utilized thus far have been in the form of conventional helical springs. The disadvantage in the use of such helical springs consists in the difficulty with which they are mounted on an arch wire. Helical springs do not provide a convenient access to the cylindrical cavity defined by the helical turns. There essentially exists two methods presently available for mounting a helical spring on an arch wire. The first way is to pass the arch wire through the end openings of the spring before the arch wire is mounted and connected to brackets in a conventional manner. Although the springs are easily mounted on the arch wire at this time, this is not always possible and frequently a spring must be mounted on an arch wire after the latter has been fixed to the brackets by, for example, tie wires. After the arch wire has so been fixed and connected, it is possible, of course, to free the arch wire from the connections thus made to the brackets and thereafter insert the arch wire through the end openings of the spring as described above. However, the disconnection of the arch wire from the brackets and the reconnection subsequently after the spring has been mounted thereon represents an unnecessary expenditure of time and money. Frequently, it is simpler, instead of disconnecting the arch wire from each of the brackets, to simply cut the arch wire or destroy it and start a new - mounting the spring on a new arch wire and connecting the latter to the brackets. Alternately, it is possible to engage the arch wire with the end of the outside turn of the helical spring and then turning the helical spring in such a manner so that successive turns become engaged with a section of the arch wire. This procedure is similarly inconvenient and wasteful insofar as time and expense is concerned.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an orthodontic biasing device which is not possessed of the above described disadvantages inherent in comparable prior art devices.

It is another object of the present invention to provide an orthodontic biasing device which is simple in construction and economical to manufacture.

It is still another object of the present invention to provide an orthodontic biasing device of the type under discussion which is convenient to mount on an arch wire section.

It is yet another object of the present invention to provide an orthodontic biasing device as described above which does not require that an arch wire be disconnected from brackets in order to mount the same on the arch wire.

It is a further object of the present invention to provide an orthodontic biasing device which is conveniently and rapidly mounted on an arch wire section between two brackets and which can either pull the

brackets towards each other or push them away from one another.

It is yet a further object of the present invention to provide a method for constructing an orthodontic biasing device of the type under discussion.

It is an additional object to provide an orthodontic spring and sleeve each of which is provided with an elongated slot along a peripheral portion thereof for passage of an arch wire therethrough, said spring and/or sleeve being suitable to bias adjacent brackets through which the arch wire passes.

In order to achieve the above objects, as well as others which will become apparent hereafter, the orthodontic biasing device in accordance with the present invention is suitable for use with two spaced orthodontic brackets and an orthodontic arch wire section extending between the two brackets. The device comprises a resilient member adapted to extend between the two brackets and configured to define a hollow cylindrical surface adapted to receive the arch wire section interiorly thereof. Said member includes an elongated peripheral opening generally extending along the length of said cylindrical surface. Said opening has a width smaller than the diameter of the arch wire. In this manner, once said member is urged onto the wire section by resiliently enlarging the width of said opening while passing the wire section therethrough, said member becomes securely mounted on the wire section and may thereafter act on the two brackets.

According to a presently preferred embodiment, said cylindrical surface is in the form of a circular cylindrical surface and said member is made from a continuous resilient wire.

A presently preferred construction of the member comprises alternately spaced triangular wire bracing portions positioned to each side of said elongated opening. Wire connecting portions are provided each of which connects two adjacent bracing portions positioned on opposite sides of said opening.

Other preferred constructions of said resilient member include slotted helical coils as well as slotted sleeves which are either apertured or which are in the form of a bellows.

According to one arrangement, said opening generally defines a straight opening on said surface substantially parallel to the axis of said cylindrical surface. According to another arrangement, said opening generally defines a helical opening on said surface about the axis of the latter.

The method of forming the orthodontic biasing device in accordance with the present invention comprises the steps of forming from a continuous wire a repeating triangular pattern having two opposing sets of alternating peaks. The triangular wire pattern is subsequently bent so as to bring opposing peaks adjacent one another. In this manner, the wire comprising the triangular pattern substantially defines a cylindrical surface with an elongated opening formed by said spaced adjacent peaks.

According to a further method in accordance with the present invention, a biasing device is made by bending a helical coil along one of its axial edge portions so as to indent the turns of the helical coil along the axial edge portion substantially into closed C-shaped turns to thereby form a cylindrical cavity exteri-

only of the helical coil suitable for receiving an arch wire section.

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 and illustrated in the accompanying drawings of a preferred embodiment in which:

FIG. 1 is a front elevational view of a plurality of spaced brackets mounted on adjacent teeth (not shown) and an arch wire extending through the brackets, and showing springs in accordance with the present invention mounted on arch wire sections between adjacent brackets;

FIG. 2 is a cross-section of a bracket of FIG. 1 taken along line 2—2;

FIG. 3 is a top plan view of a continuous wire in the form of a repeating triangular pattern from which the springs of FIG. 1 are manufactured;

FIG. 4 is an end view of a coil in accordance with the present invention of FIG. 1;

FIG. 5 is a front elevational view of a spring in accordance with the present invention made from the triangular wire pattern of FIG. 5 subsequent to bending the same and mounting on an arch wire;

FIG. 6 is a cross-section taken along line 6—6 of FIG. 5;

FIG. 7 is similar to FIG. 5 wherein the wire peaks of the triangular pattern are spaced further apart from each other;

FIG. 8 is similar to FIG. 5 wherein the spring is made from the wire triangular pattern of FIG. 7;

FIG. 9 is similar to FIG. 7 wherein successive adjacent wire peaks progressively rise with reference to the general direction defined by the wire triangular pattern;

FIG. 10 is similar to FIG. 8 wherein the spring is made from the triangular pattern of FIG. 9;

FIG. 11 is similar to FIG. 8 wherein the spring is shown under compression;

FIG. 12 is an end view of a spring in accordance with another embodiment of the present invention;

FIG. 13 is a side elevational view of another embodiment of a biasing device in accordance with the present invention in the form of a deformable bellows comprising a plurality of truncated cones;

FIG. 14 is a side elevational view of a further embodiment similar to the bellows of FIG. 13 but wherein the truncated cones are replaced by circular cylindrical sections with rounded peripheries; and

FIGS. 15 and 16 are yet further embodiments of the present invention, each in the form of an apertured sleeve which is deformable along its axis.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, a plurality of spaced brackets 10 are shown mounted on a plurality of bands 11 — each of the bands being mounted on a respective tooth (not shown). The brackets are of the type conventionally known as edgewise brackets which are provided with frontal wire receiving channels 12. However, although the present invention will be described in connection with edgewise brackets, it should be made clear that the present invention need not be utilized only in

conjunction with edgewise brackets and any other type of brackets, e.g., Begg brackets or any other brackets, may similarly be utilized.

An arch wire 14 is contained in the channels 12 — the arch wire sections positioned between adjacent brackets generally being designated by the reference numerals 14'. The arch wire 14 is connected to the brackets 10 in a conventional manner by the use of tie wires 16. Referring to FIG. 2, the brackets 10 each have wings 18 which, together with the bands 11, form tie wire retaining channels. The manner of securing the arch wires to the brackets is conventional and does not form part of the present invention.

Mounted on each of the arch wire sections 14' is a spring 19 in accordance with the present invention.

The details of the springs 19 will be described in connection with FIGS. 3—5. According to one presently preferred embodiment, the spring 19 is made from a continuous wire in the form of a repeating triangular pattern 20 shown in FIG. 5. The triangular patterns 20 have a plurality of adjacent upper wire peaks 22 and a plurality of adjacent lower wire peaks 22'. Connecting successive ones of the upper and lower peaks respectively are connecting portions 24. The method of forming the spring in accordance with the present invention comprises the step of bending the wire triangular pattern 20 substantially into a circular configuration as shown in FIG. 4. In this configuration, alternating peaks 20, 22 respectively are brought adjacently one another while the connection portions 24 are each bent substantially into circular configurations. The bent connecting portions 24 together generally define a circular cylindrical surface having a hollow cavity 26 and a lateral opening 28, best seen in FIG. 4, substantially parallel to the axis of the cylindrical surface. The dimensions of the cavity 26 are so selected so that arch wire section 14' may be received therein. Although the cross-section of the spring 19 is shown in FIG. 4 to essentially be circular, it should be clear that any other cross-section, including square or rectangular cross-sections, may be utilized while achieving the same advantages as with the circular cross-section.

Referring to FIG. 5, each of the wire peaks act as a triangular bracing portion — the connecting portions 24 connecting successive ones of the bracing portions along the axial direction of the spring.

The width of the opening 28 is selected to be smaller than the diameter of the arch wire section 14' so that when the spring 19 is urged onto the arch wire 14', the opening 28 must be resiliently enlarged to accommodate the arch wire section 14'. In some circumstances, it may be desirable to reduce the width of the slot 28 to zero or even cause the opposite edge portions to overlap. However, once the spring 19 has been mounted onto the arch wire section 14', as shown in FIG. 5, the spring is securely mounted thereon. Advantageously, the spring 19 is made from any resilient material which can provide compressive forces when compressed along the axial direction or which can provide tensile forces when stretched along the axial direction. Any suitable material commonly used for helical springs, e.g., spring steel, may thus be utilized. It is also contemplated, that the springs 19 be made from any suitable elastomeric material in the form of hardened rubbers or plastics.

FIGS. 7 and 8 are similar to FIGS. 3 and 5. However, the wire peaks 32 of the wire triangular pattern 30, as

well as the wire peaks 32', are spaced further from each other than are the wire peaks in FIG. 3. Accordingly, the spring formed from the wire triangular pattern 30 can be described as having a higher pitch than does the spring of FIG. 5. In all other respects, the two springs are similar and can provide similar functions.

The repeating wire triangular pattern 40 of FIG. 9 may be defined as having a longitudinal direction along which the repeating triangular pattern extends. In the cases of FIGS. 3, 7 and 9, the directions along which the triangular patterns extend are generally horizontal directions as viewed in those figures. In FIG. 9, successive upper wire peaks 42a-42d as well as successive lower wire peaks 42a'-42d' progressively rise one above the other while moving towards the right. In FIG. 10, the repeating wire triangular pattern 40 of FIG. 9 is shown mounted on an arch wire section 14' after the pattern has been bent as generally described above. It will be noted that the resulting lateral opening is substantially helical about the axis of the spring. A helical opening has the advantage that it further prevents the arch wire section 14' from passing therethrough when such passage is not desired.

FIG. 11 illustrates the positions of the connecting portions 34 when the spring is placed under compression.

A further embodiment of the present invention is shown in FIG. 12. A spring 50 has a plurality of spaced outer turns 52 and a plurality of spaced inner turns 54 each respectively connected to the external turns 52 in such a manner as to together define a helical configuration. The resulting spring has an internal cavity 56 and an external cavity 58 which is dimensioned to receive an arch wire section 14'. Advantageously, in order to take up the least space in the mouth, the internal cavity 56 is made as small as possible. The method of producing a spring as shown in FIG. 12 consists in the step of bending a helical coil along one of its peripheral axial edge portions so as to indent the turns of the helical coil along the axial edge portion substantially into closed C-shaped turns. The resulting cylindrical cavity 58, exteriorly of the helical coil, thus becomes suitable for receiving an arch wire section through an elongated lateral opening 60.

With respect to all of the above described embodiments, the springs are in the general form of slotted open sleeves. The above described embodiments are merely illustrative and are not intended to limit the precise spring configuration which may come within the scope and spirit of the present invention. Thus, for example, a spring in accordance with the present invention may equally consist of a substantially closed or apertured sleeve slotted along one of its peripheral edges to provide an opening for passage of an arch wire as described above.

Examples of sleeve configurations suitable for purposes described above are shown in FIGS. 13-16. In FIG. 13, a sleeve 50 comprising a plurality of series of hollow truncated cone sections 52 is in the nature of a bellows having a slot 54 along a peripheral portion thereof. A variation of the bellows sleeve 50 of FIG. 13 is shown in FIG. 14 wherein a bellows arrangement 60 comprises a series of hollow cylindrical sections having rounded peripheries. The bellows 60 is similarly provided with a slot 64. Other bellows configurations which are flexible along their axial directions can equally be used. In FIG. 15, a sleeve 70 is provided

about its cylindrical surface with a plurality of rectangular apertures 72 and an elongated peripheral slot 74. The only variation of the sleeve 80 of FIG. 16 is that the apertures 82 are triangular. The slot 84 corresponds to slot 74. The bellows 50, 60 and the sleeves 70, 80 can be made from any elastic material such as rubber, plastic, metal and so on.

With respect to all the above described embodiments, when the length of the spring is selected to be greater than the length of an arch wire section 14' between two adjacent brackets 10, the spring 19 is placed under compression and the spring biases the brackets in directions which tend to separate the brackets from one another. However, it is also possible, with any of the above described embodiments, to select the length of the spring 19 to be less than the length of the arch wire section 14' between two adjacent brackets 10. In such case, the ends of the springs 19 may be connected to the brackets in a conventional manner so as to generate tensile forces which tend to pull the two brackets in directions towards each other.

Although some of the above-described coils have been shown and described as being made from a repeating wire triangular pattern, it should be clear that any other repeating or undulating pattern can similarly be used. Thus, the peaks, instead of being pointed, could be rounded and the pattern could be wave-like, e.g. sinusoidal.

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. Orthodontic biasing device comprising in combination two spaced orthodontic brackets suitable for mounting on respective adjacent teeth and having lateral surfaces; an orthodontic arch wire section extending between said two brackets; and an elongate resilient member defining a cylindrical surface and a hollow cylindrical cavity configured to receive said arch wire section in substantially coaxial relation, said resilient member being in a state of compression along the length when mounted on said archwire section thereof to cause each end to abut against a lateral surface of another one of said brackets, said resilient member including an elongate opening generally extending along the length thereof to provide access to said cylindrical cavity, said opening having a width smaller than the diameter of said arch wire section, whereby once said resilient member is urged onto said arch wire section by resiliently enlarging the width of said opening and passing said arch wire section therethrough, said resilient member becomes securely mounted on said arch wire section and acts on said brackets to move the same apart.

2. Orthodontic biasing device as defined in claim 1, wherein said cylindrical surface is in the form of a circular cylindrical surface.

3. Orthodontic biasing device as defined in claim 1, wherein said resilient member is made from a continuous resilient wire.

4. Orthodontic biasing device as defined in claim 1, wherein said resilient member comprise alternately spaced triangular bracing portions positioned to each side of said elongate opening, and connecting portions

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each connecting two adjacent bracing portions positioned on opposite sides of said opening.

5. Orthodontic biasing device as defined in claim 2, wherein said elongate opening generally defines a straight opening on said surface substantially parallel to the axis of said cylindrical surface.

6. Orthodontic biasing device as defined in claim 2, wherein said opening generally defines a helical opening on said surface about the axis of the latter.

7. Orthodontic biasing device as defined in claim 1, wherein said member is in the form of an elongate bellows flexible along its axis and having an elongate slot along a peripheral portion thereof.

8. Orthodontic biasing device as defined in claim 7, wherein said slot is substantially parallel to said axis.

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9. Orthodontic biasing device as defined in claim 1, wherein said member is in the form of an elongate apertured sleeve flexible along its axis and having an elongate slot along a peripheral portion thereof.

10. Orthodontic biasing device as defined in claim 9, wherein said slot is substantially parallel to said axis.

11. Orthodontic biasing device as defined in claim 1, wherein said resilient member is formed by bending a helical coil along one of its axial edge portions so as to indent the turns of the helical coil along the axial edge portion substantially into closed C-shaped turns to thereby form a cylindrical cavity exteriorly of the helical coil.

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