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Wallshein

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[54] **ORTHODONTIC COIL AND RETAINING DEVICE UTILIZING THE SAME**

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

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

[58] **Field of Search** ..... 32/14 A, 14, 40 R, 40 A, 32/1

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Primary Examiner—Robert Peshock

Attorney, Agent, or Firm—Friedman & Goodman

[57] **ABSTRACT**

An orthodontic retaining device in the form of a removable partial denture or active orthodontic appliance that cooperates with teeth includes an acrylic member having an external peripheral portion configurated in the general arch-shape of a normal dentition of the teeth. A plurality of coils in the form of springs are at least partially embedded in the acrylic and positioned adjacent to the peripheral portion of the acrylic member. A portion of the spring, which may be of the same or a different pitch than the embedded portion, extends exteriorly of the acrylic member and is provided at its free end with a clasp or rest. The clasp is preferably in the form of a ball clasp or a bar clasp which engages the teeth when the partial denture or appliance is fully positioned interiorly of the arch of the teeth. The rest is so configurated so that it abuts the crown of a tooth and is securely lodged in a groove thereof when the partial denture is positioned lingually or palatally of the arch of the teeth. In each case, the exposed portion of the coil has limited freedom of movement. Turning of the coil about its axis within the acrylic member is limited by an extension at the free end of the embedded portion which defines a pitch other than the pitch of the embedded portion of the coil.

18 Claims, 9 Drawing Figures

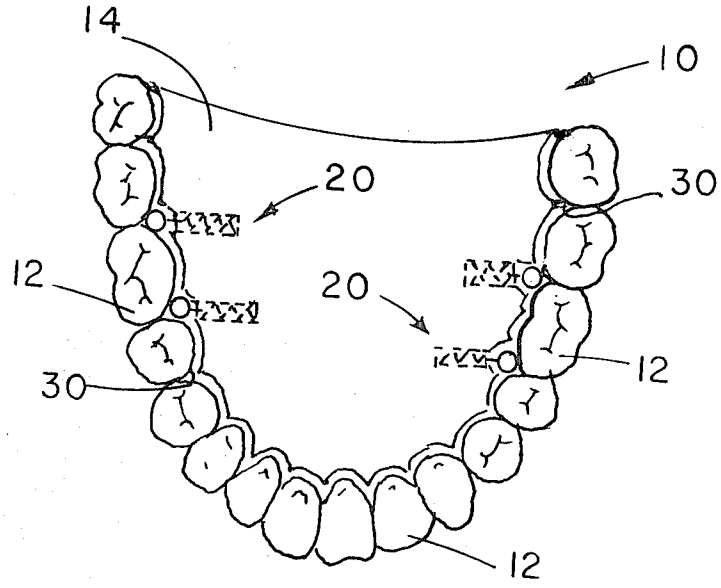


FIG. 1.

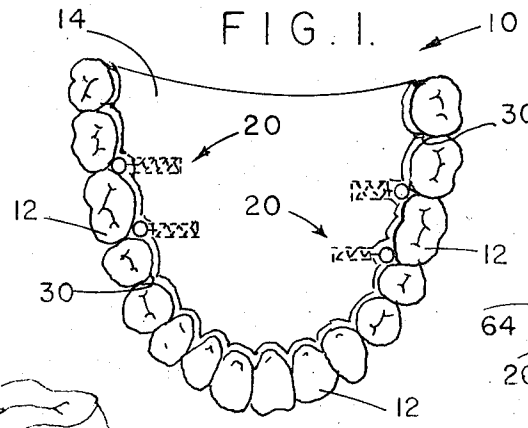


FIG. 2.

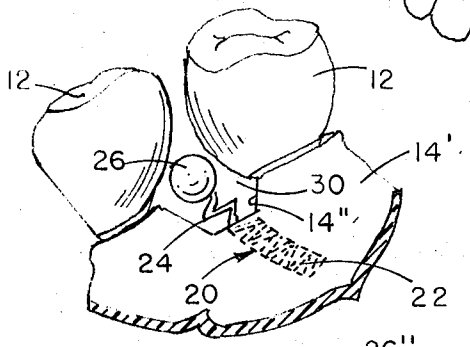


FIG. 9.

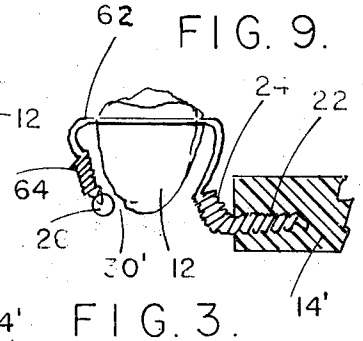


FIG. 3.

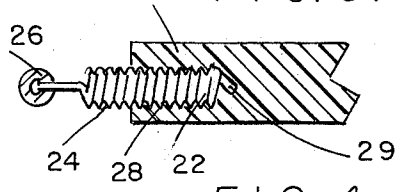


FIG. 4.

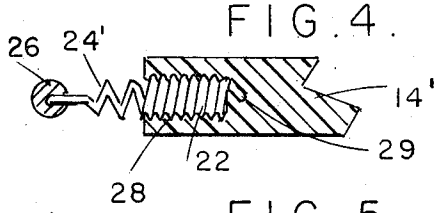
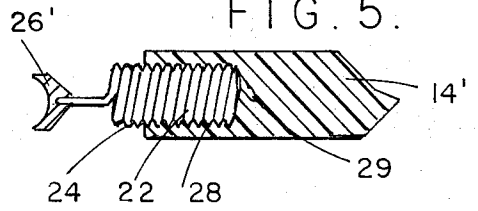


FIG. 5.



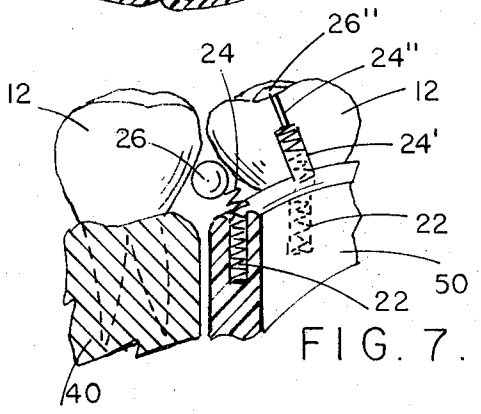


FIG. 7.

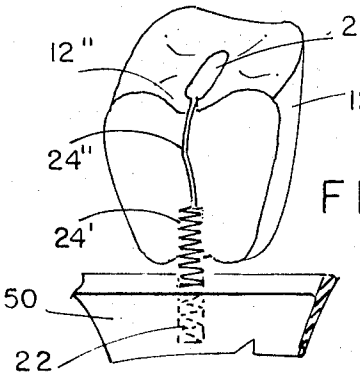


FIG. 8.

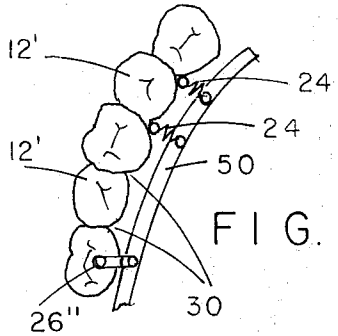


FIG. 6.

ORTHODONTIC COIL AND RETAINING DEVICE UTILIZING THE SAME

BACKGROUND OF THE INVENTION

The present invention relates to orthodontic retaining devices, and more particularly to a removable partial denture or active orthodontic appliance which is simply and removably secured by urging the denture or appliance into its normal position lingually or palatally of the arch of the teeth.

Retaining devices in the form of removable partial dentures as well as active orthodontic devices for applying forces to teeth are already known. Also known are clasps of various types which project from a removable partial denture and which fit around natural teeth and resist dislodging forces to maintain the denture in position. Also known are the use of rests and indirect retainers of various forms which cooperate with removable partial dentures for preventing vertical displacement of a denture.

However, the known rests and clasps have the disadvantage that they have not provided the flexibility desirable in the manufacture and use of such partial dentures or appliances. Thus, a commonly used type of clasp is a circumferential clasp which almost fully embraces a tooth to which it is secured. A partial denture provided with a plurality of such clasps is inconvenient to place on teeth. The circumferential clasps, as well as other commonly used types of clasps, must generally be configurated in the form of the specific teeth with which they are to cooperate. This requires that the clasps be fitted to the teeth. This represents additional time as well as expense in the preparation of the clasps. The latter disadvantage is equally applicable with respect to rests.

A still further disadvantage of the known clasps is the requirement of many of these appliances that they extend over occlusal surfaces. A further disadvantage in the known clasps and rests used in conjunction with partial dentures or active appliances is their lack of adjustability. Thus, the clasps and rests must be fitted carefully if proper engagement is to be made and the partial denture or appliance is to be retained in its desired position. Frequently, however, when teeth move, either as a result of the partial denture itself or other orthodontic appliances acting on the teeth, the original relationship between the clasps and rests and the teeth no longer exists. Consequently, the partial denture or appliance becomes subject to dislodgements. Frequently, the clasps and rests cannot be adjusted to fit new conditions of the teeth and a new partial denture or appliance must be prepared.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an orthodontic coil and retaining device utilizing the same which are not possessed of the above described disadvantages.

It is another object of the present invention to provide a retaining device employing orthodontic coils in accordance with the present invention which is simple in construction and economical to manufacture.

It is still another object of the present invention to provide an orthodontic coil, which is supplied at one free end thereof with any desirable clasp or rest and

which is suitable for use with retaining devices such as acrylic removable partial dentures.

It is yet another object of the present invention to provide an orthodontic coil for use with partial dentures which includes a projection at one end thereof which, when mounted in the partial denture, prevents the free turning of the coil.

It is a further object of the present invention to provide a retaining device in the form of a partial denture which may easily and removably be secured lingually or palatally of an arch of teeth.

It is still a further object of the present invention to provide an orthodontic retaining device which includes coils having exterior portions and embedded portions, the exterior portions being connected to either clasps or rests — the exterior portions acting either as compression or tension springs for biassing the teeth relative to the partial denture or appliance.

It is yet a further object of the present invention to provide a removable partial denture or active appliance including coil means having ball clasps at free exposed portions thereof which spring into spaces formed by adjacent teeth, whereby flexing the exterior portions into an engaging position retains the denture or appliance in a normal position lingually or palatally of the arch of the teeth.

In order to achieve the above objects, as well as others which will become apparent hereafter, the orthodontic retaining device in accordance with the present invention comprises a member having an external peripheral portion configurated in the general arch-shape of a normal dentition of the teeth. Coil means are provided having an internal portion supported by said member in the region of said peripheral portion. Said coil means has an external portion projecting from said member. Engaging means are provided which is connected to said external portion and configurated to releasably engage at least one tooth when said member is fully positioned lingually or palatally of the arch of the teeth.

According to the presently preferred embodiment, said member is substantially flat and in the form of an acrylic partial denture or active appliance. Also, said internal and external portions comprise turns having the same pitch. According to a variation, said internal and external portions comprise turns having a different pitch.

Said engaging means may comprise a ball clasp, a bar clasp arranged to engage the side portions of a tooth, or a rest arranged to engage a groove in the crown of a tooth.

According to another feature of the present invention, said internal portion comprises substantially parallel turns and a free end provided with an extension which extends in a direction other than said parallel direction. Said member is provided with a screw thread configurated to meshingly receive said parallel turns. Said internal portion is prevented from freely turning due to the frictional engagement of said extension with said screw thread.

When adjacent teeth form spaces therebetween, said coil means may be so positioned along said peripheral portion so that said engaging means is positioned in the region of at least one of the spaces. In this manner, said engaging means can enter the space and retain said member in a position relative to the teeth forming the space. When at least one of the teeth has a crown with

a groove, said coil means may be so positioned along said peripheral portion so that said engaging means is positioned in the region of at least one groove. Said engaging means comprises a rest configurated to abut against the crown so as to be securely positioned in the groove. In this manner, said rest supports said plastic member on the tooth having the groove.

The invention also encompasses a coil which is used with orthodontic retaining device as above described.

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 bottom view of a normal dentition of the maxillae or upper teeth, showing a retaining device in the form of a removable partial denture retained in the arch of the teeth by means of orthodontic coils in accordance with the present invention;

FIG. **2** is a fragmented perspective view of a portion of the partial denture as shown in FIG. **1,** showing one coil in accordance with the present invention provided with a ball clasp lodged in a space formed by two adjacent teeth;

FIG. **3** is a fragmentary side elevational view, partly in cross-section, showing the coil of FIG. **2** in a normally unstressed position;

FIG. **4** is a view similar to FIG. **3,** but showing a coil in accordance with the present invention wherein an exposed or external portion of the coil has a greater pitch than the embedded portion;

FIG. **5** is a view similar to FIG. **3,** but showing a bar clasp at the free end of the coil in accordance with the present invention instead of a ball clasp;

FIG. **6** is a partial view of a normal permanent dentition of the mandable or lower teeth, and showing the utilization of coils in accordance with the present invention provided with clasps as well as a rest which cooperate with the teeth;

FIG. **7** is a fragmentary perspective, partly in cross-section, of the partial denture used in the lower part of the mouth and showing the manner in which a ball clasp and a rest connected to the coils of the present invention cooperate with the teeth;

FIG. **8** is a perspective view of one of the teeth shown in FIG. **7,** showing the details of the manner in which the rest cooperates with the coil in accordance with the present invention and the manner in which it is lodged in the groove of a tooth crown; and

FIG. **9** is a view similar to FIG. **3,** but showing a spring wire-coil arrangement with a ball clasp at a free end for engaging spaces between the teeth on the facial side of the mouth.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to orthodontic coils and to an orthodontic retaining device in the form of a partial denture or active appliance which incorporates the coils — the coils being provided with clasps and/or rests at the free ends thereof for engaging teeth and securing the partial denture or appliance in relation thereto. As will become clear, the present invention may be utilized with both upper and lower dentures or appliances. For the purposes of the specification and the claims, partial dentures and active orthodontic appliances shall be collectively designated as orthodontic devices.

Referring now to the FIGURES, in which similar identical parts have been designated by the same reference numerals, and first referring to FIG. **1,** a set of upper teeth **12,** also referred to as the normal permanent dentition of the maxillae, are shown in their normal arch-configuration. A plastic removable device **10,** in the form of a partial denture, frequently utilized as a retaining device, is shown positioned lingually or palatally of the arch of teeth **12.** The removable device **10** typically comprises a plastic or acrylic member **14** which has an external peripheral portion configurated in the general arch-shape of the teeth **12.** In its normal position, the acrylic member **14** is adjacent to the palate (not shown) of the mouth. It is clear, therefore, that there is little danger of the acrylic member **14** in moving upwardly. However, upper removable appliances require securing means which prevent the appliances from moving away from the palate and falling out of the mouth by becoming disengaged from the upper teeth **12.** Consequently, clasps in the form of metal projections that fit around natural teeth and resist dislodging forces are utilized to maintain the dentures in position. In place of the conventional clasps, the present invention utilizes retaining members **20,** the exposed portions of which become lodged in spaces **30** between adjacent teeth so as to bias the acrylic member **14** superiorly and prevent the latter from becoming dislodged from its normal position adjacent the palate.

The specific manner in which the retaining member **20** cooperates with the teeth **12** is best seen in FIG. **2.** As there shown, the retaining member **20** comprises an internal coil portion **22** and an external coil portion **24** which extends through a cut-out **14''** of the external peripheral portion **14'** of the acrylic member **14.** The cut-out **14''** is not a critical feature of the present invention and may be omitted if the external portion **24** is otherwise permitted to flex. Connected to the free end of the external portion **24** is a ball clasp **26** which acts as an engaging member. External coil portion **24** is of sufficient length and has sufficient flexibility so that the ball clasp **26** may be deflected to either side of the plane generally defined by the acrylic external peripheral portion **14'.**

The internal coil portion **22** is embedded in the peripheral portion **14'** in a conventional manner.

In use, the acrylic member **14** is raised towards the palate. During such action, the ball clasps **26** are deflected downwardly in the mouth when they engage the teeth **12** and are initially prevented from freely proceeding or following the acrylic member **14** towards the top of the mouth. However, once the acrylic member **14** has reached approximately its normal position adjacent the palate, the ball clasps are pulled substantially along the long axis of the teeth while the external coil portions **24** are in stressed conditions. When a ball clasp **26** reaches of comes in the vacinity of a space **30** formed between two adjacent teeth, lingually or facially, the stressed external coil portion **24** urges the ball clasp into the spaces **30** — the biassing action arising from the forces generated in the external portion **24** due to the deformation of the same. The external coil portion **24** seeks to return to its straightened or un-

stressed condition. To the extent to which this is possible, the ball clasp **26** penetrates the space **30** — the length of the external portion being so selected so that the latter preferably remains in at least a partially stressed state when the ball clasp **16** has fully penetrated the space **30.**

To effect the above described engagement, the retaining members **20** in the form of coils are positioned along the external peripheral portion **14'** in regions adjacent naturally formed spaces **30** — preferably adjacent the posterior teeth. However, similar retaining means may be utilized in conjunction with the anterior teeth.

As should be clear, the stressed position of the external coil portion **24,** once the ball clasp **26** has fully penetrated the space **30,** is such that the external coil portion slightly deflects downwardly away from the direction of the palate. The external coil portions **24** together act as spring cushions or absorber mounts which support the acrylic member **14** and prevent the latter from dropping down from the palate of the mouth. To achieve this action, the length of the external portions **24** must be such that, in the normal operative positions, the external portions **24** bias the ball clasps **26** in directions to further penetrate the spaces **30.** Also, the external coil portion **24** is selected to have sufficient stiffness so that it does not, under the weight of the acrylic member **14,** flex sufficiently to thereby permit the acrylic member **14** to move away sufficiently from the palate so as to move substantially below the engaged positions of the ball clasps **26.**

As should be clear, the acrylic member **14** is spring mounted on the teeth and snaps into the mouth adjacent the palate once the ball clasps **26** have become interposed opposite corresponding spaces **30** between adjacent teeth. To remove the acrylic member from the mouth, the acrylic member is urged in a downward direction sufficiently to flex the external coil portions **24.** Once the acrylic member is sufficiently below the ball clasps **26,** further downward urging of the acrylic member **14** pulls the ball clasps **26** downward and out of the spaces **30.** Once the ball clasps **26** have become substantially dislodged from the spaces **30,** the acrylic member can be simply removed from the mouth.

The details of the orthodontic coils in accordance with the present invention are illustrated in FIGS. **3–5.** In FIG. **3,** the coil is shown with its external coil portion **24** exposed and its internal coil portion **22** embedded in the external peripheral portion **14'** of the acrylic member. The external and internal coil portions are shown to comprise a plurality of concentric helical turns substantially parallel to each other. The pitch of the turns of the external coil portion is the same as the pitch of the internal coil portion. Provided at the free end of the external coil portion is a ball clasp **26** which is utilized as described above.

According to another feature of the present invention, a thread **28** is provided in the external peripheral portion **14'** which meshes with the helical turns of the coil. In this manner, the helical coil may be turned about its axis so as to move the ball clasp **26** closer or further from the external peripheral portion **14'.**

At the free end of the internal coil portion **22,** there may be provided an extension **29** which projects in a direction other than the parallel direction of the internal coils to thereby define a pitch which is different from the pitch of the internal coils and of the thread **28.**

As will be clear, the extension **29** prevents the free turning of the coil about its axis. Thus, although the position of the coil is adjustable, the turning of the coil requires a substantial torque applied to the coil in order to overcome the frictional forces which are developed by the extension **29** brushing against the thread **28** or other portions of the interior of the acrylic member **14.** This feature constitutes a safety feature which prevents the coils from freely turning to thereby possibly move further into the acrylic under the pressure of external forces and thereby decrease the number of helical turns in the external coil portion. Such action may result in loss of the biassing action described in connection with FIG. **2.**

Variations of the embodiment as shown in FIG. **3** are illustrated in FIGS. **4** and **5.** In FIG. **5,** the external portion **24'** is shown to have a pitch greater than the pitch of the coils of the internal portion **22.** This increased pitch may be provided by pulling the external portion **24** and deforming the same by the application of such an external force. The external portion **24'** may thus be utilized as both a pressure biassing means or a tension biassing means. In FIG. **5,** the ball clasp **26** has been replaced by a bar clasp **26'.**

Although the internal portions **22** may be directly embedded in the acrylic member **14** while the latter is still soft, in a conventional manner, it is also possible to prepare an external coating or sleeve member about the internal portions **22** prior to insertion of the same in a softened acrylic member. In this manner, one may be assured that a suitable thread **28** is provided for the internal coils. Alternately, in order to prevent sticking of an internal coil portion in a directly embedded acrylic member, it is also possible to coat the internal portion **22** with a lubricant prior to the embedding step. Of course, if it is not desired to adjust the position of the coil along its axis, the extension **29** will prevent such movement. In this case, the extension **29** can be made longer so as to make it more difficult to turn the coil about its axis.

Although ball clasps and bar clasps have been shown, it is clear that any other type of clasp commonly used in the art or other retaining orthodontic device may be connected to the free ends of the coils.

FIGS. **6–8** primarily concern partial dentures or active devices utilized in the lower part of the mouth. Thus, in FIG. **6** a partial arch of the mandable or lower teeth **12'** is shown. The lower device **50,** also shown in FIG. **7,** generally comprises an annular cylindrical member which closely follows the outline of the teeth as did the external peripheral portion **14'** of the upper device.

Referring to FIGS. **6** and **7,** the internal portions **22'** are shown to be mounted in a substantially vertical direction in the retaining device **50** — as opposed to a substantially horizontal direction in connection with upper devices. The external portion **24'** is shown connected to a ball clasp **26** whose operation is substantially the same as that described in connection with FIGS. **1** and **2.** However, in the case of a lower device, the retaining means **20** serve to prevent excessive movement of the device in an upper direction. Although the internal portions **22** in FIG. **7** have been shown to be substantially in a vertical direction, it is clear that the direction can be slightly changed as required to insure that the ball clasp **26** remains biased

in the space **30** after the clasp has been positioned therein.

An additional problem in connection with lower devices is the prevention of the latter from dropping excessively from their normally desired position, and so to come into contact with the soft tissues of the bottom of the mouth in the region of the tongue. The coils in accordance with the present invention insure that the lower denture **50** is maintained in its desired position as shown in FIGS. **7** and **8.** An internal portion **22** is mounted as described above. However, an external portion **24'** is provided with a wire extension **24''** which terminates at its free end thereof with a rest **26''**. The rest **26''** is arranged substantially in a direction normal to the direction of the wire extension **24''** and the external coil portion **24'**. The external portions **24'** are so spaced about the periphery of the device so as to be positioned or disposed adjacent teeth **12'** having grooves **12''** in their crowns. The rest **26''** is so arranged and positioned so as to be capable of engaging the crown by becoming securely lodged in a groove **12''**.

The external coil portion **24'** is made sufficiently stiff so that the latter does not open excessively with the consequent lowering of the lower partial denture **50** in response to the weight of the latter as well as the downward biassing forces of the ball clasps **26** and external portions **24.** The external coil portions **24'** are normally in a state of tension and merely serve to support the device in a vertical direction.

Although the above described coils and clasps have been described as being utilized for the purpose of securing an acrylic member relatively fixed relative to teeth in a mouth, it should be clear that the same coils, with high or low pitched external portions may also be utilized to apply pressures or tensions on a particular tooth and thereby move the tooth in a desired fashion.

A further embodiment of the invention is shown in FIG. **9,** wherein a wire **62** is connected to the external coil portion **24.** The wire is preferably stiff but sufficiently flexible so as to be capable of flexing, as to be described. A further coil **64,** not unlike the coil portions **22, 24,** is provided at the free end of the wire **62** and a ball clasp is connected to the free end of the coil **64.** The wire **62** is so configurated so as to bridge regions formed by two adjacent teeth. More specifically, the wire **62** and spring **64** are so arranged to that the clasp **26** initially moves in the facial direction relative to the portion **14'** of the device when the device is urged lingually or palatally between the teeth. When the device assumes its near final position, the biassed coil **64** urges the clasp **26** to penetrate a space **30'** between two adjacent teeth. It will be appreciated that although the wire **62** bridges the arch of the teeth, it need not extend over occlusal surfaces of the tooth. By making the wire **62** of sufficiently small cross-section, it can bridge the arch between the occlusal surface of adjacent teeth. This last described embodiment may be utilized in conjunction with both upper and lower devices.

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 device comprising a removable dental plate adapted to cooperate with a dentition of teeth and having an external peripheral portion configurated in the general arch-shape of the dentition and having at least one threaded hole in said peripheral portion, said peripheral portion of said dental plate substantially following and being adjacent to the dentition when normally disposed in an operative position relative to the corresponding arch; coil means having an internal portion comprising a plurality of turns threadedly receivable in said threaded hole, whereby said coil means is axially movable in response to rotation thereof about the axis of the same and resulting threaded engagement between said internal portion turns and the internal screw thread formed in said hole, and having an external portion projecting from said dental plate; and engaging means connected to said coil external portion and configurated to releasably engage one tooth of the dentition when said dental plate is disposed in the operative position, whereby said dental plate is maintained in the normal or operative position by the action of said coil means and engaging means.

2. Orthodontic retaining device as defined in claim **1,** wherein said dental plate is in the form of a partial denture.

3. Orthodontic retaining device as defined in claim **1,** wherein said dental plate is an active appliance.

4. Orthodontic retaining device as defined in claim **1,** wherein said dental plate is substantially flat.

5. Orthodontic retaining device as defined in claim **1,** wherein said internal and external portions comprise turns having the same pitch.

6. Orthodontic retaining device as defined in claim **1,** wherein said internal and external portions comprise turns having different pitch.

7. Orthodontic retaining device as defined in claim **6,** wherein the pitch of the turns of said external portion is greater than the corresponding pitch of said internal portion.

8. Orthodontic retaining device as defined in claim **1,** wherein said engaging means comprises a ball clasp.

9. Orthodontic retaining device as defined in claim **1,** wherein said engaging means comprises a bar clasp.

10. Orthodontic retaining device as defined in claim **1,** wherein said engaging means comprises an extension, and a rest member configurated and arranged to engage a groove in the crown of a tooth.

11. Orthodontic retaining device as defined in claim **1,** wherein said engaging means comprises a wire curved substantially in the form of a U-shape so as to bridge the arch of teeth from the lingual towards the facial side of the mouth, and a clasp at the free end of the wire on the facial side, said wire being so configurated so as to bias said clasp lingually to thereby permit said clasp to penetrate a space between two adjacent teeth.

12. Orthodontic retaining device as defined in claim **1,** wherein said internal portion comprises substantially parallel turns and has a free end portion provided with an extension which extends in a direction other than said parallel direction.

13. Orthodontic retaining device as defined in claim **12,** wherein said dental plate is provided with a screw thread configurated to meshingly receive said parallel turns, said internal portion being prevented from freely

turning due to the frictional engagement of said extension with said screw thread.

14. Orthodontic retaining device as defined in claim **1**, wherein said dental plate is provided with cut-out portions in the regions of said periphery where said coil means is supported so that said external portions may flex without interference with said member.

15. Orthodontic retaining device as defined in claim **1**, wherein adjacent teeth form spaces, and wherein said coil means is so positioned along said peripheral portion so that said engaging means is positioned in the region of at least one of the spaces, whereby said engaging means can enter the space and retain said dental plate in position relative to the teeth forming the space.

16. Orthodontic retaining device as defined in claim **1**, wherein at least one of the lower teeth of the dentition has a crown with a groove, and wherein said coil means is so positioned along said peripheral portion so that said engaging means is positioned in the region of at least one groove; said engaging means comprising a rest configurated to abut against the crown as to be securely positioned in the groove, whereby said rest supports said dental plate on the tooth having the groove.

17. Orthodontic retaining device as defined in claim **1**, wherein said dental plate is made from plastic.

18. Orthodontic retaining device as defined in claim **17**, wherein said plastic is acrylic.

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