June 16, 1953 L. S. GREENMUN 2,641,835

ARTIFICIAL DENTURE

Filed Sept. 21, 1950

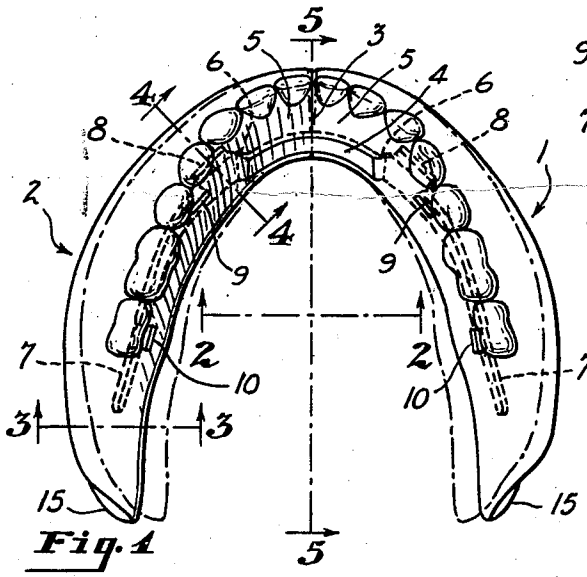

Fig. 1

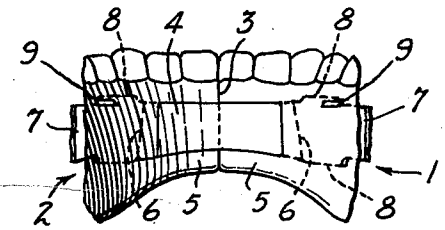

Fig. 2

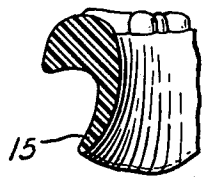

Fig. 3

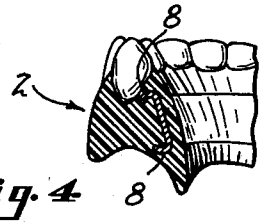

Fig. 4

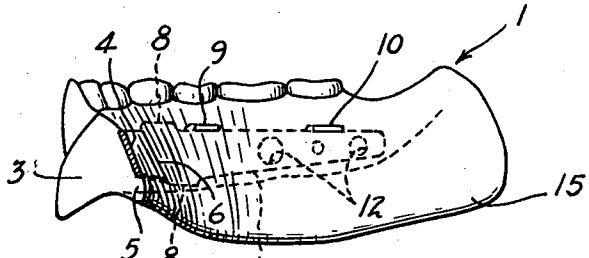

Fig. 5

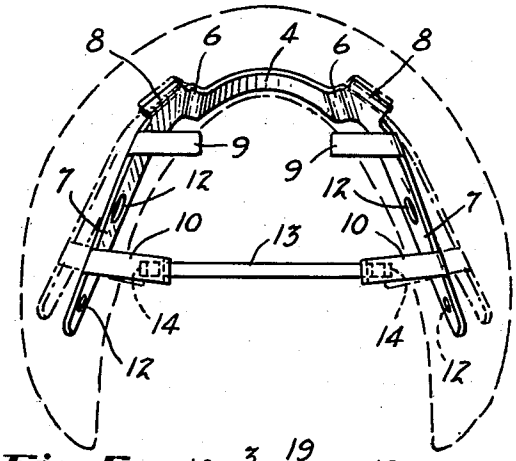

Fig. 6

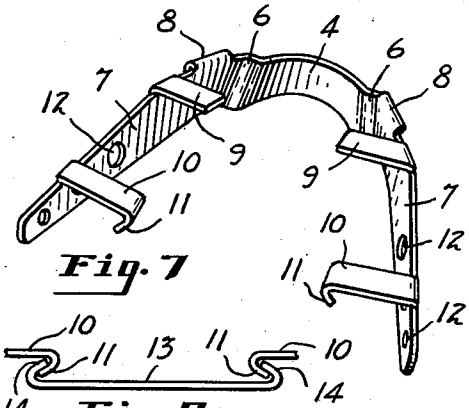

Fig. 7

Fig. 8

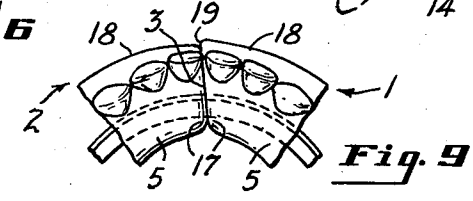

Fig. 9

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ARTIFICIAL DENTURE

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24 Claims. (Cl. 32—2)

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This invention relates to artificial dentures, but has reference more particularly to lower dentures.

In the making of lower dentures, the principal problems encountered are (1) proper fitting of the dentures in a manner to permit them to be satisfactorily retained in position in the mouth during use thereof, and (2) avoidance of irritation of the gums and formation of sore spots or areas in the mouth caused by the friction and/or uneven pressure of the denture against the gum tissues during mastication of food.

As exemplified by Hagerman U. S. Patent No. 2,250,373 and Snell U. S. Patent No. 2,266,478, attempts have been made, through the use of soft rubber inserts, springs, and special denture shapes to achieve a better degree of retention of the denture in the mouth and greater comfort for the wearer of the denture. While some improvements in retention have been effected, such improvements have usually been at the expense of increased friction or excessive pressure of the denture against the gum tissues, or both, resulting in irritation of the gum tissues and formation of sore spots or areas.

The present invention is based to some extent on my discovery that during chewing or biting there is some displacement of the stress-bearing tissues underlying a lower denture and apparently an appreciable flexing of the lower jaw bone, due to the stresses imposed thereon. This flexing and displacement of the stress-bearing tissues underlying the denture causes changes in the curvature of the arc of the gums and tends to dislodge a conventional rigid denture, which is incapable of any flexing itself. The relative movement of a conventional rigid denture with respect to the thin gum tissues which cover the lower jaw bone also causes pressure areas and friction that produce sore spots on these tissues. When the conventional rigid denture is relieved sufficiently to partially accommodate the aforesaid movement, the denture becomes too loose, food particles accumulate thereunder, and it is difficult to retain the denture in position.

In accordance with the invention, I provide a flexible lower denture shaped to fit against the undercut surfaces of the mylohyoid ridge and so constructed as to compensate for displacement of the supporting tissues resulting from the flexing of the mandible during biting and chewing, whereby the denture maintains a proper fit and position in the mouth at all times with no appreciable pressure or friction, the tendency towards breaking of the vacuum or suction between the denture and the tissue covering of the jaw is eliminated or greatly minimized, the efficiency of

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use of the denture is appreciably increased, and the general comfort of the wearer is materially improved, while at the same time, the denture is removable from the mouth and replaceable with a minimum of effort.

To insert a denture with portions thereof fitting against the undercut surfaces of the mylohyoid ridge, it is necessary to compress the back ends of the denture so that it may pass over the crest of the ridge and then be released to fit under it. Thus, one of the principal objects of the invention is to provide a denture capable of being compressed in this manner but designed so that no continuing outward pressure against the gum tissues is possible after its insertion, thereby avoiding any possibility of atrophy which would develop if continuing pressure were exerted on the tissues at any point or area.

A further object of the invention is to provide a denture which is reinforced throughout its length, enabling the denture to be made thinner, and thereby aiding in comfort and articulation.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a top plan view of a denture embodying the novel features of the invention;

Fig. 2 is a fragmentary rear elevational view of the denture, as indicated by the arrows 2—2 in Fig. 1;

Fig. 3 is a transverse cross-sectional view, taken on the line 3—3 of Fig. 1;

Fig. 4 is a transverse cross-sectional view, taken on line 4—4 of Fig. 1;

Fig. 5 is a longitudinal cross-sectional view, taken on the line 5—5 of Fig. 1;

Fig. 6 is a top plan view of the denture spring, showing the denture in broken lines, and also a clip which is used during the process of making the dentures;

Fig. 7 is a perspective view of the denture spring;

Fig. 8 is a fragmentary view, showing the manner in which the clip is used, and

Fig. 9 is a fragmentary view, similar to Fig. 1, but showing a modification, in which the portion of the spring shown exposed at the front of the denture in Fig. 1 is embedded in the denture.

Referring more particularly to Figs. 1 to 8 inclusive of the drawings, the invention is shown as applied to a lower denture, the denture comprising right and left hand molded base portions

1 and 2, respectively, these base portions being made of an acrylic resin or other suitable plastic material and being connected only by the spring which forms part of the denture. In their normal position in the mouth, the adjacent ends of these base portions 1 and 2 are normally in contiguity with each other along a parting line or plane 3, at the front of the denture, which acts as a stop preventing outward movement of the rear ends of the denture. By reason of the ability of the spring both to bend and twist in the region of the juncture of the parting plane, the base portions 1 and 2 are relatively movable in all except outward directions. The movement resulting from bending of the spring is illustrated by the dot and dash outline of the denture in Fig. 1.

The molded base portions 1 and 2 of the denture are held in assembled relation and connected to each other solely by means of a spring, made from a wire strip or ribbon of stainless steel or other stainless alloy, which is bent or curved to a U-shaped form generally conforming to the curvature of both halves of the denture, the spring being totally or partially concealed within the plastic denture material to which the artificial teeth are attached.

The spring comprises a central curved portion 4, which lies across the parting line or plane 3 and is inclined at an angle corresponding to the inclination or slope of the inner faces 5 or the denture halves 1 and 2, and best seen in Fig. 5. This portion 4 of the denture spring, which may or may not be concealed within the composition of the denture material as hereinafter explained, is centered on the center radius of the denture, running from behind the left to behind the right cuspids. If this part of the spring is only partially embedded in the material of the denture, as best shown in Figure 5, then its radially-inward surface is substantially flush with the surfaces 5. In this manner, any danger of food particles becoming embedded between the spring and denture parts 1 and 2 is satisfactorily precluded.

In the embodiment of the invention shown in Figs. 1 to 8, the spring is further bent to provide offsets or shoulders 6, which extend substantially radially from the central portion of the spring into the material of the denture, and spring portions 7, which extend rearwardly, are wholly embedded in the denture parts 1 and 2 and are curved as required to conform generally with the curvature of these denture parts. The spring portions 7 need not be inclined to the same extent as is the central portion 4 of the spring (compare Figs. 4 and 5), and may even lie in vertical planes normal to the general or horizontal plane of the denture.

Adjacent the offsets or shoulders 6, the portions 7 of the spring may be provided at their upper and lower edges with curved radially-outwardly extending flanges 8, which extend toward each other to provide anchors for firmly holding the spring in the base portions of the denture adjacent the points where the spring is sharply bent to form the exposed central portion where the flexing of the spring occurs. These anchors assist in avoiding any tendency of the base portions of the denture to crack in these regions where relative movement of the base portions with respect to the spring during the flexing action seems to concentrate stresses in the base portions.

The portions 7 of the spring may also be provided at their upper edges with longitudinally spaced inwardly extending ears 9 and 10, the ears 10 being somewhat longer than the ears 9 and being provided at their inner extremities with downwardly and outwardly turned flanges 11. The portions 7 of the spring are preferably also provided with longitudinally spaced openings 12. The short ears 9 and the holes 12 serve to securely hold or anchor the spring in the denture material, while the ears 10, as will be presently described, permit the spring to be firmly held in a dental flask in a prestressed condition while the denture is being molded about the spring.

The procedure for making the denture may be conventional up to the point where the waxed up stone has been completed with the artificial teeth embedded in the wax. The wax may then be cut away around the inner surface of the arch to form a channel for receiving the spring. Before incorporating the spring in the denture, it is prestressed by bending it to the shape shown in solid lines in Fig. 6. For this purpose, the free ends of the spring may be pulled toward each other from the unstressed shape shown in dot and dash lines in Fig. 6 and retained in the stressed shape shown in solid lines, either by means of a clip 13 having upturned ends 14 (Fig. 8) or other suitable tension member secured to the ends 11 of the ears 10.

The spring is preferably heated to a temperature around 200° F. so that it will soften the wax when pressed into the previously prepared channel and cause the wax to conform to the contour of the spring even though the channel has been rather imperfectly shaped to receive it. After inserting the spring into the channel, additional wax is applied over the spring portions 7 which are to be wholly embedded in the denture.

A vertical cut is then made entirely through the wax at the front of the denture between the two central teeth where the parting line or plane 3 is to be located, and a thin divider or separator is inserted in the cut. The separator may be a thin sheet of stainless steel, gold, or the like, of a thickness preferably not greater than 0.003 of an inch, the separator sheet being first cut to provide a shallow notch into which the central portion 4 of the spring will fit with the separator extending through the wax above and below the spring. After the separator is inserted, the wax may be pressed tightly against both sides of the separator or additional wax poured into place to eliminate any spaces or voids.

The waxed up stone, with the teeth, the prestressed spring, and the separator sheet all in place, is then inserted in a conventional flask containing a suitable plastic material to form the final mold in the usual manner. When the final mold has set, the wax is melted out and replaced with the acrylic resin or other plastic denture material, which is then cured in place to form the final denture. Upon removal of the final denture, the metallic separator sheet is pulled out to leave the adjacent ends of the right and left denture base portions 1 and 2 substantially contiguous and connected only by the spring. The clip 13 is then removed, and abutment of the contiguous ends of the denture base portions 1 and 2 and of the two central teeth prevents any material outward movement of the rear ends of the denture and continues to hold the spring in a stressed condition. The portions of the ears 9 and 10 which project beyond the surface of the denture are cut off, and the exposed ends smoothed and polished so that they can only be

seen as metal spots on the inner surface of the denture. The finished denture normally retains substantially the shape to which it was molded, and its rearwardly projecting ends are capable of flexing in all directions but outwardly, as above described.

The rigidity of the spring to be used in accordance with the invention may readily be controlled by selecting an appropriate spring thickness for the alloy from which the spring is made. Only sufficient prestressing of the spring to insure retention of the denture is desired. By keeping the amount of the prestressing and the rigidity of the spring relatively low, the desired flexing of the denture results during chewing without imposing excessive pressures on the supporting tissues. Also, by reason of the stop that positively limits outward movement of the rear ends of the denture, there is no outward pressure against the inner surface of the gum structure when the jaw is relaxed.

While removal of the separator used during the molding of the denture introduces a slight inaccuracy in the fit of the denture, the effect is generally negligible when a suitably thin separator is employed. To avoid this inaccuracy entirely, a film of cellulose acetate or similar plastic may be employed as the separator with a film of oil spread over one surface only of the film before it is inserted into the wax. The unoiled surface will be welded to the adjacent denture base portion and the oiled surface will not adhere to the opposite denture base portion. Thus, the separator sheet becomes an integral part of one of the denture base portions and may be left in place after trimming off its projecting edges.

The base portions 1 and 2 of the denture are respectively shaped to provide inner retaining lips 15 (Figs. 1 and 3) that fit under the mylohyoid ridges on both sides of the mouth to prevent upward movement of the denture with respect to the gums during biting and chewing. When the flexing of the jaw bone and/or gum tissue causes the inner surfaces of the arc of the gums to move inwardly against the retaining lips 15 of the base portions, the resultant inward forces readily flex the spring at the front of the denture in the exposed region 4 thereof.

This flexing of the spring permits the base portions 1 and 2 of the denture to move relatively to each other in all directions except outwardly, thereby following the flexing movement of the jaw bone and gum tissues, and minimizing the pressure between the inner sides of the gums and the denture which would result if the denture were "rigid." These movements of the denture parts may be in the common horizontal plane of the denture, or, as mentioned above, one denture part may move vertically relatively to the other denture part as permitted by twisting of the exposed central portion 4 of the spring.

In their normal positions in the mouth, and with the mouth relaxed, the base portions of the denture are in abutment with each other at the parting line or plane 3, so that there is virtually no possibility of food particles entering the joint between said base portions. During chewing, the gap which is opened between the base portions at this line or plane, due to inward flexing of the rear ends of the denture, is so small as to preclude the entrance of food particles of any substantial size into this gap. Consequently, the denture is substantially free from a defect that has plagued all previous attempts to make articulated multi-part dentures, namely, the possibility of entry of food particles into the denture, with the resultant discomfort and difficulty of cleaning the denture.

Insertion and removal of the denture is permitted by manually flexing the rear ends of the denture inwardly, against the resistance of the spring. This inward flexing also occurs automatically during chewing. When the jaw bone and/or gum tissue flexes outwardly, the denture presents no obstacle to such movement, and outward springing of the denture is unnecessary to accommodate such movement. This outward flexing is rarely sufficient to permit the denture to rise up off the gums if full advantage is taken of the undercut of the mylohyoid ridge. When the jaw bone and tissues flex inwardly, the denture follows the movements of the jaw bone, so that the denture maintains a proper fit and position in the mouth, the tendency towards formation of sore spots due to friction and/or uneven pressure is greatly reduced, and the general comfort of the wearer is materially improved.

In Fig. 9 of the drawings, a modification of the invention is shown in which a spring 16, that does not have the offsets 6 of the above described embodiment, has its central portion as well as its legs wholly embedded in the material of the denture. To permit inward flexing of this portion of the spring, the inner faces 5 of the denture parts are relieved, as at 17, the relief extending to the inner surface of the spring for the full height thereof; and the spring is preferably disposed substantially closer to the inner surfaces 5 than to the outer surfaces 18 of the base portions.

Any possibility of pinching either gum or lip tissues at 3 may be effectively precluded by use of an offset or unevenly matched meeting of the denture parts 1 and 2, as shown at 19 in Fig. 9. This technique is commonly used by both dentists and dental laboratories in overcoming cheek bite of artificial teeth. Also, as illustrated in Fig. 9, the contiguous end surfaces of the denture portions 1 and 2 need not be normal to the center of the spring, but may be disposed at an acute angle thereto.

In addition to the advantages of the invention which have been particularly stressed above, the following may be enumerated:

(*a*) The strength of the denture is greatly increased by virtue of the metallic reinforcement thereof substantially throughout its entire length provided by the one-piece spring. This enables the denture to be made thinner, thereby aiding in comfort and articulation.

(*b*) My contracting the rear ends of the denture when placing it on the lower jaw, easy insertion of the denture below the undercut under the mylohyoid ridge is permitted.

(*c*) The denture being flexible, wearer tolerance of the undercut support is achieved, and a natural anchor is made available for securing the denture.

(*d*) By using the undercut as an anchor, a greater area is made available for creating suction between the denture and gums, and the danger of breaking this suction is reduced, due to the fact that the denture flexes with the resilient underlying tissues and the jaw during chewing.

(*e*) The denture is more comfortable for the wearer, because it is a flexible denture on a flexible jaw, rather than a rigid denture on a flexible jaw.

(f) The incorporation of my spring into a lower denture presents no new technique or problem to the dental profession or laboratory, as it closely follows the technique now used for incorporating supporting clips in all partial dentures.

The use of my spring represents a simple and practical means of developing the controlled flexibility in a lower denture which is essential to accomplishing the many advantages discussed above.

It is to be understood that the forms of my invention, herewith shown and described, are to be taken as preferred examples of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. An artificial denture comprising molded base portions each having an end face in substantial contiguity with the end face of the other over the transverse cross-section of the denture, and a spring having a central portion extending across the juncture of said base portions in contiguity with edges of said end faces and having its end portions respectively embedded in the base portions, said spring securing said base portions together at said juncture and yieldingly resisting relative pivotal movement of said base portions.

2. A denture, as defined in claim 1, in which said spring is contiguous with the inner edges of said end faces and is stressed to exert forces on the base portions tending to cause separation of the rear portions of the denture from each other, and the contacting of said end faces with each other limits said separation.

3. A denture, as defined in claim 2, in which the central portion of the spring is exposed at the inner surface of the denture, and the embedded end portions of the spring are offset from its exposed central portion.

4. A denture, as defined in claim 3, in which said spring is a leaf spring and said exposed central portion of the spring has its inner surface inclined to the general plane of the denture and flush with the inner surface of the denture.

5. A denture, as defined in claim 3, in which said end portions are provided at their upper edges with horizontally extending ears embedded in the molded base portions of the denture for anchoring the spring therein.

6. A denture, as defined in claim 1, in which the base portions of the denture are provided with downwardly extending lips shaped to fit against the undercut surfaces of the mylohyoid ridge of the wearer.

7. An artificial lower denture comprising a generally U-shaped supporting base including generally symmetrical right and left portions having end faces in substantial contiguity at the front of the denture, a relatively thin generally U-shaped spring having its legs respectively embedded in said right and left portions of the supporting base, the central portion of said spring being contiguous with said edges of said end faces and bridging the parting region therebetween for connecting said portions of the supporting base into an articulated unit, said spring being embedded in said right and left portions of the supporting base in a stressed condition to urge the spaced rear ends of said portions further apart in an outward direction and normally maintain said end faces in abutment, limited movement of the rear ends of said portions toward each other being resiliently restrained by resistance of said spring to bending in said parting region.

8. A denture, as defined in claim 7, in which each of said right and left portions of the supporting base is shaped to conform to the upper and inner side surfaces of the gum structure to which it is to be applied with an extension thereof reaching downwardly and outwardly to fit partially under the mylohyoid ridge and assist in holding the denture in place.

9. A denture, as defined in claim 7, in which each of said right and left portions of the supporting base is shaped to conform to the upper and inner side surfaces of the gum structure to which it is to be applied with an extension thereof reaching downwardly and outwardly to fit partially under the mylohyoid ridge for assisting in holding the denture in place, said extension being shaped with reference to the normal undercut contour of the mylohyoid ridge so that abutment of said end faces at the front of the denture, in resisting outward movement of the rear ends of said right and left portions of the denture, also substantially prevents outward pressure of said extension against the mylohyoid ridge in the region of the undercut.

10. An artificial lower denture comprising a generally U-shaped supporting base including generally symmetrical right and left portions parted at the front of the denture, a relatively thin, generally U-shaped spring having its legs respectively embedded in said right and left portions of the supporting base, the central portion of said spring bridging the parting region between said right and left portions of the supporting base and connecting said portions into an articulated unit, the central portion of said spring that bridges said parting region having its inner surface exposed and flush with the adjacent inner surfaces of said right and left portions of the supporting base, said spring being embedded in said right and left portions of the supporting base in a stressed condition to urge the spaced rear ends of said portions further apart in an outward direction; and means at the front of the denture resisting such outward movement of the rear ends of said portions by said spring and holding the spring in said stressed condition, limited movement of the rear ends of said portions toward each other being resiliently restrained by resistance of said spring to bending in said parting region.

11. An artificial denture comprising molded base portions each having an end face in substantial contiguity with the end face of the other over the transverse cross-section of the denture, and a spring extending across the juncture of said base portions in contiguity with edges of said end faces and having its opposite ends respectively embedded in said base portions, said spring securing said base portions together at said juncture and yieldingly resisting relative pivotal movement of said base portions.

12. An artificial denture comprising a pair of molded base portions, each being shaped to conform to a portion of the arc of a gum ridge, said base portions being disposed in end-to-end relation with adjacent end faces thereof in substantial contiguity, and a leaf spring embedded in said base portions over the entire length of the spring and bridging the juncture of said end faces

for connecting said base portions into an articulated unit.

13. An artificial denture comprising a pair of molded base portions, each being shaped to conform to a portion of the arc of a gum ridge, said base portions being disposed in end-to-end relation with adjacent end faces thereof in substantial contiguity, and a leaf spring embedded in said base portions over the entire length of the spring and bridging the juncture of said end faces at one side thereof for connecting said base portions into an articulated unit.

14. An artificial denture comprising a pair of molded base portions, each being shaped to conform to a portion of the arc of a gum ridge, said base portions being disposed in end-to-end relation with adjacent end faces thereof in substantial contiguity, and a leaf spring embedded in said base portions over the entire length of the spring and bridging the juncture of said end faces at the inner edges thereof for connecting said base portions into an articulated unit, said spring being stressed to urge said end faces into abutment.

15. An artificial denture comprising a pair of molded base portions, each being shaped to conform to and extend along a portion of the arc of a gum ridge, said base portions being disposed in end-to-end relation with adjacent end faces thereof in substantial contiguity, and a leaf spring embedded in said base portions over the entire length of the spring and bridging the juncture of said end faces at the inner edges thereof for connecting said base portions into an articulated unit, and one surface of the spring being exposed at said juncture and flush with the inner surfaces of said base portions.

16. An artificial denture comprising a pair of molded base portions, each being shaped to conform to and extend along a portion of the arc of a gum ridge, said base portions being disposed in end-to-end relation with adjacent end faces thereof in substantial contiguity, and a leaf spring embedded in said base portions over the entire length of the spring and bridging the juncture of said end faces at the inner edges thereof for connecting said base portions into an articulated unit, one surface of said spring being exposed at said juncture and flush with the inner surfaces of said base portions, and the end portions of the spring beyond said exposed surface being offset and entirely covered by the material of said base portions, said spring being stressed to urge said end faces into abutment.

17. An artificial denture comprising a supporting base formed of two parts each having an end face in contiguity with the other, and a spring having an exposed curved central portion extending across the parting region defined by said contiguous end faces, and end portions offset from said exposed central portion and wholly embedded in the respective parts of the supporting base, said central portion of the spring lying in abutment with the inner surface of the supporting base adjacent said parting region and being inclined to the general plane of the denture.

18. An artificial denture comprising a supporting base formed of two parts each having an end face in contiguity with the other, and a spring having an exposed curved central portion extending across the parting region defined by said contiguous end faces, and end portions offset from said exposed central portion and wholly embedded in the respective parts of the supporting base, said central portion of the spring lying in abutment with the inner surface of the supporting base adjacent said parting region and being inclined to the general plane of the denture, and said end portions of the spring being at substantially right angles to the general plane of the denture.

19. An artificial denture comprising a supporting base formed of two parts each having an end face in contiguity with the other, and a spring having an exposed curved central portion extending across the parting region defined by said contiguous end faces, and end portions offset from said exposed central portion and wholly embedded in the respective parts of the supporting base, said central portion of the spring lying in abutment with the inner surface of the supporting base adjacent said parting region and being inclined to the general plane of the denture, said end portions of the spring being at substantially right angles to the general plane of the denture and being provided at their upper edges with horizontally extending ears that are embedded in and serve to reinforce the material of the denture supporting base.

20. A gnerally U-shaped leaf spring adapted to be embedded in a molded denture, the central portion of said spring being inwardly offset with respect to the legs thereof.

21. A generally U-shaped leaf spring adapted to be embedded in a molded denture, the central portion of said spring being inwardly offset with respect to the legs thereof, said spring having its broad surfaces curved to form the U-shape with the central portions thereof inclined to the general plane of the U.

22. A generally U-shaped leaf spring adapted to be embedded in a molded denture, the central portion of said spring being inwardly offset with respect to the legs thereof, said spring having its broad surfaces curved to form the U-shape with the central portions thereof inclined to the general plane of the U and the end portions thereof substantially normal to the general plane of the U.

23. A generally U-shaped leaf spring adapted to be embedded in a molded denture, the central portion of said spring being inwardly offset with respect to the legs thereof, said spring having its broad surfaces curved to form the U-shape with the central portions thereof inclined to the general plane of the U, and projections extending from the body of the spring to assist in anchoring it in a molded denture.

24. A generally U-shaped leaf spring adapted to be embedded in a molded denture, the central portion of said spring being inwardly offset with respect to the legs thereof, said spring having its broad surfaces curved to form the U-shape with the central portions thereof inclined to the general plane of the U, and projections extending inwardly with hook-shaped ends for attachment to the ends of a tension clip adapted to hold the legs of the spring inwardly from their normal positions.

LEO S. GREENMUN.

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