United States Patent [19]

Hirsch

[11] **3,916,525**

[45] **Nov. 4, 1975**

[54] **SWAGED METAL DENTAL CROWNS**

[76] Inventor: **Arnold J. Hirsch,** 207 N. Harrison St., Princeton, N.J. 08540

[22] Filed: **Jan. 21, 1971**

[21] Appl. No.: **108,648**

Related U.S. Application Data

[63] Continuation of Ser. No. 871,589, Nov. 7, 1969, abandoned, which is a continuation of Ser. No. 623,680, March 16, 1967, abandoned.

[52] **U.S. Cl.** **32/12**

[51] **Int. Cl.** **A61c 5/08**

[58] **Field of Search** 32/12

[56] **References Cited**

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Primary Examiner—Robert Peshock
Attorney, Agent, or Firm—Arthur L. Plevy

[57] **ABSTRACT**

A swaged crown or band useful in the fields of general preventive dentistry and orthodontic work produced by placing a crown blank upon a rigid die of the tooth to be banded or crowned and then forcing the die with the blank thereon between confined laminae of a non-rigid material, such as a roll of cloth tape. When the die is forced completely into the laminae, the blank assumes the shape of the die only in the direction in which it is forced, and not in any transverse direction. Thus, the product is a crown which is swaged on the occlusal surface and on the occlusal one-third or one-half of the sides of the tooth down to, but not including, the undercut portion which is normally designated as the gingival one-third or gingival one-half of the tooth.

9 Claims, 12 Drawing Figures

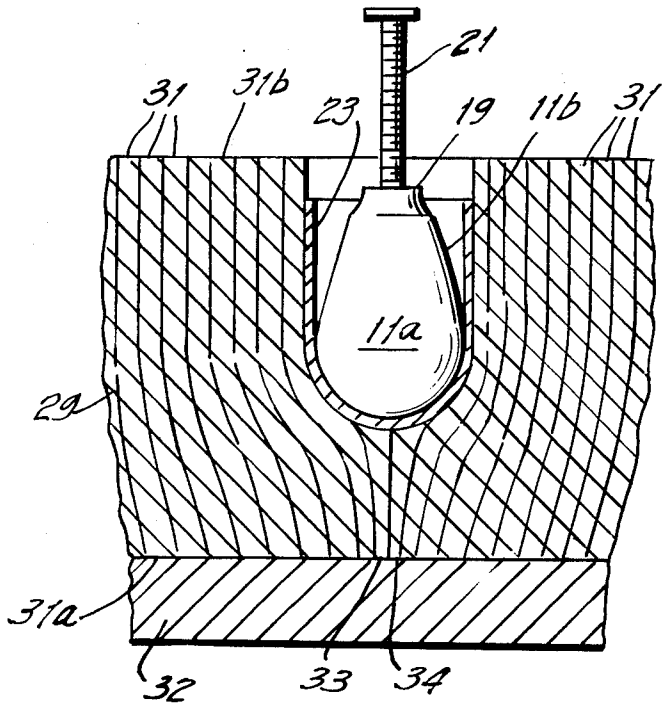


FIG. 1

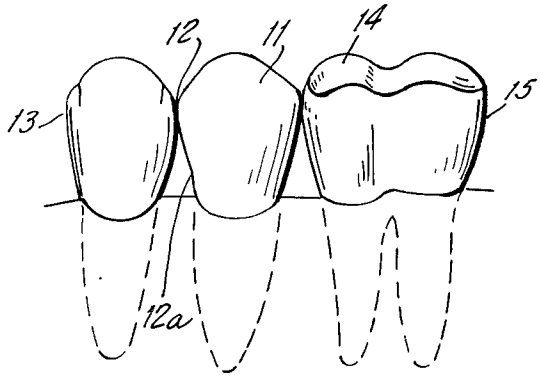


FIG. 2

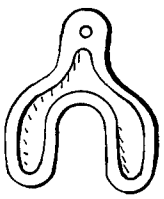


FIG. 2a

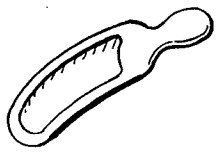


FIG. 2b

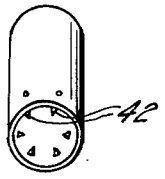


FIG. 3

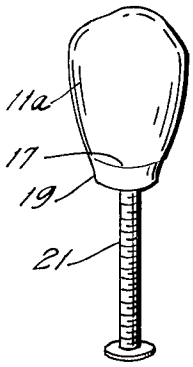


FIG. 4

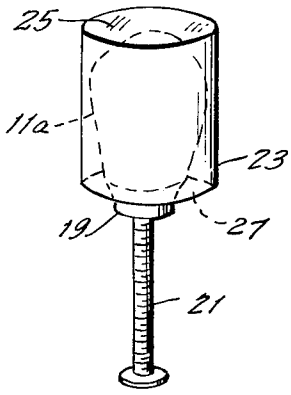


FIG. 8

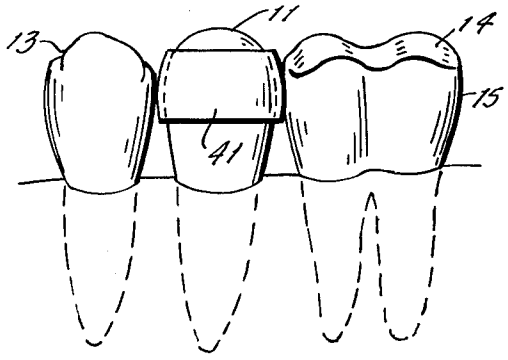


FIG. 5a



FIG. 5b

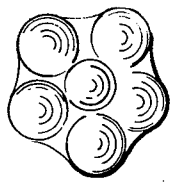


FIG. 6

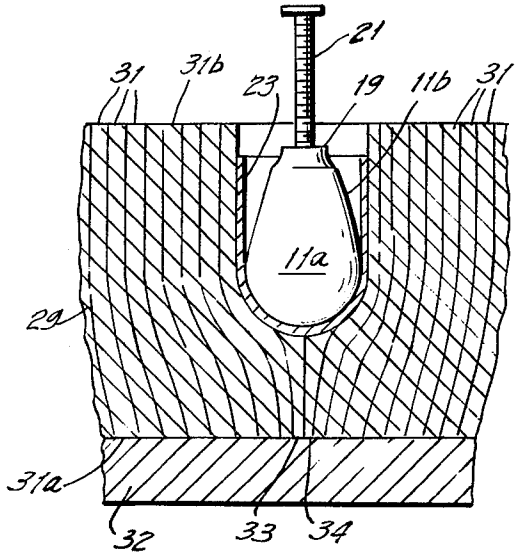


FIG. 7

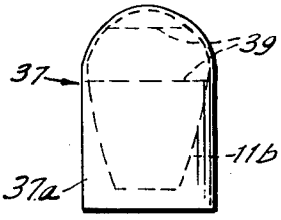
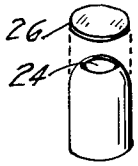


FIG. 9



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SWAGED METAL DENTAL CROWNS

The present application is a continuation of application Ser. No. **871,589,** filed Nov. **7, 1969,** and abandoned subsequent to the filing of the present application. Said application Ser. No. **871,589** was itself a continuation of application Ser. No. **623,680,** filed Mar. **16, 1967** and abandoned subsequent to the filing of Ser. No. **871,589.**

This invention relates to a novel method for swaging metal dental crowns and bands and to novel swaged crowns and bands prepared by the novel method. The novel crowns may be used for dental treatment, particularly the practice of preventive, interceptive and corrective orthodontics, and in the practice of general dentistry or other phases or specialties of dentistry for the prevention of decay.

In the field of general dentistry, prevention of decay is accomplished by virtue of full coverage of teeth or fully covering a tooth with metal, so that a veneer can be emplaced on the labial or buccal portions for aesthetic reasons, such veneers to be anodized or bonding (MICROBOND) acrylic or plastic or polycarbonate. The novel crown of the instant invention affords full coverage of the tooth in question, which thereby results in a sealing of, or isolation of, the tooth structure from food debris and liquids, including saliva, because the crown is sealed to the tooth with suitable dental cement.

In the field of corrective and/or preventive orthodontic treatment, it is frequently necessary to adapt a piece of metal, (commonly known as a band) around the circumference of a tooth, to join the ends of the metal piece so that it will be properly fitted around the tooth, and then to cement this metal piece to the tooth. An improved version of the metal piece is a seamless band which does not require the joining of ends thereof. The purpose of the band is to provide a means to which an attachment, such as a bracket, tube, eyelet, spur, or hook may be welded or soldered to the band. It is by means of these attachments that forces may be applied to the tooth as by wires, coils or elastic bands in the course of orthodontic treatment in order to move the tooth to a more correct or desired position or alignment. A further improved band is one which is both seamless and swaged to conform more exactly to the shape of the tooth.

Swaged crowns have the advantage when cemented on a tooth that none of the tooth surface is exposed to the oral saliva, food particles, and natural dyes in foodstuffs and tobacco, thereby reducing the opportunity for decay, decalcification, pitting and staining of the enamel surface of the tooth. Swaged bands and crowns also have the advantage that they can be made to fit better than conventional bands, thereby reducing the chance of loosening during treatment or during the course of chewing food. In the case of orthodontic treatment, such loosening would result in the loss of positive action of the forces of the wire or elastic band. Once a band loosens, there is a considerable exposure and great accentuation of the possibility of decay, stains, or decalcification, because of the opportunity for leakage or seepage of food debris and liquids underneath the metal band, such that lodgement and/or contact of such material can affect the enamel surface of the tooth.

Swaged bands and crowns have the further advantage that they may be prepared in a laboratory by unlicensed technicians, thereby reducing the amount of time spent by both patient and dentist in the fitting of the band and/or crown.

Swaged bands and crowns have previously been made by making a die in exact conformity with the tooth to be banded or crowned, then plunging a crown blank upon the die, and then forcing the die with the blank thereon into an apposed die, or into a granular or plastic material. The products of such processes are completely swaged in that the product will include the undercuts of the die.

The provision of a completely swaged crown has serious disadvantages which the instant invention effectively eliminates. Specifically, completely swaged crowns (that is with the undercuts of the die covered with the conforming metal crown) are difficult, time consuming, often requiring copper plating of individual tooth impressions, and, therefore, expensive to prepare. Secondly, and perhaps most important, it will be appreciated that if a crown covers the entire die (the replica of the tooth), including the largest diameter portion thereof, and the undercut portion, which is generally of smaller diameter, it is difficult to withdraw the die from the swaged crown (because of the limit of elasticity of the metal). Similarly, it is correspondingly difficult to place the crown upon the tooth for which it was ultimately prepared.

In contradistinction, the instant invention provides a more desirable swaged crown or band for orthodontic work (or swaged crown used for other dental purposes), in which the top and sides of the crown conform with the tooth but do not conform with the undercuts of the tooth. In this manner, the swaged crown can be easily prepared by the unskilled technician by the method of the instant invention, to be described in greater detail, and after receipt of same from the laboratory, the dentist or orthodontist can make such appropriate adjustments, as may be necessary, by recontouring the crown to the gingival one-third or gingival one-half (the undercut area) of the tooth.

The novel method of the instant invention comprises generally placing a crown blank upon a rigid die of the tooth to be banded or crowned, and then forcing the die with the blank thereon between confined laminae of a non-rigid material, such as a roll of cloth tape. When the die is forced completely into the laminae, the blank assumes the shape of the die only in the direction in which it is forced and not in any transverse direction. Thus, the product is a crown which is swaged on the occlusal surface and on the occlusal one-third or one-half of the sides of the tooth down to, but not including, the undercut portion which is normally designated as the gingival one-third or gingival one-half of the tooth. As noted above, if the dentist or orthodontist feels that the undercut portions of the tooth should be covered with the crown also, he can recontour the crown to the undercut portions of the tooth with trial seatings in the patient's mouth.

Accordingly, it is an object of this invention to provide a novel method for swaging dental bands and crowns.

A further object of the instant invention is to provide novel bands and crowns which are particularly well adapted for use in orthodontic treatment as well as for use in the prevention of decay even though orthodontic considerations may not be a matter of concern.

A further object is to provide a novel band and crown which is particularly suitable for temporary splints or for temporary or permanent cementation to an unprepared or partially prepared (unground or partially ground or fully ground or prepared) tooth for use as a prosthetic abutment for copings or for prosthetic restoration or for the repair of fractured, broken decayed, stained, pitted or decalcified teeth.

Another object of the instant invention is to provide a method for preparing crowns or bands which comprise placing a crown blank upon a rigid die of the tooth to be banded or crowned, and then forcing the die with the blank thereon between confined laminae of a non-rigid material, such as a roll of cloth tape, such that the blank assumes the shape of the die only in the direction in which the die is forced, and not in any transverse direction, whereby the product is a crown which is swaged on the occlusal surface and on the occlusal one-third or one-half of the sides of the tooth down to but not including the undercut portion which normally is the gingival one-third or gingival one-half of the clinical crown of the tooth.

Yet another object of the instant invention is to provide swaged crowns which do not have undercuts, whereby they may be easily removed from the die, trimmed, and positioned on the tooth and recontoured to fit undercuts (if desired) without danger of distortion.

Still another object of the instant invention is to provide a novel swaged crown or band which may be securely cemented to the tooth in such a manner as to prevent loosening and to provide maximum protection to the tooth because of the tooth coverage and sealing with a cement or a medicament used in dentistry or phases thereof, including orthodontics, pedodontics, other specialties, and anti-caries treatment.

Another object of the instant invention is to provide novel bands and crowns made by semi-skilled or relatively unskilled technicians in a dental laboratory, thereby materially reducing the cost of the orthodontic treatment insofar as is related to the time that formerly was required on the part of the practitioner to make the crowns.

Yet another object is to provide better fitted crowns and bands which necessitate less chair time in the overall course of treatment; materially improves the quality of the treatment with little or no increase in cost; and which provides higher reliability and dependability, since the dentist or orthodontist need not be concerned with the more frequent loosening and tearing or deformation of the conventional bands.

These and other objects and a better understanding of the instant invention may be had by referring to the following detailed description of a preferred embodiment thereof and the drawings, in which:

FIG. **1** is an elevational view of a portion of the dentition in the lower left quadrant from the buccal aspect;

FIG. **2** is a sample form or tray which would be used to hold the impression of the entire lower dental arch;

FIG. **2***a* is a sample form or tray for a quadrant of a dental arch (lower right or upper left);

FIG. **2***b* is a single impression band for a single tooth;

FIG. **3** is a perspective view of a die which is a substantial copy of one of the teeth illustrated in FIG. **1**;

FIG. **4** is a perspective view of the die shown in FIG. **3** with a blank shell crown positioned thereover and ready for swaging in the novel process;

FIG. **5***a* is a plan view of a roll of tape cloth which is to be used with the die and blank of FIG. **4**;

FIG. **5***b* is a plan view of a plurality of rolls of tape cloth of the type shown in FIG. **5***a*, being held together by cloth tape wrapped around same;

FIG. **6** is a sectional elevational view of the die and crown illustrated in FIG. **4** during swaging by the novel process in either the roll of tape of FIG. **5***a* or one of the rolls of tape of FIG. **5***b*;

FIG. **7** is an elevational view of the swaged crown in place on the die of FIG. **3** after being subjected to the process shown in FIG. **6**; and

FIG. **8** is an elevational view of the dentition of FIG. **1** with a band trimmed from the crown of FIG. **7** positioned on one tooth; and

FIG. **9** illustrates steps utilized in an alternative embodiment of the instant invention.

Turning to FIG. **1**, there is shown a lower left second bicuspid **11** which is situated between the lower left first bicuspid **13** and a first molar **15** of the same quadrant. For the purpose of illustrating the instant invention, assume that for furture orthodontic treatment, it has been decided to cement a crown to the surface of the second bicuspid **11**.

As noted previously, a human tooth is not round or circular in cross-section, but is irregular without exception, characterized by a decided mesio-distal flattening at the gingival border. As illustrated in FIG. **1**, the posterior tooth flares outwardly at **12** towards the occlusal surface **14** to a greater or lesser degree around the tooth and then curves inwardly toward the undercut surfaces generally shown at **12***a*. The occlusal surface **14** of a tooth is also irregular in shape. It is apparent, therefore, that a proper fitting crown or band must be made especially for each tooth. To this end, a die is made of the tooth of interest, in this case, the second bicuspid **11**.

As a first step, an impression is made of the tooth of interest, **11**, by using an impression tray of the type shown in FIGS. **2** and **2***a* or the single impression band of FIG. **2***b*. Any method for making an impression may be used. A preferred method comprises preparing a mixture of commercially available aqueous alginate or alginate impression powder, or rubber-based composition or silicone composition. One composition which may be used is marketed under the mark KALGINATE by Lee Smith Company, Chicago **10**, Illinois, and is an alginate impression powder which is mixed with water. The paste or mixture (impression material) is then placed in a metal (or other material) form similar to those shown in FIGS. **2**, **2***a* and **2***b* and impressed over the tooth or teeth in the dental arch and held firmly in position until the paste is set to a solid or non-flowing condition. The impression is then removed from the teeth and any excess may be trimmed away. In practice, an impression of as many teeth as possible is taken at one time with one form or impression tray, thereby enabling several dies to be made (by cutting apart the teeth) from only one impression. Also, in practice, impressions are routinely made of dental casts of a patient's teeth, such casts commonly known as study casts.

Next, a die of the tooth of interest is made from the impression. The die should be of a rigid material, which, at room temperature, can resist the subsequent swaging operation without distortion. Commercially

available low melting point alloys have been found useful for this purpose.

The alloy is melted in a suitable container. The impression is suitably dammed if necessary and then filled with the molten alloy. The alloy is permitted to solidify in the impression and then the solidified copy of the arch is removed. A copy of the arch, of course, includes the gums and the gingival margin of each of the teeth therein. The copy of the tooth of interest is cut from the copy of an arch.

FIG. 3 shows the copy 11*a* of the tooth of interest, 11, which has been cut from the copy of the arch. The copy of the tooth 11*a*, referred to hereinafter as a die, includes the gingival margin 17 and has been cut so as to provide a recessed shoulder 19 below the margin 17 into which is positioned (preferably by threading) a flat headed screw 21. In the case of low fusing metal dies, by heating the screw well above the melting point of the die material, the screw can be embedded in die 11*a* by plunging the screw within the shoulder and body of the die, holding firmly, and allowing to cool, thereby resulting in a rehardening of the die material holding the screw.

The die material may be a methyl methacrylate, acrylic or any other plastic or metal material, the only requirement being that it is sufficiently hard at room temperature and has the proper characteristics such that it will not deform under the forces of swaging.

Next, as shown in FIG. 4, a crown blank 23 is positioned over the die 11*a*. The crown blank 23 is a thin walled metal cap of any desirable shape, usually cylindrical, closed at one end 25 or closed at this end with the exception of a hole in the center (such as shown at 24 in FIG. 9), and open at the other end 27. The purpose of the small hole is to permit, if desired, escapement of excess cement or in order to permit visual inspection of the sealing of the crown when it is finally placed on the tooth. Such crown blanks are available commercially in various sizes, it being preferred to use the smallest blank that will fit over the die. Where the blank is excessively long, it may be trimmed to a desired length preferably so that it does not extend beyond the shoulder 19. Next the blank is tapped or swaged by the application of hammer-like blows which produce a rough adaption of the blank to the top surface of the die. The assembly shown in FIG. 4 can now be swaged by the novel method of the instant invention.

Swaging by the novel method may be accomplished by forcing the assembly shown in FIG. 4 between confined laminae of a non-rigid material. One suitable structure for such confined laminae is a roll of cloth electrician's tape, such as shown in FIG. 5*a* (a plurality of such rolls being shown confined in a retaining band in FIG. 5*b*). Rolls of other types of tape may also be used, or layers of other suitable material may be stacked and pressed together. The laminae may be subjected to different degrees of confinement. The desired degree of confinement is easily determined (by trial and error) for each material and arrangement. The desired degree will provide for complete swaging of the occlusal surfaces and occlusal one-half or incisal one-half crown surfaces without any substantial swaging of the undercut portions of the sides of the die.

FIG. 6 shows a portion of a roll of electrician's tape 29 wherein the layers of tape comprise the confined laminae 31 of the process. The roll is supported on the edges 31*a* of the roll on a table or other flat rigid support 32. The assembly as shown in FIG. 4 is placed at a convenient position on the opposite edges 31*b* of the tape roll 29. The assembly of FIG. 4 is then forced between the confined laminae 31 of the roll. The forcing may be accomplished by a steady pressure, or by strokes of a hammer, applied to the head of the screw 21. As shown in FIG. 6, the assembly has been forced into the tape roll, between the laminae 33 and 34. The crown 23 has formed itself to the occlusal one-half crown portion of the die 11*a*.

After completing the swaging, the swaged crown 37, as shown in FIG. 7, is removed from the die 11*a*. It will be appreciated that it will be very easy to remove the die since there are no undercuts in the swaged crown 37, that is, the crown does not conform to undercut surfaces 11*b* of the die 11*a*. This is to be contrasted with the prior art where crowns are completely swaged such that the entire surface of the die is covered and it is, therefore, difficult to remove the die (and stay within the limits of elasticity of the crown). Similarly, when the crown is placed on the tooth 11, there will be no undercut portions thereof to "stretch." (If a full crown is desired, the cylindrical sides 37*a* of the crown may be contoured to the tooth in the patient's mouth.) The crown may be trimmed for use either as a crown or as a band. The dashed lines 39 indicate where the cuts may be made for a particular band.

Where the blank has a hole in one end the steps are as follows. First, the blank is placed on the die and tapped as before, with hammer-like blows. Next, the die with the blank thereon is forced between confined laminae of non-rigid material such as shown in FIG. 6 for the blank without a hole in the end. The blank is then removed from the die. Then, as shown in FIG. 9, a small metal insert 26 is located over the aperture 24 in the end of the blank and partially secured there as by tack welding or soldering. Then the blank with the insert partially secured thereto is once again placed over the die and the assembly is once again forced between the laminae of a non-rigid material, such as shown in FIG. 6. Finally, the die is removed once more and the insert is permanently welded to the blank. Then the blank is put over the die once again and the assembly, including the welded units, is forced for the last time into the confined laminae of non-rigid material (FIG. 6). After this last step, a small hole is bored in the insert and the finished crown may be removed from the die, ready for the practitioner to use in the patient's mouth.

FIG. 8 illustrates the quadrant illustrated in FIG. 1 with a band 41, cut from the crown illustrated in FIG. 7, positioned on the second bicuspid 11. An orthodontic attachment (not shown) may be soldered or welded to the band 41 and then cemented to the tooth 11.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. For example, this invention can be used for providing a crown for bovine or other animal teeth. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appending claims.

I claim:

1. A method for swaging dental crowns and bands to conform to the contour of a tooth to be crowned except for the undercut portion of the tooth comprising

a. placing a crown blank upon a rigid copy of the tooth to be crowned and

b. then forcing said copy with said blank thereon between confined laminae of a non-rigid material which

1. exerts a resistive force against the insertion of said copy and blank and

2. the resistive force being only in the direction in which said copy and blank are forced.

2. The method for swaging dental crowns and bands described in claim 1, wherein said confined laminae are comprised of layers of cloth tape.

3. The method for swaging dental crowns and bands described in claim 1, wherein said laminae are at least partially confined in the direction normal to the major surfaces of said laminae.

4. The method for swaging dental crowns and bands defined in claim 1, wherein said copy with said blank thereon is forced between layers of a roll of cloth tape.

5. A method for swaging dental crowns and bands comprising:

a. placing a crown blank upon a rigid copy of the tooth to be crowned, said crown blank having an aperture in the end wall thereof;

b. forcing said copy with said blank thereon between confined laminae of a non-rigid material;

c. removing said blank from said copy;

d. inserting a metal insert over said aperture and partially securing said insert to said blank;

e. placing said blank with said insert therein over said copy;

f. then forcing said copy with said blank and insert thereon between confined laminae of a non-rigid material;

g. then removing said blank from said copy;

h. welding said insert to said blank;

i. then forcing said copy with said blank, with said insert welded thereon between confined laminae of a non-rigid material; and

j. then boring a small hole in said insert.

6. A dental crown of the type comprising a metallic cup which is substantially cylindrical along substantially its entire length and having a cylindrical axis; said cup having a top surface whcih is conformed in general to the occlusal surface of a tooth of an intended wearer, and said cup extending over the undercut portion of the tooth in a direction parallel to the cylindrical axis of said cup whereby said cup is not conformed to the shape of the undercut portion in either of the directions parallel or transverse to the cylindrical axis of said cup; the improvement in combination therewith of a swaged crown, comprising:

a. said top surface of said cup being swaged to precisely conform to the occlusal surface of a precise copy of the tooth of an intended wearer and characterized in that said swaged top surface is formed by subjecting said cup to resistive forces substantially parallel to the cylindrical axis of said cup, said top surface being conformed to said natural tooth by said parallel resistive forces as provided by resistance produced by confined lmainae of a non-rigid material through which said cup has been forced.

7. The dental crown according to claim 6 further comprising an insert member permanently affixed to said top surface of said crown with both said insert and said crown being swaged to precisely conform to said tooth of said wearer, said swaged conformation being characterized by the forming of both said insert and said cup through confined laminae of a non-rigid material to swage said cup and insert by providing resistive forces parallel to the axis of said cylindrical cup.

8. A dental crown of the type comprising a metallic cup which is substantially cylindrical along substantially its entire length and having a cylindrical axis; said cup having a top surface which is conformed in general to the occlusal surface of a tooth of an intended wearer, and said cup extending over the undercut portion of the tooth in a direction parallel to the cylindrical axis of said cup whereby said cup is not conformed to the shape of the undercut portion in either of the directions parallel or transverse to the cylindrical axis of said cup, the improvement in combination therewith of a swaged crown comprising:

a. an insert member rigidly coupled to the top surface of said crown, said insert and said top surface of said crown being swaged to precisely conform to the occlusal surface of the natural tooth of an intended wearer.

9. The dental crown according to claim 8 further including an aperture located on said top surface of said crown.

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