United States Patent

Evenson

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[54] APPARATUS FOR MAKING PONTIC CORES

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[52] **U.S. Cl.** **164/246,** 164/34, 18/DIG. 11, 18/DIG. 12, 249/54, 249/62, 104/91

[51] **Int. Cl.** **B22c 7/02**

[58] **Field of Search** .....164/246, 36, 35, 132, 369, 164/34, 138; 18/DIG. 11, DIG. 12; 249/61, 54, 62

[56] **References Cited**

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[57] **ABSTRACT**

This invention relates to the preparation of artificial teeth. Significant reductions in weight and cost of pontics are achieved by using a hollow metallic core filled with porcelain. The tooth has a greater flexural strength because of the greater compressive strength of the procelain filling in the metallic core. Vaporizable forms for making the hollow metallic cores are provided in various sizes in sheet form.

5 Claims, 8 Drawing Figures

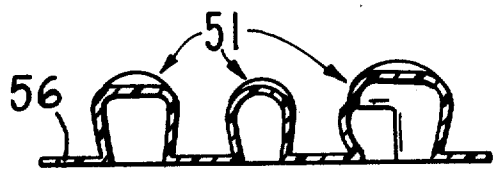


FIG. 1

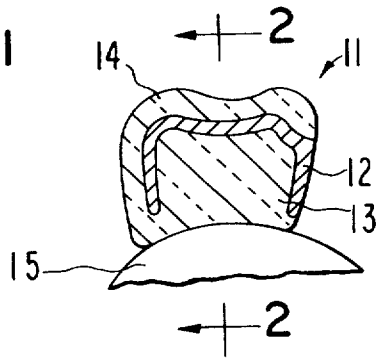
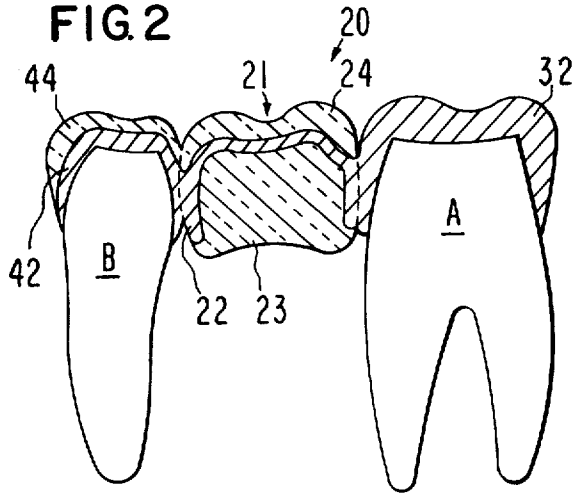


FIG. 2



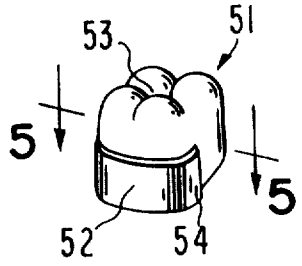


FIG. 3

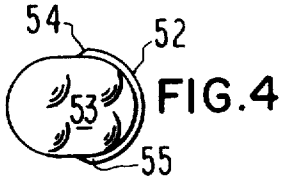
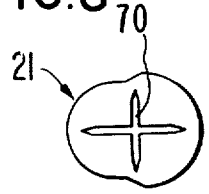


FIG. 4

FIG. 5

FIG. 8



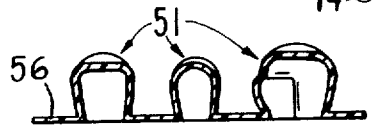
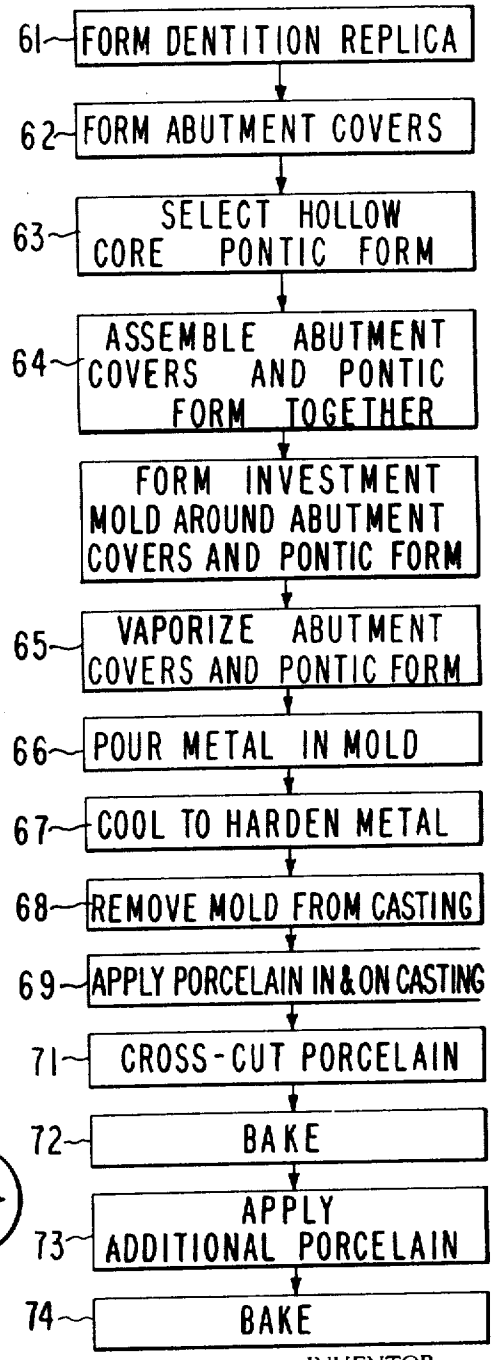


FIG. 6

FIG. 7



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APPARATUS FOR MAKING PONTIC CORES

BACKGROUND OF THE INVENTION

This invention relates generally to the manufacture of an artificial tooth on a dental bridge or pontic. More particularly, the invention relates to a method of forming a strong lightweight pontic, the resulting pontic, and a form useful in manufacturing the metallic core.

It has been known in the art to manufacture pontics having a base metal structure adapted to rest on the alveolar ridge. These metallic structures ordinarily are constructed from precious metals, such as gold or platinum or alloys thereof. These metals have the desirable properties of being inert to continued exposure to bacteria, enzymes, acids and other chemicals commonly present in the mouth. In order to improve the appearance of these metallic structures and to more closely resemble natural teeth, it has been known in the art to cover the metallic structures with porcelain. It has been the practice to affix an opaque layer between the metallic structure, usually dark in color, and then cover the opaque layer with the translucent porcelain.

However, the prior structures have required considerable amounts of precious metals which, at recent prices, raises the price of the pontics so that it is not readily available to the total number of persons requiring the same. Moreover, precious metals are extremely dense and have a high thermal conductivity, so that an artificial pontic with only a thin layer of porcelain covering has an unnatural weight and also a high thermal conductivity between the alveolar ridge and hot and cold substances taken orally. A further disadvantage of the prior pontics has been the fact that the previous metal has a lower compressive strength than porcelain. As a result, the porcelain covering transmits the considerable compressive forces upon the tooth to the metal which tends to flex. This flexing of the underlying metal structure causes rupture in the porcelain covering. Finally, the prior structures have had to be built on an ad hoc basis to fit the precise tooth being replaced. Manufacture of a pontic according to prior art was a time consuming, laborious process and the resulting product was expensive.

SUMMARY OF THE INVENTION

A hollow metal base structure is provided in which porcelain is filled and over which the porcelain covering is placed. The hollow metal core is made from a vaporizable form which evaporates upon excessive heating of an investment casting formed thereabout.

It is an object of this invention to provide a pontic having lower costs, lower weight and greater strength than prior art pontics.

It is a further object of this invention to provide an improved method of manufacturing pontics.

It is a further object of this invention to provide an improved form for producing metallic cores to permit prefabrication and prompt fabrication of pontics.

DESCRIPTION OF DRAWINGS

FIG. 1 is an elevational sectional view of a pontic according to the present invention worn on an alveolar ridge;

FIG. 2 is a side elevational sectional view of a pontic in accordance with the present invention supported in a bridge and is taken along line 2—2 in FIG. 1;

FIG. 3 is a top perspective view of a hollow core pontic form in accordance with the present invention;

FIG. 4 is a plan view of the structure shown in FIG. 3;

FIG. 5 is a cross-sectional view of the structure shown in FIG. 3 taken along line 5—5 in the direction of the arrow;

FIG. 6 is an elevational sectional view of a sheet containing a number of hollow core plastic forms in accordance with the present invention;

FIG. 7 is a flow sheet showing the formation of an artificial pontic according to the present invention; and

FIG. 8 is a bottom view of a pontic during one step in the manufacture thereof in accordance with the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

While the present invention has been described above as directed to a pontic construction and method and apparatus for making same, it will be appreciated that the structures and techniques described are applicable for making other dental structures. However, for purposes of illustration, the invention will be described with reference to a preferred embodiment of the invention as shown in the drawing.

Turning now to the drawing, with particular reference to FIG. 1, there is shown a pontic 11 constructed in accordance with the present invention and including a hollow, inverted cup-shaped, metal, base structure 12 such as of a platinum-gold alloy having a porcelain filling 13 therewithin and a porcelain coating 14 over substantially all of the exterior surface. The pontic 11 illustrated has an exposed area of metal base structure on one side thereof as preferred by some dentists. The pontic 11, as will be described below, is designed to be positioned on the alveolar ridge 15.

Typically, to be supported over the alveolar ridge, the pontic is cantelever supported from one side on another tooth or supported from both sides in a bridge spanning a space between teeth. A pontic 21 supported in a bridge 20 is illustrated in FIG. 2. As illustrated, the pontic 21 includes a hollow, inverted cup-shaped, metal base member 22 integrally formed with an abutment crown cover 32 and an abutment cover 42 on teeth A and B on either side of the space for the pontic. The pontic 21 includes a porcelain filling 23 and a porcelain coating 24 which extends over the abutment cover 42 as a coating 44. While the cover abutment 32 for tooth A has been shown as a full crown, this cover abutment could also include a porcelain coating if so desired.

The method of making the pontic 21 as will be described below with reference to FIG. 7 includes the use of hollow core pontic forms 51 illustrated in FIGS. 3–6. The forms 51 made of a vaporizable material such as thermoplastic resin are formed generally in the shape of the occlusal, lingual, buccal, mesial, and distal faces of a tooth and typically of smaller overall dimensions than the pontic to be formed. In accordance with the present invention, a large variety of shapes and sizes for typical pontics to be made in practice is vacuum formed on a mold in a single sheet 56 and provided to the dental technician for selection of appropriate forms 51 as desired. As illustrated, the preferred construction for the form 51 includes an enlarged portion 52 extending substantially half way around the form 51 extending downwardly from the top of the crown 53 on the lingual face so that the enlarged portion 52 includes enlarged parts 54 and 55 on opposite mesial and distal faces of the form adjacent to the teeth serving as a support for the bridge.

Referring now to FIG. 7, there is shown a flow diagram of the steps utilized in practicing the present invention. As indicated, the dental technician first forms 61 a dentition replica in dental plaster from the dentist's impression. Next, the abutment cover or covers are formed 62 for the teeth or tooth to support the pontic, and a hollow core pontic form 51 of appropriate size is selected 63 to fill the appropriate space. The abutment covers can either be formed by hand out of dental wax as is conventional of from a thermoplastic material formed onto the abutment supports. The abutment covers and pontic forms are assembled and placed on the dentition replica and joined together such as with dental wax and then transferred with a sprue post to an investment molding assembly wherein an investment molding is formed therearound 64 utilizing commercially available dental investments and investment techniques.

When the investment molding has been formed and the sprue base removed, the mold is heated 65 to elevated temperature, such as 1,300° F., to vaporize the abutment covers

and hollow pontic form. Then with the investment mold defining the configuration of the metal portion of the pontic and support structure to be formed metal such as platinum-gold alloy is melted **66** such as with a torch into the mold. A centrifugal casting machine can be utilized to aid in the formation of the desired cast structure and the assembly cooled **67** to harden the metal in the mold. The mold is then removed **68** from the casting and dental porcelain paste applied **69** to both the interior of the hollow pontic portion and the exterior of those surfaces desired coated therewith.

Since there is an unavoidable loss of porcelain volume during firing and the tendency of porcelain shrinkage is toward the greatest mass, it has been found that cross cuts **70** (See FIG. 8) should be made in the porcelain and of such depth as to achieve the effective division of the porcelain into separate quadrants resulting upon firing in the shrinkage of porcelain away from the cuts rather than away from the metal walls leaving an unfilled space in the porcelain corresponding to the sectional lines. It has been found that the porcelain within the hollow metal portion of the pontic cut with a cross **70** to at least substantially 50 percent of the depth of the porcelain does not separate from the metal body.

Typically, porcelain is applied from an aqueous slurry of suitable consistency, gradually accomplishing the porcelain buildup in desired shape and mass in several stages with a firing after each application and a final firing to accomplish porcelain vitrification and suitable esthetic glaze. While continued desired buildup of porcelain is being achieved on the exposed pontic surface, voids at the cross **70** can be filled at the same time.

Pontics constructed in accordance with the present invention sandwich the metal support structure thereof between a porcelain covering and a porcelain filling avoiding flexing of the body that would otherwise rupture the bond between the porcelain and the body. Furthermore, it has been found that pontic structures formed in accordance with this invention are as strong as or stronger than structures with solid metal pontics.

With the present invention, there is a significant saving in metal employed in the construction of a bridge span or a cantelever pontic with the added advantage of reduced weight and a material with a more desirable thermal conductivity resulting in greater comfort to the patient. Also, by this method of this invention the construction span or cantelever pontic is simplified and less dependent on the skill of an individual technologist resulting in increased uniformity and reliability of the finished product. It has been discovered that thermoplastic forms of the type described above and 0.3–0.5 millimeters produce sufficiently strong pontics and pontic support structures. These forms should be at least 0.2 millimeters thick.

I claim:

1. A form for producing pontic cores for artificial replacement teeth, comprising a vaporizable planar sheet having upstanding therefrom a hollow form in the general shape of inwardly projected, occlusal, lingual, buccal, mesial and distal faces of a human tooth but not in the specific configuration of said faces and having an outside surface smaller in all dimensions than at least the occlusal, buccal, mesial, and distal faces of the replacement tooth to serve as a subsurface tooth form, the thickness of said upstanding form being at least 0.2 millimeters.

2. A form for producing pontic cores for artificial replacement teeth comprising a vaporizable thermoplastic resin formed in the general shape of the occlusal, lingual, buccal, mesial and distal faces of the exposed portion of a human tooth and having an outside surface smaller in all dimensions than at least the occlusal, buccal, mesial and distal faces of the replacement tooth to serve as a subsurface tooth form and having an enlarged portion on the lingual face thereof extending downwardly toward the base thereof from below the top of the crown and substantially half way therearound to the mesial and distal faces.

3. Apparatus for producing pontic cores for artificial replacement teeth, comprising a planar sheet of material vaporizable at elevated temperature having a plurality of upstanding hollow forms each in the general shape of inwardly projected occlusal, lingual, buccal, mesial and distal faces of a human tooth but not in the specific configuration of said faces and having outside dimensions less than the outside dimensions of the desired pontic to be produced therefrom, said sheet including forms of a plurality of different sizes and different tooth configurations.

4. A form for producing pontic cores for artificial replacement teeth comprising a vaporizable planar sheet having upstanding therefrom a hollow form in the general shape of the occlusal, lingual, buccal, mesial, and distal faces of a human tooth and having an outside surface smaller in all dimensions than at least the occlusal, buccal, mesial, and distal faces of the replacement tooth to serve as a subsurface tooth form, the thickness of said upstanding form being at least 0.2 millimeters and said form including an enlarged portion on the lingual face thereof extending downwardly toward the base thereof from below the top of the crown and substantially half way therearound to the mesial and distal faces.

5. Apparatus for producing pontic cores for artificial replacement teeth, comprising a planar sheet of material vaporizable at elevated temperature having a plurality of upstanding hollow forms each in the general shape of the occlusal, lingual, buccal, mesial and distal faces of a human tooth and having outside dimensions less than the outside dimensions of the desired pontic to be produced therefrom, said sheet including forms of a plurality of different sizes and different tooth configurations and at least certain of said forms including an enlarged portion on the lingual face thereof extending downwardly toward the base thereof from below the top of the crown and substantially half way therearound to the mesial and distal faces.

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