

[54] DENTAL ALLOY

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[58] Field of Search ... 75/134 T, 165, 172 R, 172 G

[56] References Cited

UNITED STATES PATENTS

1,987,451	1/1935	Taylor	75/134 T
2,967,792	1/1961	Ruthardt	75/134 T X
2,980,998	4/1961	Coleman	75/134 T X
3,136,634	6/1964	Zwingmann	75/165

3,666,540	5/1972	Burnett	75/165 X
3,667,936	6/1972	Katz	75/134 N

FOREIGN PATENTS OR APPLICATIONS

683,004	11/1952	Great Britain
803,379	10/1958	Great Britain
290,657	8/1953	Great Britain

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[57]

ABSTRACT

A precious alloy for use in dental frames on which ceramic coverings or acrylic coverings are formed. Palladium is used in an amount ranging between 8 and 76 weight percent and indium is used in an amount ranging between 0.2 and 18 weight percent. The remainder of the alloy consists primarily of gold, or gold and silver, or silver and small amounts of trace metals. Zinc may also be included as part of the alloy. With such an alloy, there is no need for the use of platinum as in the prior art dental alloys and such alloys, according to this invention, have the same desirable characteristics as those of the prior art.

8 Claims, No Drawings

DENTAL ALLOY

This invention is a continuation-in-part of application Ser. No. 809,381 filed Mar. 21, 1969, now U.S. Pat. No. 3,667,936 dated June 6, 1972.

This invention relates to dental alloys, and more particularly, to precious alloys for use in dental frames on which ceramic and acrylic coverings are disposed.

There are hundreds of different alloys which are used in dental work for bridges, crowns, inlays, etc. A covering, having an appearance of a natural tooth, is usually provided on the exterior of the metal frame. Some of these coverings are of an acrylic material which is spread on the frame and then hardened while other coverings utilize "porcelain" which, in actuality, is a ceramic material, initially in paste form, which is spread on the frame and then baked. Whether an acrylic or a ceramic material is utilized on the dental frame, it is important that the dental frame be compatible with the material which is disposed thereon.

More particularly, when utilizing an acrylic material, it is important that the hardness of the metal frame be compatible with that of the acrylic material. Similarly, when a ceramic material is baked on the dental frame, it is not only required that the hardness of the frame be compatible with that of the ceramic, but it is also necessary that the coefficient of thermal expansion of these two materials be compatible. Still further, it is also required that the dental frame be of an alloy which will not discolor the material which is disposed thereon. This is especially important when the material disposed on the frame is a ceramic.

The present invention relates to precious alloys used in dental frames. A typical prior art alloy consists of gold (85 percent by weight), platinum (8 percent by weight) and palladium (5 percent by weight), with the remaining 2 percent by weight consisting of trace metals (defined as metals other than precious metals, e.g., copper, iron or the like) which are primarily for strengthening the alloy. Precious metals such as gold, platinum and palladium are used to obtain a white or yellow color which, when baked upon the ceramic covering, contribute to the simulation of a natural tooth appearance. Also, such precious metals do not oxidize and thus do not discolor the ceramic. Because precious metals are generally soft, hardening agents are included in the alloy. Various combinations of different precious metals are used, in preference to an individual metal, primarily to obtain a coefficient of thermal expansion compatible with that of the ceramic, that is, a value which permits the two of them to be baked together without cracks forming in the ceramic.

Conventional dental alloys of this type are very expensive primarily because of their use of platinum. Although the day-to-day prices of gold, platinum and palladium vary, approximate respective prices per ounce are \$60, \$110 and \$35. It is apparent that even small quantities of platinum can considerably add to the overall cost of the dental alloy.

Although other alloys are known which eliminate platinum as a part thereof and although it might be contemplated to utilize these alloys in dental frames, such is not the case. For example, many of these alloys include trace metals which are toxic, thereby precluding their use as a dental frame. Specifically, cadmium, lead and beryllium have been included as toxic trace metals in these alloys. Similarly, although yet other alloys do not include these toxic trace metals, these other alloys

for one reason or another, are not adaptable for use as dental frames. For example, these latter alloys have included trace metals (such as copper) in amounts which would discolor any ceramic material disposed on the dental frame; others have included trace metals which would be too brittle or otherwise undesirable with the frame covering.

Another problem with prior art alloys has been the high specific gravity of these alloys. Obviously, it is advantageous to provide a dental frame alloy having a low specific gravity since this means that less of the "material" is required in order to form the dental frame.

It is a general object of my invention to provide a precious alloy for use in dental frames which is cheaper than those of the prior art, but of equal quality.

A further object of my invention is to provide a dental alloy which is compatible with ceramic coverings which are baked thereon.

Yet another object of this invention is to provide a dental alloy which is compatible with acrylic coverings disposed on the dental frame.

Another object of this invention is to provide a dental alloy having a relatively low specific gravity.

Briefly, these and other objects of the present invention are obtained by providing a dental alloy having an increased palladium content, such dental alloy enabling decreasing amounts of platinum to be utilized without sacrificing any of the desirable characteristics of the prior art. In the prior art, platinum was required primarily to obtain a low coefficient of thermal expansion. To harden the alloy, trace metals such as tin and copper were utilized. Although greater amounts of palladium (instead of platinum) could be used to lower the coefficient of thermal expansion (for the case where the dental alloy was utilized with a ceramic covering), in the prior art there were no known satisfactory trace metals which could efficiently harden the alloy with large amounts of palladium. I have found that larger amounts of palladium can be used, instead of platinum, and that the alloy can be sufficiently hardened by using a prescribed amount of zinc. In the alternative, a prescribed amount of indium and/or zinc plus indium can be utilized to provide the requisite hardness. The coefficient of thermal expansion for such a ceramic material is typically in the range between 0.7×10^{-3} and 0.88×10^{-3} inch/600° C./inch. Such alloys according to my invention have the necessary hardness as to be compatible with ceramic and acrylic coverings; do not discolor ceramic coverings; are of thermal expansions compatible with ceramic coverings; and, are not toxic.

It is a feature of my invention to include in an alloy used in dental frames on which coverings are formed, palladium in an amount of 8-76 weight percent and indium in the amount of 0.2-18 weight percent. According to one embodiment of the invention, the dental alloy should include at least 98% weight percent of precious metal, the term "precious metal" being used to denote gold, silver, indium, gallium, platinum, palladium, ruthenium, rhodium, osmium, and iridium. The remaining part of the alloy may include trace metals (albeit trace metals which are not toxic or which would otherwise not discolor the ceramic or other material disposed on the dental frame) in amounts not greater than approximately 1% weight percent. According to another embodiment of the present invention, the alloy includes precious metals in an amount of 85 weight

percent, such precious metals including the requisite amount of palladium and indium mentioned aforesaid. However, with this embodiment, up to 15 weight percent of zinc may be utilized to harden the dental alloy.

In accordance with the principles of this invention, I have provided a dental frame alloy which includes palladium and indium as the critical ingredients thereof. Additionally (and with the exception of zinc), the trace metals should be in amounts less than 1¾ weight percent since amounts greater than this produce alloys which are either too brittle, toxic or otherwise incompatible with materials disposed on the frame. The dental alloy may also include silver; gold; gold and silver; zinc and silver; zinc and gold; and, zinc, gold and silver. The following table summarizes the various ranges of these materials in weight percentages.

	Palladium	Indium	Gold	Silver	Zinc
I	8-76%	0.5-18%	0.1-78%	0.1-74%	0.2-14%
II	8-76%	2-18%	—	0.1-74%	—
III	8-76%	4-18%	0.1-78%	—	—
IV	8-76%	4-18%	0.1-74%	0.1-72%	—
V	8-76%	0.5-18%	—	0.1-80%	0.2-10%
VI	8-76%	0.2-18%	0.1-74%	—	0.2-15%

In accordance with the principles of my invention, I have formed various dental alloys; wherein the number following each element represents the amount of that element, by weight percent, and the specific gravity and hardness are given (unless otherwise indicated, the hardness is in the terms of the Rockwell B hardness):

In Accordance With I of the Aforementioned Table:

Example 1:

Palladium (18), Indium (1), Gold (7), Silver (71.6) and Zinc (2.4);

Specific gravity = 8.4, Hardness = 87.

Example 2:

Palladium (25), Indium (0.5), Gold (62), Silver (8.5) and Zinc (4);

Specific gravity = 16.0, Hardness = 76.

In Accordance With II of the Aforementioned Table:

Example 3:

Palladium (55.5), Indium (12.3), Silver (32.2);

Specific gravity = 11.0, Hardness = 83.

In Accordance With III of the Aforementioned Table:

Example 4:

Palladium (16.7), Indium (6.8), Gold (76.5);

Specific gravity = 17.5, Bernell Hardness = 154.

In Accordance With IV of the Aforementioned Table:

Example 5:

Palladium (30), Indium (6.5), Gold (50), Silver (13.5);

Specific gravity = 15.6, Hardness = 85.

Example 6:

Palladium (21), Indium (5.5), Gold (66.5), Silver (7);

Specific gravity = 16.3, Hardness = 88.

In Accordance With V of the Aforementioned Table:

Example 7:

Palladium (60), Indium (2.5), Silver (33.5), Zinc (4);

Specific gravity = 11.5, Hardness = 55.

Example 8:

Palladium (60), Indium (2.5), Silver (31.5), Zinc (6);

Specific gravity = 11.5, Hardness = 82.

Example 9:

Palladium (28), Indium (1.0), Silver (66.4), Zinc (4.6);

Specific gravity = 9.1, Hardness = 96.

In Accordance With VI of the Aforementioned Table:

Example 10:

Palladium (52), Indium (0.5), Gold (37.9), Zinc (9.5);

Specific gravity = 15.4, Hardness = 82.

One particular advantage of the alloys according to the present invention and, more particularly, in the alloy of II and V of the aforementioned table is the elimination of gold from the alloy. This is particularly important with the present day "gold crises" and difficulty and/or undesirability of using gold for many applications.

In the prior art, it has generally been necessary to roughen the dental frame prior to placing the material thereon. This was required, for example, when ceramic coverings are utilized, in order to properly adhere the ceramic to the dental frame. Another advantage of my invention is that the use of indium in the aforementioned ranges does not require roughening the frame in order that the covering adhere thereon. It is believed that the indium reacts chemically with conventional ceramic coverings, such as those sold under various trademarks such as Ceramco, Thermalite, Vita, etc.

Although the invention has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the application of the principles of the invention. Numerous modifications may be made thereon without departing from the spirit or scope of the present invention. For example, the alloy according to my invention may be utilized in other applications wherein the alloy must be compatible with a ceramic or acrylic material. Thus, my alloy may be utilized in the jewelry art or the electronic art, etc.

What is claimed is:

1. A material compatible alloy consisting essentially of at least 85 weight percent of a precious metal alloy, said precious metal alloy including 8-76 weight percent palladium and 0.2-18 weight percent indium, said com-

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patible alloy further including 0-15 weight percent zinc, said compatible alloy being free of other trace metals in amounts greater than 1¾ weight percent.

2. The invention according to claim 1 wherein said precious metal alloy further includes 0.1-80 weight percent silver and wherein said compatible alloy includes 0.2-10 weight percent zinc.

3. The invention according to claim 1 wherein said precious metal alloy further includes 0.1-74 weight percent gold and wherein said compatible alloy includes 0.2-15 weight percent zinc.

4. The invention according to claim 1 wherein said precious metal alloy further includes 0.1-78 weight percent gold and 0.1-74 weight percent silver and wherein said compatible alloy includes 0.2-14 weight

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percent zinc.

5. The invention according to claim 1 wherein said compatible alloy includes said precious metal alloy in an amount at least 98¾ weight percent.

6. The invention according to claim 5 wherein said precious metal alloy includes 0.1-78 weight percent gold.

7. The invention according to claim 5 wherein said precious metal alloy includes 0.1-74 weight percent silver.

8. The invention according to claim 5 wherein said precious metal alloy includes 0.1-74 weight percent gold and 0.1-72 weight percent silver.

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