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ALLOYS AND DENTURES MADE THEREOF

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The present invention relates to alloys and more particularly to alloys especially suitable for cast dentures and for jewelry.

It has previously been proposed to provide various types of alloys for use in place of gold for dentures and for jewelry use. In general these alloys are of the chromium-cobalt-nickel type with minor additions of other modifying metals. This type of alloy has proven superior for many uses to the gold previously used but at the same time suffered from several disadvantages. Among the disadvantages of alloys of this type were their extremely high melting points, great hardness, brittleness, etc. The high melting point made them rather difficult for use in dental and other casting since the melting point was too high to permit the use of the ordinary calcium sulfate bonded investment material. Use of the alloys of this type therefore required special investments and special casting techniques. Their high hardness and fusion point also required special techniques for soldering and the use of special hard solders.

Although attempts have been made to lower the fusion point of the chromium-cobalt or chromium-cobalt-nickel type of alloy by the addition of other metals, such as, for example, copper or copper and iron, the addition of these metals lowers the corrosion resistance of alloys of this type and also resulted in the production of more readily oxidized alloys which produced undesirable rough castings.

In accordance with the present invention, however, the surprising discovery has been made that when gold is added in minor amount to alloys of the nickel-cobalt-chromium type the resultant alloy has a lowered fusion point sufficient to enable its casting according to the conventional casting technique and also permits the use of the conventional calcium sulfate bonded investment material. Although as is known in the art, gold and alloys consisting primarily of gold are, in some instances, less desirable for dental use and other uses involving extreme corrosive conditions than the nickel-cobalt-chromium types because of the tendency of the gold to discolor in the presence of sulfides and other sulfur containing materials, it has been found in accordance with the present invention that alloys containing in addition to the base alloy of nickel,

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cobalt and chromium, a relatively small amount of gold as, for example, of the order of 2% to 25% by weight of the total alloy, and preferably from 5% to 10% by weight, are not subject to discoloration or attack even in the presence of sulfides or sulfur. At the same time, the addition of the gold lowers the fusion point sufficiently to permit casting in the calcium sulfate bonded investment. Further, the new alloys may be easily soldered, using the ordinary soft solders and methods of the dental and jewelry art.

The new alloys are sufficiently ductile so that they may be drawn into wire and they combine this high ductility with high resilience and impact strength. Further, they may be machined and may be ground and polished on regular grinders.

The new alloys have melting points which vary from approximately 1900° F. to 2150° F., depending upon the amount of gold added to the base alloy, for example with the addition of 5% gold, the fusion point of the alloy is approximately 2150° F. and with the addition of 25% gold the fusion point is lowered to approximately 1900° F.

For ordinary dentures it is preferable to utilize an alloy containing between 5% and 10% of gold and for more complicated dentures or other articles which require bending or fitting as much as 20% to 25% gold may be added. Preferably the base alloy to which the gold is added in the amounts hereinbefore specified, consists of 30% to 40% nickel, 20% to 35% chromium and 20% to 30% cobalt. In addition to these metals from 0.1% to 10% of molybdenum may be added, this addition serving to improve the fluidity of the alloy for more intricate castings. Beryllium may be added in amounts from 0.1% to 5% since this addition of beryllium serves to help lower the fusion point and at the same time helps to increase the strength and hardness of the resultant castings. Preferably, in order to prevent extreme hardness, the carbon content should be maintained as low as possible and in any event should not be allowed to exceed 0.8%. It is also to be understood that small amounts of other elements may be added if desired for conventional purposes such as the deoxidation of the melt, without affecting the desirable properties of these alloys.

The new alloys according to the present inven-

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tion possess a pleasing platinum-like color and where the higher proportion of gold is used there is a slight yellowish tint.

The following examples serve to illustrate the alloys of the present invention but are not intended to limit the same:

Example I

An alloy was prepared containing the following metals in the proportions specified by weight:

	Per cent
Nickel -----	Approximately 35
Cobalt -----	Approximately 25
Chromium -----	Approximately 35
Gold -----	Approximately 5

The above alloy had a melting point in the neighborhood of 2150° F. and produced excellent dentures when melted and cast in the conventional calcium sulfate bonded investment in accordance with dental casting technique.

The surface of the castings thus produced were smooth and require a minimum of further finishing steps. The castings were of a platinum-white color, were hard but resilient, and could be easily polished utilizing an ordinary lathe.

Example II

An alloy was prepared containing the following metals in the proportions specified by weight:

	Per cent
Nickel -----	Approximately 30
Cobalt -----	Approximately 20
Chromium -----	Approximately 25
Gold -----	Approximately 25

This alloy was softer than the alloy of Example I but still possessed a relatively high degree of hardness. The melting point of the alloy was approximately 1900° F. and the alloy could be easily cast utilizing the ordinary calcium sulfate bonded investment materials.

The alloy of this example had a platinum-like color with a slight yellowish tint.

A denture was produced from this material by casting. The casting was smooth, more easily polished and could be more easily bent into various shapes as compared to the denture of Example I. It was smooth, less resistant to highly corrosive conditions and to tarnishing in the presence of sulfur and sulfides. The corrosion resistance, however, was still quite marked and suitable under most conditions.

Example III

An alloy was prepared containing the following metals in the proportions specified by weight:

	Per cent
Nickel -----	Approximately 30
Cobalt -----	Approximately 25
Chromium -----	Approximately 35
Gold -----	Approximately 10

The above alloy had a melting point in the neighborhood of 2075° F., and produced excellent dentures when melted and cast in the conventional calcium sulfate bonded investment in accordance with dental casting technique.

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The surface of the castings thus produced were smooth and require a minimum of further finishing steps. The castings were of a platinum-white color, were hard but resilient, and could be easily polished utilizing an ordinary lathe.

To any of the alloys of the above examples beryllium and molybdenum could be added in the amounts specified hereinbefore without changing the fusion point to any appreciable amount. The major effect on the fusion point being produced by the addition of gold. Beryllium and molybdenum will, however, change the relative fluidity, castability, resilience, hardness and machinability and can be adjusted to conform to the properties known in the art.

It would be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is described in the specification but only as indicated in the appended claims.

What is claimed is:

1. An alloy consisting of a base alloy consisting of from 30% to 40% of nickel, from 20% to 35% of chromium and from 20% to 30% of cobalt, said base alloy being modified by the addition thereto of from 2% to 25% of gold.

2. An alloy consisting of a base alloy consisting of from 30% to 40% of nickel, from 20% to 35% of chromium and from 20% to 30% of cobalt, said base alloy being modified by the addition thereto of from 5% to 10% of gold.

3. An alloy consisting of a base alloy consisting of from 30% to 40% of nickel, from 20% to 35% of chromium, from 20% to 30% of cobalt, and from 0.1% to 10% of molybdenum, said base alloy being modified by the addition thereto of from 2% to 25% of gold.

4. An alloy consisting of a base alloy consisting of from 30% to 40% of nickel, from 20% to 35% of chromium, from 20% to 30% of cobalt, and from 0.1% to 5% of beryllium, said base alloy being modified by the addition thereto of from 2% to 25% of gold.

5. An alloy consisting of a base alloy consisting of from 30% to 40% of nickel, from 20% to 35% of chromium, from 20% to 30% of cobalt, from 0.1% to 10% of molybdenum and from 0.1% to 5% of beryllium, said base alloy being modified by the addition thereto of from 2% to 25% of gold.

6. A denture formed of the alloy of claim 1.

7. A denture formed of the alloy of claim 2.

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