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ALLOY.

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To all whom it may concern:

Be it known that I, CHARLES E. HANSEN, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Alloys, of which the following is a specification.

This invention relates to new and useful improvements in metal alloys, and has for its object the production of such an alloy embodying qualities that make the alloy highly desirable for use in the fabrication of articles that may be subjected to the action of corrosive liquids such as acids, and which shall at the same time possess physical properties which permit it to be worked, machined, and otherwise manipulated in the fabrication of articles by tools and methods which are at present employed in working metals.

My improved alloy further possesses properties which make it valuable for use as an electrical resistance element, the alloy being high in its specific resistance, at the same time possessing the physical properties of ductility and malleability which permits its being rolled into sheets or drawn into wire form.

With these and other objects in view the invention consists in the alloying of metals of different properties as will be more fully described and particularly pointed out in the appended claims.

The alloy herein proposed comprises an alloy of gold, with nickel or cobalt, iron or chromium, and magnesium or manganese. Certain of these elements in their metallic state have certain acid-resisting properties, but when they are combined in the form of an alloy the acid resisting properties are greatly enhanced.

In preparing my metal alloy I find that I can vary the proportions throughout a great range and still obtain the desired characteristics and acid resisting properties. More specifically the composition consists of from fifty to seventy-five percent gold, ten to twenty-two percent nickel or cobalt; one-tenth of one percent to thirty percent iron or chromium; and from one-quarter to one-half of one percent magnesium or from one-tenth of one percent to four percent manganese. The characteristic properties of this alloy are effected about equally by the presence of either nickel or cobalt and therefore so far as this composition is concerned these substances are substantial equivalents and have the same properties and therefore one may be substituted in place of the other. This same is also found to be true of iron and chromium as well as of magnesium and manganese. I use the manganese or magnesium in this alloy in order to increase its tensile strength, the quantity varying with the tensile strength desired, but the percentage of either or both of these two substances is kept low in order not to counteract other desirable qualities such as malleability and ductibility. The proportions of the alloy are varied slightly, depending on the final use to which the substance is to be put. The larger amount of gold produces an alloy of greater acid resisting properties and is correspondingly more expensive.

In some instances a small percentage such as five percent of zinc may be present and still a very satisfactory result obtained. It is to be understood however, that zinc is not an essential ingredient of this composition inasmuch as an alloy without it is equally satisfactory.

In still other instances a very small quantity of vanadium may form a part of this composition which seems to act as a scavenger to clear the structure and give an even grain to the alloy, however, it is to be understood that the presence of this metal does not in any essential way effect the properties of the allow as the composition is satisfactory without vanadium.

The alloy which has been described possesses the physical properties of ductility, high tensile strength, and is easily machinable. The alloy is risistant to corrosive liquids such as certain acids, particularly cold dilute sulphuric, nitric and hydrochloric acids. It is also resistant to corrosion with respect to hot diluted sulphuric acid to approximately 150° Fahrenheit.

In the alloy described cobalt may be used in place of nickel if desired, and in the case of articles which may be made to be used in connection with the handling of the diluted hydrochloric acid, cobalt is preferably substituted for nickel.

Because of the machinability and other physical properties which have been mentioned this alloy can be worked into hypodermic needles. In fact, the alloy is adapted for general use in the fabrication of any

article where the property of resistance to corrosion of the dilute acids before mentioned is to be overcome.

This alloy in which is gold and nickel or cobalt possesses certain properties which makes it highly useful for fillings, crowns and plates for teeth for the dental trade, as it resists the action of the acids of the stomach and mouth while its ductibility permits it to be easily rolled into sheets, tubing or drawn into wire. In the use of the alloy in this connection, the amount of manganese utilized might be slightly higher than that which has heretofore been specified.

An alloy of nickel and gold, or nickel, gold and iron, with manganese would be prepared by the addition of small amounts of magnesium to the other metals when in melted condition, the addition of magnesium increasing the workability, that is to say, the properties of easy rolling and drawing, and both elements being easily oxidizable form a protecting film of oxide, thus preventing further oxidization of the alloy.

The foregoing alloys of gold and nickel, or cobalt, and of gold, iron and nickel, or cobalt, being subject to oxidization at moderate temperatures, which oxides are largely composed of nickel and zinc oxide.

Doubtless other uses may be found for the alloy herein described, which result from the peculiar and particular properties inherent in the alloy.

Inasmuch as nickel and cobalt in the alloy herein described have substantially the same properties, it is to be understood that nickel and cobalt are interchangeable in the alloy, and therefore in the claims where there is mentioned a "metal having the properties of nickel and cobalt" it is intended to include by that expression, either nickel or cobalt. The same is also to be understood of the metals iron and chromium as well as magnesium and manganese.

I claim:

1. A metal alloy containing more than fifty per cent gold, nickel and iron each in substantial amounts, and manganese or magnesium in an amount substantially less than the iron and nickel but sufficient to increase the tensile strength and workability of the substance.

2. A metal alloy containing more than fifty percent gold, nickel and iron each in substantial amounts, and magnesium from one-quarter to one-half of one percent.

3. A metal alloy containing gold more than fifty per cent, nickel fifteen to twenty-two per cent, iron from one to nine per cent and magnesium in an amount less than said iron but sufficient to increase the tensile strength and workability of the substance.

4. A metal alloy containing gold from fifty-five to seventy-five per cent, nickel from fifteen to twenty-two per cent, iron from one-tenth to four per cent and magnesium from one-quarter to one-half of one percent.

In testimony whereof I affix my signature.

CHARLES E. HANSEN.