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ALLOY

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This invention relates to alloys, and with regard to certain more specific features, to gold alloys.

This application is in part a continuation of my copending application Serial No. 226,328, filed August 23, 1938.

Among the several objects of the invention may be noted the provision of a gold alloy which may be used to manufacture either so-called "solid" gold objects or gold-plated objects, which gold alloy will wear longer than other gold alloys of similar karats and colors, when subjected to the wear normally encountered by articles of jewelry that are worn on the hands and wrists, etc., or clothing; the provision of a gold alloy which has an exceedingly fine, close grain, which fineness and closeness of grain make much easier the manufacture of articles from the alloy, and prevent what is known as "orange peel" (surface roughness caused by abnormally large crystals of metal being set in relief by mechanical working of the metal such as bending and other manufacturing operations) during the manufacture of articles of jewelry from the gold alloy; the provision of a gold alloy which may be used either as solid gold or as gold plate which has much greater resistance to tarnish and corrosion encountered in atmospheric conditions and in perspiration acids, etc.; and the provision of a gold alloy which, hardness for hardness, is adapted to higher annealing and soldering temperatures in the manufacture of jewelry articles from it than other gold alloys now available. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the ingredients and combinations of ingredients, the proportions thereof, and features of composition, which will be exemplified in the products hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the manufacture of plated gold articles of jewelry, one of the difficulties encountered is the provision of a gold plate which will stand up against the abrasion caused by clothing, etc. when the article is being worn. The gold plate on such an article is generally very thin, and the life of a plated gold article is determined to a great extent by the resistance to abrasion of the gold plate itself. It has been possible in the past to provide gold alloys of a given karat which will withstand wear to a greater degree than alloys commonly in use. This is ordinarily done by adding to the gold alloy metals of harder nature in considerable amounts. The effect on the alloy is to give it greater hardness, but the resulting color, from the standpoint of the jewelry industry, is not as good as it was before. Consequently, it has been somewhat of a problem to provide a hard gold alloy in a given karat which would present a color which, for the given karat of the gold, would be acceptable to the jewelry industry. The alloy which is the subject of this invention provides a metal which for a given karat and given color has much greater wear resistance than other hitherto known gold alloys of similar karat and color. It is known to the applicant, of course, that white gold, which has nickel in it, has superior resistance to tarnish and abrasion than yellow gold of like karat. However, the base alloy described herein makes possible the manufacture of a yellow gold alloy whose resistance to wear and corrosion compares favorably with white gold.

In the manufacture of articles of jewelry from gold, it is customary in many cases to use a gold-plated stock. In the subsequent bending, stretching, and shaping operations, etc., of the article, the gold plate has a tendency to present a rough crystalline appearance on the surface. This phenomenon is commonly called "orange peel" in the jewelry and allied industries. It is a serious defect and great pains must be taken to prevent it in the manufacture of jewelry items. The present invention discloses an alloy which has a very fine, close grain which to a great extent prevents this so-called "orange peel." This fine, close grain is inherent in the structure, and while fine, close grains can be obtained in other gold alloys, it is only at the expense of much mechanical working. The cobalt addition, which is a provision of this invention, prevent abnormal crystal size in the alloy. The present alloy thus provides a metal which affords in either case, cold-worked or annealed condition a fine, close grain.

Among the many difficulties encountered in the provision of gold alloys for the jewelry industry, is the difficulty of tarnish and corrosion of the gold by atmospheric conditions and by the acids commonly present in the perspiration of individuals. For example, in the optical goods industry, it is no uncommon occurrence to receive complaints from customers regarding the fact that various parts of their spectacle frames have become eaten away on the surface by the skin acids, with resulting roughness and raggedness of the metal, which in turn causes skin irritation where it comes in contact with the skin.

This is caused by the fact that the perspiration acids have eaten away the gold plate which covers a plated spectacle frame. This destruction of the gold plate is a very common occurrence in all gold-plated articles of jewelry which come in contact with the skin of the wearer. One of the solutions in the past has been to substitute a gold alloy for the plate which has a richer gold content. This is a necessarily expensive procedure and one that it is desired to avoid. The gold alloy which is the subject of the present invention provides a metal which has greater tarnish and corrosion resistance to skin acids, etc. than other known alloys of similar karat and color.

In the manufacture of many articles of jewelry, either the gold-plated variety or the solid karat gold variety, it is necessary many times in the course of manufacture, to submit the article to either high annealing temperatures or high soldering temperatures. The tendency of hitherto known gold alloys of similar color has been for the alloys to soften unduly with this treatment, creating distortion and too great flexibility in the finished article. For example, in the manufacture of watch cases, which are made of very thin material (relatively speaking), at one stage of the manufacture the watch cases must be annealed, and at another point they must have the hinges soldered on. One difficulty that has been encountered is that the watch case itself will buckle due to stresses in the metal being relieved too unevenly. Furthermore, the finished watch case will be so soft that in its use, it is apt to twist and distort in shape, thus causing misalignment of parts and possibly damage to the contained delicate mechanism. Furthermore, many gold or gold-plated articles of desirable color for their karat, wear excessively in use. This is caused by softness in the finished article caused by necessary annealing operations during the manufacturing processes. The present gold alloy is one that provides a metal which is adapted (for given hardness) to higher annealing and soldering temperatures. For example, if the watch case mentioned above were to be annealed at, say, 800° F., it would come out with a certain softness. If the same watch case is made out of the gold alloy which is the subject of this invention, and is subjected to the same annealing temperature, the resulting case will be harder temper than in the former case. This means, of course, that the metal has more springiness and consequently more resistance to bending and buckling. It will also wear longer, an important desideratum.

The gold alloy of the present invention consists basically of gold, copper, cobalt, and silver.

The gold content depends upon the desired karat of the gold. The present invention relates principally to alloys within the karat range of 8 to 20; hence the proportion of gold in the alloy, by weight, may vary from about 33% to about 84.%.

The copper content may vary from about 11% to about 67%, by weight, of the alloy, depending upon the color, hardness, and other qualities desired of the alloy. Less than 11% copper ordinarily produces an unsatisfactory alloy.

The cobalt content may vary from about 0.1% to about 5%, by weight, of the alloy, about 1% being usually preferred. The cobalt, possibly in combination with the copper present, seems to act as the regulator of grain size in the alloy. If no cobalt is used, the grain size of the alloy of the present invention is not superior to the grain size of prior gold alloys.

The silver content may vary from about 2% to about 12%, by weight, of the alloy, depending on the color desired in the alloy, as well as its desired malleability.

One non-limiting specific alloy made in accordance with the teachings of the present invention, for example, consists of 41.67% gold, 48% copper, 1% cobalt, and 9.33% silver. This alloy was rolled and annealed for 40 minutes at 1200° F. The reduction in rolling was 50%. The following table gives the hardness measurements (Vickers No. 5 and Rockwell B) for the resulting alloy, in thickness of 0.060 and 0.030 inches, in both hard and annealed conditions:

0.060", hard		0.060", annealed		0.030", hard		0.030", annealed	
Vick. 5	Rock. B	Vick. 5	Rock. B	Vick. 5	Rock. B	Vick. 5	Rock. B
241	106	170	90	232	98	168	85

A 5 mm. Erichsen cup made from the above 0.030 inch thick annealed alloy showed a very smooth and silky surface, with no orange peel. The grain size in the cup, measured microscopically, was about 0.002 millimeters.

The superiority of the alloys of the present invention is evident from the above.

In general, the best procedure for making up the alloys of the present invention is first to make a base alloy of the copper and silver, then to modify said base alloy by adding thereto the correct amount of cobalt, and finally to alloy the cobalt-containing base alloy with fine gold.

The effect of increasing the cobalt content is to produce a paler gold (the decolorizing effect, or paling effect, of cobalt being roughly only one fourth as great as that of nickel), and at the same time to increase its resistance to corrosion, its resistance to wear, and its temper for a given anneal or working operation. It also has a tendency to give the resulting alloy a finer, closer grain if the cobalt content is increased. The effect on the melting point of the final gold alloy of increase of cobalt is to raise the melting point.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above alloys without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A gold alloy consisting of about 33 to 84% gold, 11 to 67% copper, 0.1 to 5% cobalt, and 2 to 12% silver.

2. A gold alloy consisting of about 41.67% gold, 48% copper, 1% cobalt, and 9.33% silver.

3. A gold alloy of substantially finer grain and greater hardness than ordinary yellow gold of the same karat consisting of Au, Cu, Ag and Co, the gold ranging from 35 to 60% of the alloy, and the cobalt ranging from .1 to 2% thereof.

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