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PROCESS FOR THE MANUFACTURE OF ALLOYS OF PRECIOUS METALS WHICH ARE AMENABLE TO HEAT TREATMENT

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The object of my invention is a process for the manufacture of precious metal alloys which are amenable to heat treatment resulting in a modification of their physical and mechanical properties.

It is well known that alloys of precious metals of a certain composition may be subjected to a heat treatment resulting in a modification of their mechanical and physical properties. When I use the expression heat treatment I wish it to be understood that I mean a treatment which consists, on the one hand, on subjecting said alloys to certain relatively high temperatures which are, however, well below their fusion point and subsequently quenching the said alloys, this treatment resulting in a softening of the treated objects, and on the other hand heating the alloys previously treated in the said manner to certain lower temperatures than those applied in the first instance, whereby the treated objects are hardened. Such alloys have the particular advantage that after they have been converted into a softer modification they may be mechanically worked with greater ease and subsequently they may be subjected to suitable temperatures, whereby they are hardened again.

I have found that alloys of precious metals which per se are not amenable to heat treatment as described above may be converted into alloys amenable to heat treatment by the addition of relatively small quantities of certain other metals.

Alloys which are amenable to heat treatment in the sense described above are, for instance, gold-platinum alloys, which contain 20% and more of platinum. Such gold-platinum alloys, however, which contain smaller quantities of platinum are not amenable to heat treatment in the sense described.

I have found that the desired heat responsive property may be given to alloys of precious metals which originally are not amenable to heat treatment by the addition of relatively small quantities of certain metals, especially metals which do not belong to the class of precious metals. My invention may inter alia be applied to such alloys as consist chiefly of precious metals such as, for instance, gold and silver and which in addition contain metals of the platinum group such as, for instance, platinum, palladium, iridium and the like.

Besides components such as gold, silver, platinum and other metals of the platinum group the alloys may contain other metals such as copper.

Alloys which are composed of constituents of the kind just mentioned or which are intended to be manufactured from constituents of the above described kind and which do not have the property of being amenable to heat treatment may attain this property of being amenable to heat treatment, as I have ascertained, by the addition of relatively small quantities of other metals. Such metals are, for instance, iron and similar metals such as, for instance, nickel, cobalt, chromium and the like, furthermore zinc and similar metals such as cadmium, magnesium, beryllium and the like cause the said alloys to have the same property of being amenable to heat treatment. The quantity of the main constituents such as, for instance, gold, silver and the like, may be for instance from 60 up to slightly less than 100%. The quantity of the precious metals such as platinum and/or other platinum metals, which are the minor components and are to be alloyed with the main component may be up to 25%. The metals such as iron, zinc and the like which are added to the precious metals in order to make the resulting product amenable to heat treatment may be present in quantities of, for instance, 0.05 to 5%. In certain cases the quantities may be slightly less or slightly greater. In general it was found that on utilizing iron and similar metals as additional metals relatively small quantities are sufficient to attain the purpose desired. Such quantities are, for instance, 0.05 to 0.5%. In applying zinc and similar metals as additional constituents, on the whole, slightly greater quantities are required. The components of the principal alloy such as, for instance, gold and silver on the one hand (main constituents) and platinum, palladium, iridium and the like, on the other hand, have to be selected with the aim of forming so-called solid solutions. I have formed the opinion that the action of the additional metals such as iron, zinc and the like might depend upon their capability of forming compounds with certain precious metals, especially with the metals of the platinum group, these compounds probably being soluble at higher temperatures for instance, those of 900° centigrade in the metals forming the main constituents of the alloys such as gold, silver and the like to a greater degree than at lower temperatures such as, for instance, 500° centigrade. This may be the reason why the alloys made according to my invention have the capability of forming at higher temperatures of about 900° centigrade solid solutions which after having been subjected to quenching yield products which are soft and capable of being mechanically

worked upon with ease and which on being subjected subsequently to lower temperatures such as, for instance, 500° centigrade are hardened and made more compact. This latter fact may be attributed to the circumstance that compounds of the additional metals such as iron with the constituent of the precious metal alloys, such as platinum or platinum metals, are separated from the supersaturated solution by the treatment.

Example 1

An alloy consisting of 89.87% Au, 9.92% Pt and 0.21% Fe is heated to about 900° centigrade and then quenched whereby it is made considerably softer. This product, which if desired, may be mechanically worked upon is then heated to about 550° centigrade for about 120 minutes. The Brinell hardness is increased from normally 40° to 110°.

Example 2

An alloy consisting of 85,8 parts gold, 10,0 parts platinum, 1,6 parts silver, 1,2 parts copper, and 1,4 parts iron is heated to approximately 900° centigrade and quenched. The alloy thus treated is heated during 60 minutes to about 550° centigrade. By this treatment a Brinell hardness of 120° is attained whilst it was originally 40°.

Example 3

An alloy of 732.8 parts gold, 100 parts platinum, 120 parts silver, 47 parts copper, and 0.2% iron is heated to about 900° centigrade and quenched. By subsequent heating to about 550° centigrade its hardness is increased from 80° Brinell originally to 110°.

The same alloy without the addition of iron does not show when treated in exactly the same way an increase of hardness. Nor even does the hardness increase when the second heating is carried on at a lower temperature, although it was to be expected that the addition of copper would influence the alloy in such a way that its hardness might be increased.

Example 4

An alloy consisting of 885 parts by weight of gold, 100 parts platinum and 15 parts zinc has, after it has been treated by firstly heating it to 900° centigrade, quenching it and subsequently heating it again to 550° centigrade for 5 minutes, a hardness of 150° Brinell results, and 170° Brinell if the second heating lasts for 15 minutes, whilst the hardness of the untreated alloy is 60° Brinell.

In the same or similar manner other alloys of precious metals such as, for instance, of silver may be made. The alloy may consist of 70 to 95% Ag, a metal of the platinum group (for instance 29.05 to 0.05% Pt) and an additional metal (for instance 0.05 to 5% Fe). Such alloys may be subjected successfully to a heat treatment which gives similar results as in the other cases.

The addition of iron may vary in general from 0.05 to 5%, the addition of zinc from 1 up to 8%. The quantities of the additional metals required in order to obtain the optimum in each case can easily be ascertained by previous experiment.

What I claim is:

1. An alloy which may be annealed and/or hardened by heat treatment consisting of about 70% to 95% of gold, 1 to 25% of platinum, and 0.05 to 5.0% of iron.

2. An alloy which may be annealed and/or hardened by heat treatment consisting of about 70% to 95% of gold, 1.0% to 25% of platinum, and from 0.05% to 5.0% of a metal selected from the group consisting of iron, nickel, cobalt.

3. An alloy which may be annealed and/or hardened by heat treatment comprising 1 to 25% of platinum, 0.05 to 5.0% of iron, the rest gold.

4. An alloy which may be annealed and/or hardened by heat treatment comprising 1 to 25% platinum, 0.05 to 5.0% of a metal selected from the group comprising iron, nickel, and cobalt, the rest gold.

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