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METHOD OF MAKING ALLOYS

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This invention relates to a new and improved method of making alloys.

An object of this invention is to provide a method whereby a substantially homogeneous alloy is produced.

Another object of the invention is to produce an alloy without fusing the metals which comprise the alloy.

Ordinarily an alloy may be made by fusing the metals which make up the alloy. However, in carrying out the ordinary processes in which fusion of the metals is employed, though it is desirable, it is often difficult to obtain an alloy in which there is a substantially homogeneous distribution of the metals. In order to obtain such a product it is necessary to have the components of the alloy intimately mixed together.

I have discovered a method whereby I can produce alloys which have a more homogeneous distribution of the elements than usually follows from the ordinary processes which use fusion. Briefly, my process consists of two main steps: first, the preparation of an exceedingly intimate mixture of easily reducible compounds, such as the oxides or hydroxides of the metals; and second, the reduction of this mixture to the metallic state. The essential point in this process is to start with a solution of a mixture of mutually non-reactive compounds which contain the elements desired in the final alloy, since the molecules in solution are intimately in contact with each other, so that a final product may be obtained which will be as homogeneous as possible.

In carrying out my invention I first start with solutions of compounds of the metals I desire in the finished alloy. I select the proportions of the compounds in such manner that I will have the desired proportions of metal in the finished product. Such compounds are selected which are water soluble and which when in solution will not interact. For example, I may make a solution of the nitrates of each of the metals I desire in the alloy. A convenient, desirable, and preferred way to produce the oxides or hydroxides of the metals in the form of a very intimate mixture is to squirt the solution of the compounds of the metals in the form of a fine, high velocity stream into an excess of alkaline solution such as an aqueous solution of ammonium hydroxide or sodium hydroxide. Under such conditions of precipitation, the mixture of the oxides or hydroxides will be exceedingly intimate though non-colloidal. Such mixture will be much more intimate than it is possible to obtain by mechanically mixing the oxides or hydroxides in the solid state. Also the oxides or hydroxides of each of the metals will all be precipitated completely and together since there is always present under these conditions an excess of hydroxide and as each particle of metal strikes the solution it is immediately in contact with sufficient hydroxide to insure complete and intimate precipitation. The precipitate thus obtained is separated and is reduced in an atmosphere of hydrogen at a suitable temperature, thus giving a powder of a metallic alloy in which the components are very intimately mixed. During reduction the metals come out of the molecules of oxides or hydroxides with the minimum chance for migration throughout the mass and therefore with an optimum chance of having a homogeneous distribution of the metals in the alloy. The powder of metallic alloy may be pressed up and sintered and the sintered material may be subsequently subjected to mechanical working.

I have prepared by means of this process brass without fusion, and also alloys of nickel and iron, two metals which diffuse very slowly in the solid state to produce equilibrium. My invention, however, is not limited to the production of these alloys, but is applicable to the preparation of other alloys as well as those indicated. It will be obvious from the disclosure of the invention given in the foregoing specification that the process is limited to the precipitation of metals from solution in which the metal is a positive ion, that is, a metal which is normally base forming.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The method of making an alloy from normally base forming metals which consists

in converting a mixture of mutually non-reactive solutions of compounds of the metals desired in the alloy to an intimate physical non-colloidal mixture of mutually non-reactive compounds which are reducible, and then reducing said mixture to the metallic state.

2. The method of making an alloy from normally base forming metals which consists in preparing non-reactive solutions of compounds of the metals desired in the alloy, obtaining therefrom an intimate physical non-colloidal mixture of the oxides or hydroxides of the metals, and then reducing this mixture to the metallic state.

3. The method of making an alloy from normally base forming metals which consists in preparing non-reactive solutions of compounds of the metals desired in the alloy, so precipitating the oxides or hydroxides of the metals with an alkaline solution that an intimate physical non-colloidal mixture is obtained, and reducing the precipitate in a stream of hydrogen at a suitable temperature.

4. The method of making an alloy which consists in preparing a solution of a mixture of compounds of the metals desired in the alloy which compounds do not react in solution, the compounds being such that the metals desired in the alloy form positive ions when the compound is in solution introducing this solution so prepared in the form of a fine high velocity stream into an excess of an alkaline solution to obtain an intimate physical non-colloidal mixture of the oxides or hydroxides of the metals, and then reducing the mixture in hydrogen.

5. The method of making an alloy which consists in preparing a solution of mutually non-reactive compounds of the metals desired in the alloy in proportions such that the elements will be present in the proportions desired in the finished product, the compounds being such that the metals desired in the alloy form positive ions when the compound is in solution introducing the solution prepared in the form of a fine high velocity stream into an excess of alkaline solution to obtain an intimate physical non-colloidal mixture of the oxides or hydroxides of the metals, separating the precipitate and reducing to the metallic state in a stream of hydrogen at a suitable temperature, and finally pressing and sintering the finished product.

6. The method of making a brass which consists in preparing a solution of the nitrates of the metals desired in the brass in proportions such that the metals will be present in the proportions desired in the finished product, introducing this solution in the form of a fine high velocity stream into an excess of alkaline solution to obtain an intimate physical non-colloidal mixture of the oxides or hydroxides of the metals, separating the precipitate and reducing it to the metallic state in a stream of hydrogen at a suitable temperature, and finally pressing and sintering the finished product.

In witness whereof, I have hereunto set my hand this 24th day of May, 1929.

WHEELER P. DAVEY.