

UNITED STATES PATENT OFFICE.

EMIL DUHME, OF BERLIN-CHARLOTTENBURG, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, AKTIENGESELLSCHAFT, OF SIEMENSSTADT, BERLIN, A CORPORATION OF GERMANY.

MANUFACTURE OF METAL ALLOYS.

No Drawing. Application filed May 7, 1925, Serial No. 42,051, and in Germany August 2, 1924.

My invention relates to improvements in the manufacture of metal alloys.

My improved process for producing metal alloys consists essentially in combining or mixing the metals to be alloyed with mercury into an amalgam and then removing the mercury from this amalgam so that the alloy remains.

In the known processes for the manufacture of metal alloys it is difficult to attain an alloy of accurately predeterminable composition. This difficulty arises from the fact that in the known processes the constituents of the alloys are mixed together by melting or fusing them individually and that frequently losses are unavoidable in this process, particularly in constituents having a low fusing point. Even when the metals are mixed together in form of powders a molecular mixture of the individual constituents does not always happen. These drawbacks are eliminated in my improved process, because the mercury is the solvent for the individual constituents of the alloy and thus a molecular mixture of the metals in the mercury takes place in my process.

The improved process may, for instance, be carried out in the following manner:

The metals to be alloyed are first embodied in the mercury in pulverized form. No losses of any kind occur thereby. During this process the metals are dissolved in the mercury and form amalgams. If thereupon the mercury in any well known manner, for instance by evaporation in a vacuum is removed from this amalgam the desired alloy remains as a porous mass. Since mercury evaporates already at 100°-120° C., and since almost all metals have a fusing point by far higher than that no losses of the alloy metals will occur during this evaporation process.

When this amalgam is formed so fine and homogeneous a distribution of the individual constituents of the alloys occurs, that after the mercury has been removed in the manner indicated above the perfectly homogeneous alloy will melt at the melting point of the alloy and not as is otherwise the case at the melting temperature of the constituent which has the highest melting temperature. In fact it is not even necessary to heat the porous mass to the melting temperature of the alloy since the metal constitu-

ents, owing to the fine and homogeneous distribution during the amalgamizing process already fuse into each other below the melting temperature of the alloy. Of course the lower the temperature at which the alloy is melted the smaller will be the evaporation losses in the individual constituents.

The novel process can be employed for alloying any metals which will form an amalgam with mercury.

For instance it might be desired to produce an alloy of copper and gold the alloy requiring the contents of 40% copper and 60% gold. The melting point of this alloy is approximately 880° C. The melting point of the individual constituents is considerably higher, copper melting at approximately 1084° C. and gold at 1063°. When heretofore the alloy was made without the aid of mercury and in the old well known manner it was necessary to heat the two mechanically mixed metals to the melting point of copper thus to approximately 1100° C., which would entail certain losses in the amount of copper by oxidation and other incidental reactions, whereas according to the process of the present invention a perfectly homogeneous alloy is obtained which will melt at 850° at which no losses in the constituents by evaporation or oxidation can be observed.

If for instance in another case the melting point of the alloy should lie between the melting point of its constituent elements, the following condition exists. Let us assume for instance an alloy of copper and zinc to be produced. If the two metals are mixed together and heated, the zinc will melt at approximately 419° C. If it is desired to have 10% copper, this copper on further heating the mixture will already melt below its own melting point by dissolving in the molten zinc. However, a complete alloying between the copper and the zinc will occur only at about 850° C. At this high temperature some of the zinc is likely to be lost by oxidation or evaporation and thus the final product would not contain the percentages of admixtures originally intended.

If on the other hand according to the present process the two metals have first been joined into an amalgam by means of

mercury and if then mercury is subsequently removed the melting point of the alloy is at approximately 580° C. The losses of zinc which in this case has already been alloyed with the copper before that temperature is reached are so small, though this melting point may be above that of zinc, that practically they may be disregarded.

Thus aside from the fact that in the process according to the present invention by far smaller losses of the constituents would occur and that consequently the alloy will be quite exact as intended, the further advantage of the novel process resides in the fact that the alloy is absolutely homogeneous, because already before the porous mass is remelted a thorough mixture of the individual constituents has occurred while they were amalgamated with the mercury.

Preferably the individual metals to be alloyed are incorporated with the mercury in an electrolytic manner, the mercury being employed as depositing cathode. Hereby a particularly uniform mixture of the individual constituents of the alloy takes place. The incorporation of the constituents to be alloyed with the mercury takes furthermore place in their purest state. The improved process thus enables the manufacture of metal alloys of a composition which may be accurately predetermined.

Various modifications and changes may be made without departing from the spirit and the scope of my invention and I desire therefore that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:—

1. The process for the manufacture of metal alloys which consists in mixing the metals to be alloyed with mercury into an amalgam and subsequently removing the

mercury again from the amalgam and then melting the porous alloy product into a solid mass.

2. The process for the manufacture of metal alloys which consists in incorporating the metals to be alloyed electrolytically with mercury and subsequently removing the mercury again from the amalgam and then melting the porous alloy product into a solid mass.

3. The process for the manufacture of metal alloys which consists in mixing the metals to be alloyed with mercury into an amalgam and subsequently removing the mercury again from the amalgam by evaporating the mercury in a vacuum and then melting the porous alloy product into a solid mass.

4. The process for the manufacture of metal alloys which consists in incorporating the metals to be alloyed electrolytically with mercury and subsequently removing the mercury again from the amalgam by evaporating the mercury in a vacuum and then melting the porous alloy product into a solid mass.

5. The process for the manufacture of metal alloys which consists in pulverizing the metals to be alloyed, mixing them with mercury into an amalgam and removing the mercury from the amalgam and then melting the porous alloy product into a solid mass.

6. The process for the manufacture of metal alloys which consists in pulverizing the metals to be alloyed, mixing them with mercury into an amalgam and removing the mercury from the amalgam by evaporating the mercury in a vacuum and then melting the porous alloy product into a solid mass.

In testimony whereof I affix my signature.

EMIL DUHME.

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Thus aside from the fact that in the process according to the present invention by far smaller losses of the constituents would occur and that consequently the alloy will be quite exact as intended, the further advantage of the novel process resides in the fact that the alloy is absolutely homogeneous, because already before the porous mass is remelted a thorough mixture of the individual constituents has occurred while they were amalgamated with the mercury.

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Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,607,245, granted November 16, 1926, upon the application of Emil Duhme, of Berlin-Charlottenburg, Germany, for an improvement in "The Manufacture of Metal Alloys," an error appears requiring correction as follows: Page 1, in the heading to the printed specification, line 7, date of filing application, for "May 7, 1925" read *July 7, 1925*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of December, A. D. 1926.

[SEAL.]

M. J. MOORE,
Acting Commissioner of Patents.

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M. J. MOORE,
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