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METHOD OF MAKING ALLOYS.

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To all whom it may concern:

Be it known that I, RICHARD WALTER, a citizen of the German Empire, residing at Dusseldorf, Germany, have invented certain new and useful Improvements in Methods of Making Alloys, of which the following is a specification.

My invention has reference to improvements in the manufacture of acid-proof alloys, and relates more specifically to a new and improved method of making alloys of heavy metals, such as the metals of the iron and chromium groups, with silicon. The iron group comprises iron, manganese, nickel, and cobalt. And to the chromium group belong chromium, tungsten, molybdenum, and uranium.

As well known in the art the acid-proofness of alloys of metals of the iron and chromium groups with silicon is due to the silicides of the components of said alloys, such as for instance the silicides of the iron, of the chromium, of the nickel, et cetera, and thus we find for instance in the most used alloys of silicon with iron the silicides Fe_2Si, FeSi and $FeSi_2$. As can readily be verified by chemical and metallographic tests there will always be found present simultaneously several of these combinations in the acid-resisting iron-silicon alloys known so far. The manufacture of the above mentioned acid-proof alloys presents, as is well known, numerous difficulties as regards the art of casting and molding. The castings show a relatively low mechanical strength and are apt to crack during cooling in the molds, owing to their pronounced contraction and internal stress of material.

I have found that this disadvantageous phenomenon is due principally to the coexistence or association of two or more of the silicides in the above named alloys, as the silicides differ greatly from one another in the contraction and expansion coefficients. If, however, the said alloys present a single silicide only, then the disturbing casting stresses do not occur.

The present method, then, is directed to the production of alloys of heavy metals and silicon which contain only one homogeneous silicide. This I attain by first mixing the components in proper proportion for the formation of a single homogeneous silicide, and by then suitably heating the mixture by outside heat to a temperature somewhat below the fusing points of the components at which sudden exothermic reaction sets in, which will then almost instantaneously melt down the charge. The temperature at which this reaction takes place lies between 1200 and 1300° C. The reaction starts with an abrupt rise in the temperature curve and will then quickly, almost instantaneously, flash through the entire charge. In practical operation the entire charge of a large furnace, after the reaction temperature has been reached and reaction has set in at a single spot, will spontaneously melt down within a few seconds. The reaction may also be started by prodding or striking the solid charge with an iron rod whereby local pressure between the more or less loosely contacting components is exerted. The result of this violent heat reaction is a complete liquefaction and the formation of an alloy containing only one single homogeneous silicide.

My investigations have shown that the described process can be used equally well in the case of other metals of the iron group, and not only iron, such as for instance manganese, nickel, cobalt and others, and also in the case of metals of the chromium group, such as chromium, tungsten, et cetera. The silicon is preferably used in the form of compounds such as ferrosilicon, silicomanganese, and the like.

By way of example, I mix for the production of 1000 kilograms of an iron alloy with a 20% silicon content the iron and the ferrosilicon strictly in stoichiometrical weight proportion corresponding to a silicide of the formula Fe_2Si. This proportion is 780 kilograms iron and 220 kilograms high-percent ferrosilicon (90%). Then I treat this mixture in the above described manner by bringing it by outside heat to the point of reaction (1200–1300° C). In this temperature interval the exothermic reaction sets in which ends in the production of an alloy corresponding to the formula Fe_2Si.

What I claim is:—

1. The hereinbefore described process of making alloys of silicon and heavy metals, which consists in mixing the components in proper proportion for the formation of a single homogeneous silicide, in then heating the mixture to a temperature at which exothermic reaction is initiated, and in then

using this reaction to melt down the charge.

2. The hereinbefore described process of making alloys of silicon and iron, which consists in mixing the components in proper proportion for the formation of a single homogeneous silicide, in then heating the mixture to a temperature at which exothermic reaction is initiated, and in then using this reaction heat to melt down the charge.

3. The hereinbefore described process of making alloys of metals of the iron and chromium groups and silicon, which consists in mixing the components in proper proportion for the formation of a single homogeneous silicide, in then heating the mixture to a temperature between the limits of 1200 to 1300° C., and in then using the resulting reaction heat to complete the process.

4. The hereinbefore described process of making alloys of metals of the iron and chromium groups and silicon, which consists in mixing the components in a proportion substantially corresponding to the stoichiometrical proportion of the constituents of a single homogeneous silicide, in then heating the mixture by outside heat to a temperature somewhat below the fusing point of the components at which exothermic reaction sets in, and in then using this reaction heat to complete the process.

In testimony whereof I affix my signature.

RICHARD WALTER.