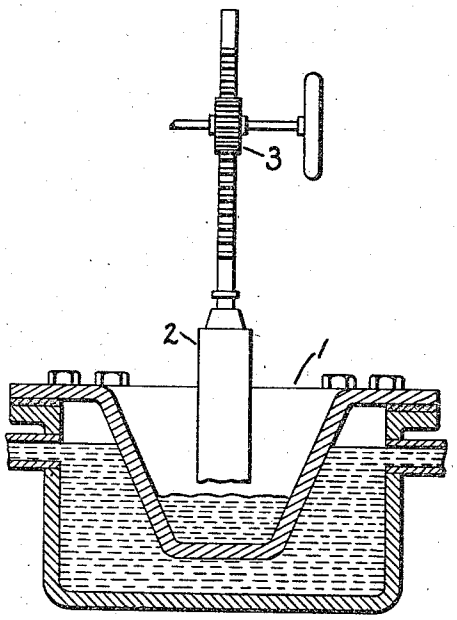
E. KRAUS.

METHOD OF MAKING TITANIUM AND OTHER ALLOYS.

APPLICATION FILED DEC. 8, 1911.

1,089,773. Patented Mar. 10, 1914.



Witnesses:
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UNITED STATES PATENT OFFICE.

ERNEST KRAUS, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

METHOD OF MAKING TITANIUM AND OTHER ALLOYS.

1,089,773. Specification of Letters Patent. Patented Mar. 10, 1914.

Application filed December 8, 1911. Serial No. 664,595.

To all whom it may concern:

Be it known that I, ERNEST KRAUS, a subject of the Emperor of Austria-Hungary, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in the Method of Making Titanium and other Alloys, of which the following is a specification.

Various methods have been suggested for the reduction of highly refractory and difficultly reducible metals such as titanium, vanadium, uranium and the like and the production of their alloys with aluminium, copper and other metals but these methods when they produce a fused regulus of metal, result only in alloys low in titanium content and when alloys high in titanium content are produced it is only in the form of grains of metal disseminated throughout the reduction mass.

By my improved process a fused regulus or ingot of metal is secured containing the refractory metals in hitherto unattainable percentages. In accordance with said invention a mixture of a reducible compound of the highly refractory metal, such as the oxid, and a reducing agent is fed into an arc or the compound of the refractory metal is itself fused by means of an arc and the reducing metal is fed into the fusion. The reduction product will vary with the amount and proportion of the reacting materials, and the temperature at which the reaction takes place. When it is desired to produce alloys containing metals taking no part in the reaction, for example, a copper-aluminium titanium, the inert alloying metal is introduced with the reducing metal.

I will explain my invention as applied to the reduction of titanium and the formation of aluminium-titanium and copper-aluminium-titanium alloys but wish it to be understood that my invention is not limited to the reduction of this particular metal and the formation of its alloys.

The accompanying drawing illustrates somewhat diagrammatically one form of apparatus for carrying out my invention.

According to one form of my new process an intimate mixture of a compound of the refractory metal, and a reducing metal such as aluminum is fed into an arc already formed between the water-cooled crucible 1, consisting conveniently of iron and an electrode 2 regulable by means of rack and pinion 3. This electrode in many cases may consist of graphite. When reducing titania, TiO_2, I prefer to employ an electrode consisting largely of about 75% of titanium suboxid and about 25% carbid. This mixture is packed into a carbon or graphite tube and fired at about 2000° C. The tube is preferably closed during the firing treatment.

The oxid melts, reduction takes place, and the reduced metal sinks to the bottom of the crucible forming a fused regulus or ingot of metal. The reduced metal alloys with the reducing metal in proportions depending upon the temperature and the proportions of the original mixture. When working with large amounts higher temperatures and higher percentages of refractory metal in the alloy are obtained.

When working with mixtures of titania and aluminum it is possible to easily obtain alloys containing about 94% of titanium. If desired other metals may be alloyed with the titanium alloy by adding the metal or its oxid to the reduction mixture. For example, alloys of titanium and copper containing some aluminum may be prepared by adding copper, preferably in the form of its alloy with aluminum.

According to a modified procedure, the compound of the refractory metal is first introduced into the arc and melted thereby and the reducing metal either alone or mixed with some other metal is charged into the melt. For example, if an alloy of 50% copper with 50% titanium is desired, an alloy consisting of 144 parts of copper 108 parts of aluminum is charged into the fused oxid of titanium. As the copper-aluminum alloy is heavier than the fused oxid, it sinks and insures a reaction under a protective layer of oxid. In this same manner, an alloy of titanium and aluminum may be charged into melted titanium oxid to reduce the proportion of aluminum in the alloy. Additional titanium is set free by reduction of the oxid with aluminum in the alloy.

What I desire to secure by Letters Patent of the United States, is:—

1. The process which consists in electrically fusing a compound of a highly refractory metal, and introducing into said fusion

a metal the heat of formation of the corresponding compound of which is greater than that of said refractory metal, thereby reducing said highly refractory metal compound to the metallic state, and continuing to develop heat electrically in said fusion to produce a fused ingot of metal.

2. The process which consists in fusing an oxid of a highly refractory metal and introducing into said fusion a metal the heat of formation of whose oxid is greater than that of the oxid of said refractory metal whereby reduction of the refractory oxid takes place with the formation of an ingot of metal.

3. The process which consists in fusing the oxid of titanium and introducing aluminium into said fusion, thereby reducing part of said oxid and producing an ingot of titanium and aluminium alloy.

4. The process which consists in fusing titanium oxid and introducing a reducing metal into the fusion, thereby reducing the titanium to the metallic state and causing it to unite to the form of ingot.

5. The process of reducing titanium which consists in melting a reducible compound of titanium and adding a reducing agent while maintaining the said compound in fusion.

In witness whereof, I have hereunto set my hand this sixth day of December 1911.

ERNEST KRAUS.

Witnesses:

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