UNITED STATES PATENT OFFICE.

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TREATMENT OF METALS.

1,155,974. Specification of Letters Patent. Patented Oct. 5, 1915.

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To all whom it may concern:

Be it known that I, TYCHO VAN ALLER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in the Treatment of Metals, of which the following is a specification.

This invention relates to the art of coating or otherwise treating metals so as to protect them against the effects of oxidation and other similar corrosive agencies and has for its object the production of a coating upon a metal normally subject to corrosive action or a condition within the metal such that it is capable of withstanding the oxidizing and corrosive influence without harmful effect.

This invention relates more specifically to the treatment of such metals as copper and iron which readily oxidize. As is well known, copper oxidizes very readily even at moderate temperatures. Iron, at moderate temperatures, oxidizes slowly if unprotected but at high temperatures the rate of oxidation is so rapid as to render its use almost prohibitive.

One of the objects of my invention is to treat iron, copper and similar metals so as to produce such a condition upon the surface of the metal or within it that it may be heated to a high temperature for practically an indefinite period without any deleterious effect upon the metal.

In carrying out my invention in one aspect I employ the metal aluminum for producing the desired condition. I have found that iron, copper and similar metals when heated with aluminum powder to a suitable temperature and under suitable conditions arrive at such a condition. I have found that under suitable conditions a protective alloy of copper and aluminum will be formed upon the surface of copper. This is accomplished by bringing aluminum powder into contact with the copper and heating to a proper temperature under conditions which prevent oxidation of the copper. One method which I have found to be very successful in practice is as follows: The aluminum powder is thoroughly mixed with a certain percentage of sal ammoniac and zinc and the articles to be treated are placed in an oven and surrounded by the powder mixture. The oven is then completely closed and slowly rotated. A temperature of about 450° C. is maintained within the oven and the treatment continues for about two hours. After the metal is taken out of the oven it is fired at a temperature of between 700° and 800° C. for about fifteen or twenty minutes. One mixture which has been found to produce excellent results contains 70% aluminum, 23% sal ammoniac, 7% zinc. Instead of zinc I may employ graphite. I have found, for instance, that a mixture of 60% aluminum, 30% graphite, 10% sal ammoniac produces very good results. When this mixture is employed the temperature may be raised with advantage to 700° C. The final product has the outward appearance of aluminum bronze and may be given a high polish. A section through a piece of copper thus treated discloses a distinct outer ring of the alloy having a depth which may vary from .001 of an inch, up to 1/64 of an inch or even thicker, depending upon the length of time the metal is under treatment. This coating is very hard and tough and is so firmly coherent that it is impossible to separate it from the copper. The coating is practically unaffected by high temperature and is unaffected by corrosive acids. Copper thus treated will be found to have innumerable uses, among which might be mentioned the soldering iron in which it is only necessary to expose the copper at the extreme end, leaving the remainder of the copper protected against oxidation and corrosion. Copper electrodes for lamps, furnaces, etc., will have their life greatly prolonged by being thus treated.

The treatment of iron is practically identical with that of copper. The same mixture may be used as well as the same temperature and the length of time which the metal is treated may be the same. In the case of iron, however, the coating is not so distinct. This may be due to the fact that the coating is considerably thinner for a given treatment than it would be with copper. The result, however, is the same in that the iron will not oxidize even at high temperatures. I have taken a wire thus treated and kept it at a red heat for over 200 hrs. without any apparent oxidation.

It should be understood, of course, that while I have described a particular process for bringing about the desired result, I do not limit my invention thereto since other

methods may be employed without departing from the spirit of my invention. I have found, for instance, that if the metal is simply brought into contact with the aluminum powder under suitable temperature conditions and in an atmosphere which will prevent oxidation, that a coating such as I have described, may be produced. By the process described, however, I am able to produce a more uniformly satisfactory result and the depth of the coating may be controlled more easily. I desire to have it understood, therefore, that my invention is in no sense limited to the particular process herein specified, nor to the particular article described, except in so far as they are limited by the scope of the claims annexed hereto.

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

1. The process of rendering metals inoxidizable which consists in heating the same under non-oxidizing conditions in contact with a powdered mixture containing aluminum and a chlorid.

2. The process of rendering metals inoxidizable which consists in heating the same under non-oxidizing conditions in contact with a powdered mixture containing aluminum and ammonium chlorid.

3. As a new article of manufacture, an oxidizable metal having its surface alloyed with another metal to form an alloy which is inoxidizable at high temperatures.

4. As a new article of manufacture, a metal having on its surface an alloy of aluminum with the metal which alloy is inoxidizable at high temperatures.

In witness whereof, I have hereunto set my hand this 3d day of October, 1911.

TYCHO VAN ALLER.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.