UNITED STATES PATENT OFFICE.

WILLIAM R. EACHES, OF READING, PENNSYLVANIA, ASSIGNOR TO JOSEPH T. WILLIAMS, OF EASTON, PENNSYLVANIA.

METHOD OF ANNEALING METAL.

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To all whom it may concern:

Be it known that I, WILLIAM RICHARD EACHES, a citizen of the United States, residing at Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Annealing Metal, of which the following is a specification.

This invention relates to the art of annealing metals; and it consists in a process in which the metal or that portion of a metal article to be annealed is introduced into a bath of a molten salt or compound, allowed to remain until sufficiently heated, and then withdrawn and slowly cooled.

In carrying out the process a suitable vessel, such as an iron pot, is provided, and a sufficient amount of the salt or other compound or compounds is melted in the vessel to provide a bath which will cover the metal or that portion of the metallic article to be annealed. When the base of a steel projectile is to be annealed by this process, the vessel is preferably a circular iron pan of sufficient width and depth to receive the base of the projectile. When a continuous strand of wire is to be annealed, a narrow rectangular trough of considerable length is desirable in order that the wire may be retained in the bath of molten salt for a sufficient period to enab e it to attain the temperature of the bath between the time it enters and leaves the bath as it is fed continuously through from end to end of the trough.

The salts or compounds which I have employed to constitute the molten annealing-bath are those which have an alkaline base—in other words, those of sodium, potassium, and ammonium. A carbonate of an alkaline base is one of the compounds which is desirable for use in the bath. The melting-point of sodium or potassium carbonate, however, is inconveniently high, and these salts when used are preferably mixed with some other salt or compound which will give a bath which can be maintained in fusion at a lower temperature than that required for the single carbonate. Other compounds which are especially serviceable for use in the fused bath are soda and potash, these terms being here used to signify the carbonate of the respective base. A mixture of soda or potash and sal-soda, otherwise sodium carbonate, makes a useful bath. I have also used with success molten baths consisting of the following mixtures: sodium chlorid, one part, by weight, and sodium carbonate, three parts; ammonium chlorid and sodium chlorid; ammonium chlorid and sodium carbonate; ammonium phosphate and sodium carbonate; sodium chlorid, one part, sodium carbonate, one part, and ammonium chlorid, one part. A bath which is perhaps preferable to any of those mentioned consists of sodium chlorid, three parts, and potassium carbonate, one part.

In carrying out the process with any of the specified molten baths the metal to be annealed or that portion of a metallic article to be annealed—for example, the base of a steel projectile or one of the journals or necks of a chilled-iron roll—is submerged in the bath and allowed to remain until heated to a sufficient temperature, usually that of the bath itself. The article is then withdrawn from the bath and allowed to slowly cool. The surface of the article when withdrawn from the bath generally carries an adherent coating of the material of the bath, which solidifies on the article and prevents the atmosphere from coming directly in contact with it, thereby materially retarding its rate of cooling. These baths are especially desirable for use in annealing iron or steel or copper wire. In reducing wire by drawing it through dies it soon becomes brittle and requires to be annealed before further reduction. This annealing is a tedious process and greatly restricts the output of wire. The wire also becomes coated during the process of annealing with an adherent oxid or scale, which must be removed by pickling before further reduction of the wire. I have found, however, that wire may be continuously annealed as it comes from the drawing-dies by running it through one of my molten baths. The wire enters the bath cold, but comes out heated to a high temperature, practically that of the bath itself. The coating of bath material which covers the wire as it emerges from the bath immediately solidifies and prevents the wire from becoming oxidized, while it also retards the cooling, as stated, thereby effecting a more uniform and perfect annealing of the metal. The coating of crystallized salt is easily removed from the wire before again

passing it into the drawing-dies—for example, by the use of brushes or by slightly bending it and causing the salt to flake off. The wire then appears as bright and clean as when it was run into the bath and is in perfect condition for further reduction. I have found that wire annealed by the use of my bath is much softer and more ductile than wire annealed in furnaces as usual, the drawing-dies effecting a reduction of several sizes before further annealing of the wire is required, as compared with the reduction of one size when the wire is annealed by the old process.

I am aware that it is old to case-harden iron or soft steel by dipping it into a molten bath containing a cyanid or prussiate, the purpose here being to carburize the surface of the metal, and thereby convert it into steel which is capable of being hardened. The purpose of my invention is evidently quite distinct from such prior art, in that I desire to obtain a soft annealed metal rather than one having a hard surface.

I claim—

1. The method of annealing metal which consists in introducing the metal into a molten bath containing a carbonate of an alkaline base, and a chlorid of an alkaline base, and free from a hardening agent, then removing the metal from the bath and slowly cooling it, as set forth.

2. The method of annealing metal, which consists in introducing the metal into a molten bath containing a carbonate of an alkaline base and chlorids of two different alkaline bases, then removing the metal from the bath and slowly cooling it, as set forth.

3. The method of annealing metal, which consists in introducing the metal into a molten bath containing a carbonate of an alkaline base and chlorids of two different alkaline bases and free from a hardening agent, then removing the metal from the bath and slowly cooling it, as set forth.

4. The method of annealing metal, which consists in introducing the metal into a molten bath consisting of sodium chlorid, about three parts, and a carbonate of an alkaline base, about one part, then removing the metal from the bath and slowly cooling it, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM R. EACHES.

Witnesses:

F. L. FREEMAN,

W. CLARENCE DUVALL.