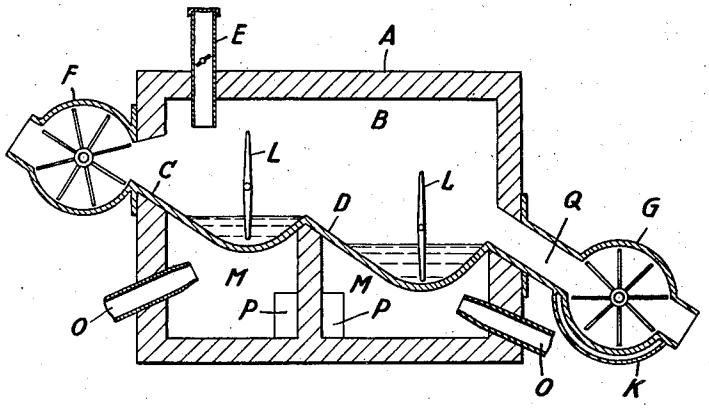
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COATING IRON OR STEEL ARTICLES WITH ALUMINUM

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COATING IRON OR STEEL ARTICLES WITH ALUMINUM

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9 Claims. (Cl. 91—12.5)

The invention relates to an apparatus for coating articles of iron or steel with aluminum in such a manner that the entire surface of the articles will be covered with aluminum and that on the surface an aluminum-alloy is formed.

It is known for this purpose to dip the articles into a bath of molten salts and subsequently into a bath of molten aluminum; it is further known in the art of coating metallic articles with aluminum to provide a reducing atmosphere over or on the top of the aluminum baths employed.

These known suggestions, however, failed to solve the problem in a satisfactory manner. The aluminum coating is unequal and therefore very liable to local destruction. Sometimes the methods of coating metallic articles with aluminum as hitherto practised involve even incidental effects injurious to said articles. These disadvantages are due or attributable to the fact that in the old methods the chief requirement of keeping the articles absolutely free from contact with air or oxygen and even traces of air or oxygen during the entire treating process from the moment of introducing the same into the preliminary bath and treating the same in the aluminum bath up to cooling the thus treated articles, has not been fully recognized or complied with.

In order to strictly comply with said requirement the articles to be coated with aluminum are subjected according to the present invention to a preliminary treatment preferably in a bath of molten salts and subsequently to a treatment in an aluminum bath while the same are kept within an atmosphere or zone of reducing gases free of air or oxygen. In other words according to the present invention it is imperative that all air be removed from the furnace and a reducing atmosphere or zone be provided in the furnace preferably by introduction of suitable reducing gases and the articles treated in the furnace are allowed to remain within said reducing atmosphere or zone for a sufficient length of time so as to be cooled therein.

The bath of molten salts, preferably chlorides, the aluminum bath and the atmosphere or zone on top thereof are kept at such a degree of temperature as will be sufficient to impart to the articles the temperature required for the purpose in view.

As the iron or steel articles under treatment are exposed to the action of an overlying atmosphere of purifying and reducing character containing any of the known reducing agents such as chloride of zinc, chloride of ammonium and the like, which are known in the art to be capable of purifying metallic surfaces when in gaseous condition or of reducing gases such as hydrogen, lighting-gas and the like, the outer surfaces of the same will be freed from oxide particles, so as to be in best condition for the subsequent treatment in an aluminum bath.

The dipping-treatment in an aluminum bath is effected immediately thereafter and without exposing the purified articles to the action of air or any other injurious gases. The aluminum combines substantially at once with the surfaces of the iron or steel or within a few seconds so as to form an alloy at the contacting surfaces of the article and a thin coating of aluminum is then deposited thereon.

The articles thus coated with an aluminum film are withdrawn from the furnace through a channel or passage which does not contain any air and is adapted to be cooled by water by means of a cooling jacket. In this way the articles are cooled to such a degree that oxidation cannot set in when the articles are subsequently passed into the outer air.

I shall now proceed to describe my invention more in detail with reference to the accompanying drawing wherein:

The figure is a diagrammatic showing of an apparatus embodying the present invention.

In the construction illustrated in the figure, A denotes the furnace and B the upper part of a chamber thereof filled with lighting-gas. C indicates a crucible containing the molten salts and D denotes a crucible charged with aluminum in molten condition. The tube E in the top of the furnace is provided with a valve and a covering cap and serves the purpose of introducing into the chamber B a substance, such as $ZnCl_2$ or NH_4Cl which will volatilize in the chamber due to the high temperature prevailing therein so as to mix with the lighting-gas.

The iron or steel articles to be treated in the described furnace are supplied to the crucible C by means of an air-tight closing winged wheel F. After the articles have been treated in the crucible C and D they are discharged from the furnace through an inclined channel Q and through a winged wheel G similar to the wheel F, the housing of the wheel G is totally or partly enclosed in a cooling jacket K. The revolving paddle-boards L are provided for the purpose of forwarding the articles through the two baths and into the channel Q as will be readily understood upon inspection of the figure. M, M denote heating cham-

bers for heating the crucibles C and D by means of suitable burners O, O. P, P indicate outlet-channels for the hot combustion gases.

In some cases it will be advisable to employ a lead-bath or a bath of any other suitable metal in lieu of the salt-bath C.

It is obvious that changes may be resorted to in the form and arrangement of the several parts without departing from the spirit and scope of my invention. Thus, for example, it may be advisable to protect the bottom of the crucible D of the furnace shown in the figure by means of a layer of lead or any other suitable metal which will prevent the molten aluminum from exerting a dissolving action on the bottom of the crucible. This precaution is of importance and especially recommendable in case that the crucible is shaped to form a shallow container.

What I claim is:

1. A furnace for coating iron and steel with aluminum, said furnace being constructed with a heating chamber therein, a preliminary bath and a coating bath in said heating chamber, means providing a cooling space in communication with said heating chamber, said heating chamber and said means being substantially air tight to contain reducing gases whereby material to be coated can be kept in a reducing atmosphere while being transferred from said preliminary bath to said coating bath and during cooling in said cooling space.

2. The combination of claim 1 wherein said furnace is provided with means to introduce articles to be coated into said heating chamber and means to remove the coated articles from said cooling space, said means comprising winged wheels, the wings thereof preventing escape of gases from said heating chamber and cooling space.

3. The combination of claim 1 wherein said preliminary bath and said coating bath are fitted with revolving paddle boards to transfer articles from said preliminary bath to said coating bath and from said coating bath to said cooling chamber.

4. A furnace for coating iron and steel with aluminum, said furnace being constructed with a heating chamber therein, a preliminary bath and a coating bath in said heating chamber, said heating chamber being substanially air tight to contain reducing gases whereby material to be coated can be kept in a reducing atmosphere while being transferred from said preliminary bath to said coating bath whereby said reducing atmosphere prevents formation of a brittle iron aluminum alloy layer on the surface of said article.

5. A furnace for coating metal objects with a protective metal coating, said furnace being constructed with a heating chamber therein, a preliminary bath and a coating bath in said heating chamber, means providing a cooling space in communication with said heating chamber, said heating chamber and said means being substantially air tight to contain reducing gases whereby material to be coated can be kept in a reducing atmosphere while being transferred from said preliminary bath to said coating bath and during cooling in said cooling space.

6. A furnace for coating metal objects with a protective metal coating, said furnace being constructed with a heating chamber therein, a preliminary bath and a coating bath in said heating chamber, said heating chamber being substantially air tight to contain reducing gases whereby material to be coated can be kept in a reducing atmosphere while being transferred from said preliminary bath to said coating bath.

7. Apparatus for coating metal with aluminum comprising a preliminary bath in a reducing gas, means for heating the bath and said gas, an aluminum bath in a reducing gas, a cooling means for positively cooling the metal after passage through the aluminum bath, and means for continuously passing the metal through the first bath to subject the same to elevated temperature in the presence of reducing gas at elevated temperature, then without exposure to oxidizing influences into said aluminum bath, and then in cooling relation to said cooling means.

8. Apparatus for coating metal with aluminum comprising a preliminary bath in a reducing gas, means for heating the bath and said gas an aluminum bath in a reducing gas, said baths being in closed communication whereby the metal is heated in the presence of said reducing gas at elevated temperature and passed successively into said preliminary aluminum baths with complete exclusion of oxidizing influences, cooling means for positively cooling the metal after passage through said aluminum bath, and means for continuously passing the metal through the said baths, and into cooling relation with said cooling means.

9. Apparatus for coating metal with aluminum comprising a preliminary bath in a reducing gas, an aluminum bath in a reducing gas, said baths being in closed communication whereby the metal is heated in the presence of said reducing gas at elevated temperature and passed into said aluminum bath with complete exclusion of oxidizing influences, cooling means receiving the metal after passage through said aluminum bath, and having closed communication therewith and with said reducing gas, whereby the article is positively cooled in a reducing atmosphere, and means for continuously moving the metal through said baths and said cooling means.

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