Patented May 12, 1936 2,040,282

UNITED STATES PATENT OFFICE

2,040,282

COATING FERROUS METALS WITH CADMIUM

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No Drawing. Application January 30, 1933, Serial No. 654,245

10 Claims. (Cl. 91—70.2)

This invention relates to the coating or plating of ferrous objects or materials with cadmium.

The invention provides a process for applying an adherent cadmium coating of uniform thickness to the common varieties of iron and steel. The invention further provides a wetting or bonding agent which may be applied to ferrous metal objects and utilized either as an intermediate bonding coating for plating such objects with other metals or as a corrosion-resisting cadmium surface coating.

By the present invention ferrous metal bodies are cadmiumized by bringing same into contact with a molten cadmium-nickel alloy with the result that the ferrous articles so treated are covered with a cadmium coating in which are combined such requisite properties as adherence, uniform thickness and good appearance.

In brief, the process of the invention may be practiced as follows: a proper cadmiumizing bath may be established by melting cadmium in a suitable container, after which nickel in suitable amounts may be introduced therein through a supernatant stratum of a suitable flux. When the nickel has been thoroughly incorporated in the molten cadmium, the ferrous object or objects to be coated may be cleansed and immersed in the molten cadmium nickel bath thereby coating the objects as desired.

In order to more fully illustrate the principles of the present invention, attention is directed to the following specific example of the process, although it is obvious that modifications will appear to those skilled in the art. In this instance, a molten cadmium bath was established under a zinc chloride cover and brought to a temperature of approximately 450° C. Nickel sufficient to yield a cadmium alloy containing approximately 1% nickel was then added to the bath in the form of small pieces of thin sheet nickel.

The bath was stirred at intervals until the nickel was thoroughly incorporated in the cadmium, after which various specimens of iron and steel including mild steel sheets, medium carbon steel, high carbon steel, malleable and cast iron were suitably cleaned by pickling in warm dilute sulphuric acid and subsequently immersed in the cadmium nickel bath by passing the specimens through the zinc chloride cover.

The specimens were then removed from the bath and were without exception covered with a smooth, adherent and uniform cadmium coating which is in direct contrast to the rough, non-uniform, less adherent coatings obtained when similar materials are immersed in a pure cadmium bath.

In forming the cadmiumizing bath, sufficient nickel should be used to insure proper bonding of the cadmium to the ferrous material being treated and to yield the desired coating.

It has been determined that the nickel content of the cadmium bath should be within the range of approximately 0.1% to 10% if the most beneficial results possible are to be secured. These nickel content limits, however, are of an economical nature rather than of a metallurgical one, as the results obtained in treating iron or steel with such a cadmiumizing bath vary gradually with the nickel content and no sharp line of demarkation is exhibited. For example, a trace of nickel gives improved results over a pure cadmium bath, but it is not until the quantity of nickel is increased to approximately 0.1% or more that the marked benefit of the alloy lends itself to an economic and commercial operation. Similarly, other factors place the upper operable limits of nickel in the cadmium bath at approximately 10%.

When the nickel content approaches its lower approximate limit of 0.1% or below, the operation is materially retarded and repeated dipping must be practiced if a substantial coating is to be effected. As it is highly undesirable to pass the iron or steel products through the cadmiumizing bath more than once, a higher nickel content in the bath is recommended. On the other hand, when the nickel content of the cadmiumizing bath approaches 10% or more, the melting point of the alloy rapidly rises and volatilization losses of cadmium result. However, the coating is rapidly and easily accomplished, although brittleness of the coating increases with the nickel content. It may be added that, for most commercial operations, a nickel content of from 1% to 6% has been found desirable. It is understood that the cadmiumizing bath, in addition to the requisite amount of nickel, may contain small amounts of various impurities, among which may be mentioned copper, cobalt, arsenic, tin, zinc, etc.

The cadmiumizing bath is preferably covered with a suitable flux at all times to prevent oxidation and to retard volatilization of cadmium, especially when relatively large amounts of nickel are used. While the process of the invention is not limited to any particular flux, zinc chloride or a mixture of zinc chloride and sal ammoniac has proven satisfactory. Further, the process of the invention may be practiced at various temperatures, the only apparent limitation being that

the bath be molten, although, obviously, excessively high temperatures are to be avoided in order to insure against losses of cadmium by volatilization. Ordinarily, the bath is held within a temperature range of approximately 375° C. to 500° C.

It will be readily appreciated that the coating applied to iron and steel by the process of the present invention may be utilized either as an external coating comprising substantially cadmium or as an intermediate bonding coat on which an outer surface coating of different metal or metal alloys may be placed. To produce a cadmium coated ferrous object, it is merely necessary to dip the object in a cadmiumizing bath of the class described. If desired, however, this coating may be utilized as an intermediate or bonding coat. For example, in coating iron or steel with lead, the iron or steel may be first dipped in a cadmium nickel bath and the thus coated articles subsequently immersed in molten lead to yield the desired product.

It is believed that the improved results effected by the present invention in the coating of ferrous metals with cadmium may be explained on the theory that a wetting agent results when nickel is added to the cadmiumizing bath. In other words, whereas pure cadmium will not readily wet iron or steel, an alloy of cadmium containing nickel in appropriate proportions will. It is believed that the nickel alloys both with the cadmium and iron which explains the firm, adherent, even and uniform cadmium coatings obtained on ferrous metals in accordance with the present invention.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In coating ferrous metal bodies with cadmium, the improvement which comprises dipping the ferrous metal body to be coated in a molten cadmium bath containing from approximately 0.1% to approximately 10% of nickel.

2. The process of applying a cadmium coating to an iron or steel body which consists in establishing a molten cadmium bath containing from 0.1% to 10% nickel under a suitable flux and immersing said iron or steel body in said bath through said flux while maintaining the bath within a temperature range of approximately 375° C. to 500° C. whereby a uniform, adherent cadmium coating forms on said iron or steel body.

3. The process of coating the common varieties of iron or steel with cadmium which consists in establishing a molten bath of cadmium under a cover slag containing zinc chloride, incorporating sufficient nickel in said bath to impart a nickel content of approximately 1% to 6% thereto and bringing said iron or steel into contact with the molten cadmium and nickel whereby an adherent uniform cadmium coating forms on said iron or steel.

4. In coating ferrous metals with another metal or metal alloy, the improvement which comprises applying an intermediate bonding coat to the ferrous base by dipping same in a molten cadmium bath containing from 0.1% to 10% of nickel.

5. In coating ferrous metals with another metal or metal alloy, the improvement which comprises applying an intermediate bonding coat to the ferrous base by dipping same in a molten cadmium bath containing 1% to 6% of nickel prior to coating same with the desired metal or alloy.

6. The process for applying a firm, adherent cadmium coating to a ferrous metal surface which consists in contacting said surface with molten cadmium containing from .1% to 10% nickel.

7. The process for applying a firm, adherent cadmium coating to a ferrous metal article which comprises immersing the article in a molten bath comprising principally cadmium but containing relatively small amounts of nickel in quantities sufficient to wet the said article and to bond the cadmium to the said article.

8. The process for applying a firm, adherent cadmium coating to a ferrous metal article which comprises immersing the article in a molten bath comprising principally cadmium but containing relatively small amounts of nickel in quantities sufficient to wet the said article and to bond the cadmium to the said article, the said nickel being present in amounts not less than substantially 0.1%.

9. The process for applying a firm, adherent cadmium coating to a ferrous metal article which comprises immersing the article in a molten bath comprising principally cadmium but containing relatively small amounts of nickel in quantities sufficient to wet the said article and to bond the cadmium to the said article, the said nickel being present in amounts not less than approximately 0.1% nor more than approximately 10%.

10. The process for applying a firm, adherent cadmium coating to a ferrous metal article which comprises dipping the article in a molten bath of cadmium in the presence of from approximately 0.1% to approximately 10% of nickel whereby the nickel bonds the cadmium to the said article.

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