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PROCESS OF RUSTPROOFING BY COATING WITH CADMIUM.

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To all whom it may concern:

Be it known that we, WILLIAM A. WISSLER and CHAD H. HUMPHRIES, citizens of the United States, residing at Kokomo, in the county of Howard and State of Indiana, have invented certain new and useful Improvements in Process of Rustproofing by Coating with Cadmium, of which the following is a specification.

This invention relates to an improved method of rustproofing iron or steel articles by applying a coating of cadmium thereto.

We have coated with cadmium many articles, such as piano wires, common iron or steel fence, baling wire, blue strip spring street, articles fashioned from iron or steel rods, such as play ground equipment, iron castings of various forms, and have found when these were subjected to severe rust tests that these treated articles were exceedingly resistant to rust.

The method of coating the surface of such metallic articles, we prefer to do by electro-deposition and the following description is a satisfactory means of so doing: The articles, which are cleaned as described later, are plated with metallic cadmium, using current densities within the range afterwards indicated and are then washed and dried. Articles so coated with cadmium in this particular physical condition obtained by our method are practically resistant to rust. We observe, however, that if these coated articles are baked for a period of time that their resistance to rust is further increased.

As a plating solution we prefer to use one prepared in the following manner: A solution containing about 25 grams of cadmium per litre of solution, we have found, is most convenient for the purpose. Enough of a salt of cadmium such as the sulphate or chloride to yield 25 grams of metallic cadmium is weighed and dissolved in as small amount of water as possible. If metallic cadmium is used, it may be dissolved in hydrochloric acid to form a neutral solution or it may be dissolved in nitric acid and evaporated to dryness with hydrochloric acid to remove the nitric acid. After the cadmium is dissolved and is in a neutral or nearly neutral solution a solution of sodium or potassium hydroxide is slowly added until the cadmium is precipitated and the solution is red to phenolphthalein. Sodium or potassium cyanide is now slowly added to the precipitated cadmium hydrate until it is all dissolved. The solution is then diluted to one litre. An excess of free cyanide is not objectionable.

A solution thus prepared contains 2.5% of cadmium; but we have found that the amount of cadmium in solution may be widely varied, as from 1.25% to 15% metallic cadmium content in solutions of approximately 1% to 25% of sodium cyanide. Preferably, the cadmium cyanide solution is kept neutral or basic.

These cyanide solutions may of course be prepared in other ways, and solutions other than cyanide solutions may be used,—however the latter are preferable.

All articles before plating are to be carefully cleaned in order to obtain a clean metallic surface. The cleaning of course, will depend upon the condition and shape of the article but we find that ordinary pickling in single or mixed acids and washing with water is usually sufficient. Some articles can be sand blasted or scratch brushed before final plating. The only thing that is necessary is that no grease or scale shall be left upon the surface of the articles.

We find it highly desirable to use, instead of a cadmium anode, an anode of graphite, carbon or other insoluble non-polarizing anode. The cadmium anode in use tends to become covered with a film and at a fixed voltage, the current density drops off rapidly with a consequent decrease of the amount of cadmium deposited on the article to be plated and a considerable increase in the length of time necessary to deposit a required thickness of cadmium. Furthermore, the condition of such deposit of cadmium at a necessarily lower potential, and therefore, decreased current density, is not as satisfactory as that obtained when a graphite anode is used. Using a cadmium anode it is difficult to obtain and maintain a desirable current density, which means that a commercially efficient process cannot be obtained.

By the use of insoluble non-polarizing anodes it becomes feasible to maintain constant the current density which is preferably kept at a relatively high degree. The

current density may vary within wide limits and will obviously depend upon the shape and electrical characteristics of the article to be plated. Thus, the current density will, in plating a very thin sheet of metal where it is difficult to make good electrical contact, be somewhat lower than where contact can be readily made, as on a large thick casting.

As an example, we find, in using a sodium cyanide solution containing approximately 10.5% of metallic cadmium, that the current densities which can be advantageously employed are from 25 to 290 amperes per square foot. The particular indication of the required density is that gas must be freely given off both from the insoluble anode and from the article being plated. The average current density which we use is approximately 150 amperes per square foot.

We find that the use of high current densities with an anode such as above described, results in the rapid production of hard, homogeneous, adherent deposits.

After the article such as piano-wire has received its coating, it is washed in water and placed in an oven and heated to about 150° C. to 200° C. The maximum in an ordinary oven is about 200° C. It has been our practice to hold the wire or other coated article at about 185° C. for 3 to 4 hours. The time is not a very important factor as good results were obtained by heating for 24 hours. Any reasonable length of time, from 2 to 23 hours will serve the purpose well. The temperature should be such that there is only a slight coating of cadmium oxide formed on the article. Excessive oxidation must be avoided. By burying the wire in calcium hydroxide the temperature may be raised to about 250° C. without excessive oxidation. The degree of oxidation of course is governed by the temperature employed and the atmosphere in which the heating takes place.

The effect of the baking is to cause the coating to become an integral part of the whole article, and this coating is distinctly harder than before the baking. These coatings are firmly adherent to the base metal by being alloyed therewith, are continuous and impervious and withstand blows and bending without peeling. Exposure tests, both under weather conditions or the salt spray test show that the baked coating is far more resistant than the unbaked coating.

While our process is particularly applicable to coating iron or steel articles, the method is also applicable to other metals, and the claims are to be read as including such application to other metals.

What we claim is:

1. The method of rust proofing iron or steel articles by electro-depositing thereon, metallic cadmium from a suitable cadmium solution, which method consists in passing a current, maintained at high current densities, through said solution from a graphite, carbon or non-polarizing anode.

2. The method of rust proofing iron or steel articles by electro-depositing thereon, metallic cadmium from a suitable cadmium solution, which method consists in passing a current through said solution from a graphite, carbon or non-polarizing anode.

3. The method of rust proofing iron or steel articles by electro-depositing thereon, metallic cadmium from a suitable basic or neutral cadmium solution, which method consists in passing a current, maintained at high current densities, through said solution from a graphite, carbon or non-polarizing anode.

4. The method of rust proofing iron or steel articles by electro-depositing thereon, metallic cadmium from a suitable basic or neutral cadmium solution, which method consists in passing a current through said solution from a graphite, carbon or non-polarizing anode.

5. The method of rust proofing iron or steel articles by electro-depositing thereon, metallic cadmium from a suitable cadmium solution, which method consists in passing a current through said solution from a graphite, carbon or non-polarizing anode, the current density being such that gas is freely evolved at both anode and cathode.

6. The method as claimed in claim 2 in which the coated article is baked after the coating has been applied.

7. The method as claimed in claim 2 in which the coated article is baked at a temperature of from 150° to 250° C.

8. The method of rust proofing metallic articles which consists in electro-depositing thereon metallic cadmium from a basic or neutral cyanide solution of cadmium, the current being maintained at such current density that gas is freely evolved from the anode and cathode, a graphite, carbon or non-polarizing anode being used.

9. The method as claimed in claim 8, in which the coated article is baked after the coating has been applied.

10. The method, as claimed in claim 8, in which the coated articles is baked at a temperature of from 150° to 250° C.

In testimony whereof, we affix our signatures.

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