

UNITED STATES PATENT OFFICE.

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METHOD OF APPLYING PROTECTIVE COATINGS TO METALLIC ARTICLES.

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Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that we, CLAYTON MARK, JR., and CLARENCE MARK, residing at Evanston, in the county of Cook and State of Illinois, citizens of the United States, have jointly invented a new and Improved Method of Applying Protective Coatings to Metallic Articles, of which the following is a specification.

Our invention relates to methods of applying protective coatings to metallic articles, and consists in introducing the article to be coated into a bath containing lead, antimony and zinc, in such proportions that when they are alloyed they are electro-positive to iron in an electrolyte such as tap water, salt solutions or common conducting solutions other than nitrates, and in maintaining a suitable protective flux for the bath.

Our invention also consists in the periodic addition of zinc to replace the amount of zinc taken up by the bath, thereby maintaining a constant proportion of zinc in the alloy.

A typical example of carrying out our process is as follows: We take the article to be coated, such as an article of iron or steel, and cleanse it in a suitable bath, preferably using the usual sulfuric acid pickle, and after washing the article, put it through a bath composed of muriatic acid and sal ammoniac or zinc chlorid, or both, and water, such as is ordinarily used in a galvanizing process. The article is then passed through a bath of molten lead, antimony, and zinc, covered with a sal ammoniac flux, in which is present zinc and iron. By reason of the great affinity of the zinc for iron or steel, the article immediately picks up small percentages of zinc, and the zinc forms on the surface of the iron a zinc-iron alloy, to which the composition of the bath will adhere. As soon as the article has reached approximately the temperature of the molten bath, which is preferably between 750° and 950° F., the article is withdrawn from the molten bath, and then is kept in motion until the coating has settled so as to prevent the coating from depositing unevenly. The bath is preferably of the following composition: Lead, 92.%; zinc, 3.5%; antimony, 4.5%, which we have found to give the best results.

Other compositions found to give favorable results are: lead 86%, zinc 6%, anti-

mony 8%; and lead 98.%, antimony 1% and zinc 1%. These alloys contain in each instance approximately the stated amount of zinc at the saturation point when a temperature of approximately 900° F. is used. When the temperature is increased more zinc may be added, or when the percentage of antimony is increased the higher is the percentage of zinc which is necessary to saturate the bath.

Zinc vaporizes readily, and also, in addition to being taken up with the other ingredients to form the coating of the article, it combines with the iron of the article to form a zinc-iron alloy, and it is also taken up by the flux, so that the bath becomes depleted of its zinc, unless special steps are taken to prevent the depletion.

We have found that it is of great importance to keep the quantities of zinc in the bath uniform, and to this end we add small quantities of zinc at frequent intervals to keep up the necessary percentage of this metal in the alloy preferably near to saturation. The zinc is preferably added in a molten state, to facilitate the ease with which it is dissolved in the bath, and it is added and maintained in slight excess of the amount desired to alloy with the other metal in the bath; thus the zinc collects around the edge of the pot and is automatically taken up by the bath as the proportion of zinc in the alloy becomes depleted and the presence or absence of the free zinc serves as an indication to the workman as to whether or not the alloy contains the desired proportion of zinc. To replenish the volume of the bath, lead, zinc and antimony are added in the usual proportions.

Analysis and examination of an article coated with the coating described above has shown the coating to consist of an underlying layer of a zinc-iron alloy, which is covered and combined with an alloy of lead, antimony and zinc, which forms the exterior coating.

We have found that lead alone, or lead and antimony, will not readily adhere to iron or steel, when low percentages of antimony are used. Zinc, however, by its affinity for iron, readily unites with the iron, and the resultant zinc-iron alloy forms a base for the adhesion of the lead-antimony-zinc alloy.

An alloy made in the proportions described maintains a comparatively bright, hard finish, under ordinary conditions of exposure, and is more resistant to acid attack than the ordinary galvanized coating, or coatings comprised of lead and zinc. The alloy forms a smooth and uniform coating which can be readily applied to pipes, sheeting and similar articles. We have found this coating to have practically all of the advantages of a galvanized or sherardized coating, with the added advantage that it is at least twice as durable to weather and acid attack as a galvanized or sherardized coating. It is also much more adherent than are the usual galvanized coatings and will not flake or peel off under expansion or contraction of the article, or even if the article is bent or hammered.

The terms and expressions which we have employed are used as terms of description and not of limitation, and we have no intention in the use of such terms and expressions of excluding any equivalent for the features shown and described, but recognize that various modifications are possible within the scope of the invention claimed.

What we claim is:

1. The herein described process of applying protective coatings to metallic articles which consists in introducing the article to be coated into a molten bath consisting of lead, with small percentages of antimony and zinc, the zinc being present substantially up to the point of saturation of the bath, the molten metal being covered by a flux of sal ammoniac containing iron and zinc salts.

2. The herein described process of applying a protective coating to iron and steel articles which consists in introducing metallic articles into a bath, the temperature

of which is between 750° and 950° F., and being protected by a flux of sal ammoniac containing iron and zinc salts, the said bath containing mainly lead but having alloyed with it antimony and zinc, there being enough zinc to render the coating obtained from said bath electro-positive to iron.

3. The herein described process of applying protective coatings to metallic articles which consists in introducing the metallic articles to be coated into a bath of lead containing antimony and zinc, heated to between 750° and 950° F., and adding more zinc periodically so as to maintain the proportion of zinc in the alloy below six per cent. but above an amount necessary to render the coating formed from the bath electro-positive to iron.

4. The herein described process of applying protective coatings to metallic articles which consists in introducing metallic articles into a lead bath, containing antimony and zinc, covered with a flux of sal ammoniac, said flux containing zinc and iron salts, the bath forming upon the surface of the article a zinc-iron alloy and forming upon the zinc-iron alloy an alloy of lead, antimony and zinc.

5. A process of coating iron articles consisting in immersing them in a molten lead bath, said lead bath containing antimony under eight per cent. and zinc substantially up to the point of saturation of the bath at the operating temperature, the maintenance of the zinc content being provided by the periodic addition of zinc in such quantity that a portion of it floats upon the surface and thus furnishes an indication as to the condition of the bath.

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