Patented May 18, 1948 2,441,776

UNITED STATES PATENT OFFICE

2,441,776

PROCESS OF METAL COATING METAL ARTICLES

Urlyn Clifton Tainton, Baltimore, Md.; Rolfe Pottberg administrator of U. C. Tainton, deceased, assignor to Freeport Sulphur Company, New York, N. Y., a corporation of Delaware

Original application October 21, 1938, Serial No. 236,340. Divided and this application February 15, 1943, Serial No. 475,865

3 Claims. (Cl. 117—52)

1

My invention relates to the treatment of metal, particularly for the cleaning of the surface thereof. The invention is especially effective for removing rust, scale, carbon and slag from the surface of iron and steel, and is particularly applicable as a preliminary treatment to various coating operations, such as galvanizing, enameling, painting, electroplating or the like. The invention, however, as will later more fully appear, is not limited to the treatment of ferrous metal.

My invention comprises the step of subjecting the surfaces of metals to the reducing action of a metal more electropositive than the metal being treated, that is having a position in the electrochemical scale above that of the metal being treated. For example, when iron or steel is being treated it may be subjected to the action of sodium or calcium, which metals are considerably more electropositive than iron.

More specifically, my invention comprises the subjection of the metal article to be treated to the action of a more electropositive metal by a method in which the article is used as a cathode in a bath comprising compounds of the more electropositive metals, under such conditions that the more electropositive metal is liberated at the surface of the article.

In presenting this invention, a specific embodiment thereof will first be described, followed by illustrative modifications and an outline of the general principles upon which it rests.

Accordingly I shall first describe the cleaning of steel or iron wire as a step in the manufacture of electroplated zinc coated wire.

Referring to the drawings:

Fig. 1 is a diagrammatic elevation, more or less in section, of a system for cleaning and electroplating the wire;

Fig. 2 is a plan view of the system shown in Fig. 1; and

Fig. 3 is a diagrammatic longitudinal elevation of a system for cleaning wire and then galvanizing it by a "hot dip" operation.

Referring first to Figs. 1 and 2, the wire 11 is fed continuously from reel 12 successively through cleaning tank 13, wash tank 14, anodic cleaning tank 15, and electroplating tank 16, to reel 17. Electrodes 18, 19 and 20 depend into tanks 13, 15 and 16 which also contain electrodes 21, 22 and 23, respectively. The wire runs over guide rolls 24 mounted on the tanks, and over guide rolls 25 mounted at the ends of electrodes 18, 19 and 20. The electrodes of the several tanks are connected to electric current sources 26, 27 and 28, respectively, electrodes 18, 19 and 20 being respectively negative, positive, and negative, while electrodes 21, 22 and 23 are respectively positive, negative, and positive. Guide rolls 25 serve to conduct current to wire 11, the wire thus being

2

rendered cathodic in tank 13, anodic in tank 15 and again cathodic in tank 16. Gas burners 29 are provided for maintaining tank 13 in a heated condition.

Tank 13 contains a fused bath of sodium hydroxide through which the wire passes. Current is passed through the fused bath to electrolyze it, the wire serving as the cathode. In this specific example of my invention, the wire passes through the bath at such a rate that each portion thereof remains immersed in the fused bath for a period of about thirty seconds and the current density employed is between 100 and 200 amperes per square foot of cathodic surface.

From tank 13 the wire passes through wash water in tank 14 to remove the adherent sodium hydroxide, thence passing through an aqueous solution of sulphuric acid in tank 15, the concentration of this being 20% H_2SO_4. Here the wire acts as the anode, the current density employed being of the order of 100 amperes per square foot or greater.

The wire next passes through an aqueous solution of zinc sulphate and sulphuric acid in tank 16, the zinc sulphate being in such an amount as to give a zinc content of 7 grams per 100 cubic centimeters of solution and the sulphuric acid about 20%. Here the wire acts as the cathode, the current density being of the order of 200 amperes or greater per square foot of cathodic surface. Here the wire is electroplated with zinc. For the anodic treatment in tank 15, the same composition may be employed as that in the coating of plating tank 16.

The treatment in tank 13 is the most significant stage of the process so far as this particular patent application is concerned. This treatment effectively cleans the surface of the wire, fully removing those obstacles to effective coating of ferrous metal. Moreover, this treatment produces a "passive" condition of the surface of the metal. This passivity of the metal surface gives it a considerable degree of resistance to corrosive influences.

Current densities in this sodium hydroxide-cathodic cleaning operation may vary over substantial ranges. However, sufficient current density and a sufficient period of time of the metal in the cleaning bath should ordinarily be employed to effect a substantially complete reduction of surface oxides while the metal is in the bath. Ordinarily the current density should be between 25 and 300 amperes per square foot of cathode surface. Most commonly the current is from 100 to 200 amperes per square foot of cathode surface.

For the most effective results, the electrolysis of the fused sodium hydroxide should be so carried out that the elemental sodium liberated does not collect in sensible amounts, preferably not