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BRIGHT ZINC PLATING

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This invention relates in general to the electro-deposition of zinc, and more particularly to the electro-deposition of zinc in a bright or lustrous form from alkali cyanide baths.

An important object of my invention is the obtaining of a firmly coherent protective electro-deposit of metallic zinc, on iron and other conductive surfaces, in a bright or lustrous form.

The invention is applicable quite generally to alkali cyanide zinc solutions, but will be described for the purpose of clear illustration in connection with the use of an aqueous solution made up of zinc cyanide, sodium cyanide and caustic soda. In order to confer upon alkali cyanide zinc solutions the property of producing a firmly coherent protective and bright or lustrous zinc deposit, I employ as an addition agent one or more ketones which are soluble in or miscible with the solution and not susceptible to unfavorable reaction with any of its components under the conditions of use. Typical examples of ketones which I have found effective for the purpose stated are acetone, methyl ethyl ketone, diethyl ketone, quinone and furoin. For the purposes of the present invention, ethyl aceto acetate is to be understood as included within the term "ketone", since it appears to act in an analogous or equivalent capacity as a brightening agent for cyanide zinc plating. With respect to the furoin mentioned, it is noted that this material is miscible with the bath in the sense that it may be maintained suspended by stirring or agitation, and in such operations, as for example barrel plating, it does not require any objectionable special manipulation to maintain it so distributed or suspended throughout the bath that it can perform its function as a brightening agent. While the various ketones and allied products have been named as the brightening agents, I wish it to be definitely understood that they do not all have the property of conferring upon the zinc deposit the luster or brightness when immediately introduced into the solution, but most of them acquire this property after a relatively short ageing period varying from several hours to several days. The acquirement of this property may be hastened by operating the bath electrolytically or by previously conditioning the ketone by treatment with a condensation catalyst such as sulphuric acid, hydrochloric acid, caustic soda, caustic potash, lime, sodium cyanide, and the like. The conditioning of any electrolytically conductive mixture or solution of the ketone and the catalyst may be considerably accelerated by passing a current through it. While I am unable to state just what chemical change occurs in the ketone by the conditioning treatment or the ageing in the bath, I am nevertheless able to definitely state the operations necessary to the attainment of the desired brightening function, and wish it to be understood that the definition of the agents as ketones must accordingly include whatever materials result from such conditioning or ageing treatment.

To clearly illustrate the preparation of the bath, I shall refer to one specific example thereof which will give satisfactory results. Such bath may be made up of a water solution containing the following ingredients:—

Zinc cyanide	oz. per gallon	8
Sodium cyanide	do	4
Caustic soda	do	11
Methyl ethyl ketone (conditioned)	cc. per liter	10
or		
Methyl ethyl ketone (not conditioned)	do	25

Two to three times the above quantity of brightener, say 30 cc. per liter of the conditioned ketone or 75 cc. per liter of the non-conditioned ketone, may be employed without unfavorable effect upon the deposit, and less than the amount stated, say about as low as one-half such amount, may be employed with correspondingly varying degree of brightening action, but the amount stated represents what appears to be an optimum quantity considering the factors of practical effect and economy.

In the conditioning of the ketone prior to its introduction into the bath, it may be treated, for example, with 2 to 5% concentrated sulphuric acid and allowed to stand for 24 hours, or electrolyzed for 2 or 3 hours, and thereafter the mixture added directly to the bath without separation or neutralization, as I find this quantity of acid may be safely added to an alkaline bath of the type specified. If desired, however, the sulphuric acid may be neutralized with an excess of caustic soda, before introducing the brightener into the plating bath. In the case of ageing the ketone in the bath instead of previously conditioning it by a catalyst, the quantity is preferably greater, as specified in the above formula. Such a quantity will develop satisfactory brightening qualities on standing idle for several days or by operating the bath for several hours.

The bath may be used for the deposition of zinc at temperatures varying, for example, from

room temperature to 130° F., and at current densities varying, for example, from 10 to 50 amperes per square foot. These limits of temperature and current densities are not actual limits, but merely represent operating conditions which are well within the range of satisfactory performance. Soluble anodes are preferable but not essential. The soluble anodes may be straight zinc, zinc aluminum, zinc mercury, or zinc aluminum mercury, but the performance of the brightening function does not depend upon the selection of the particular type of anode employed.

Slight traces of nickel cyanide or cobalt cyanide or nickel sulphate or cobalt sulphate, or a mixture of any of these, may be employed with the ketone addition agent. Such nickel and cobalt salts may be employed, for example, in about the proportions of ⅛ oz. per gallon, and in some cases enhance the brightness obtaining with the ketone.

The plated articles, upon removal from the bath, may with advantage be subjected to a bright dip composed of, for example, .5% nitric acid and water. In employing this dip, the articles, upon removal from the bath, are first rinsed, then dipped in the bright dip for a few seconds, then again rinsed, and finally dried.

In general, it is noted that the brighteners herein referred to appear to work better if the free cyanide content of the bath is not too high. So far as observed, the anode or cathode efficiency is not substantially affected by the presence of the brightener or addition agent, and the permissible current density is higher than in ordinary cyanide zinc plating. Furthermore, the deposition of the zinc may be continued for prolonged periods far beyond those necessary to the attainment of a protective thickness of deposit, without sacrificing the quality or appearance. In fact, it has been observed that the brightness increases with the thickness of deposit.

One or more of the addition agents described may be employed in the bath, the total quantity thereof corresponding in general with the amount of the addition agent already recited. Furthermore, admixtures of other addition agents for brightening or improving the color of the deposit may be employed with one or more of the ketones.

I claim:—

1. An alkali cyanide zinc plating bath comprising as an addition agent one or more ketones selected from the group consisting of acetone, methyl ethyl ketone, diethyl ketone, quinone, furoin, and ethyl aceto acetate.

2. An alkali cyanide zinc plating bath comprising as an addition agent from 5 to 75 cc. per liter of methyl ethyl ketone.

3. An alkali cyanide zinc plating bath comprising as an addition agent from 5 to 75 cc. per liter ketone selected from the group consisting of acetone, methyl ethyl ketone, diethyl ketone, quinone, furoin, and ethyl aceto acetate.

4. An alkali cyanide zinc plating bath comprising as an addition agent from 5 to 30 cc. per liter of methyl ethyl ketone preconditioned by from 2 to 5% concentrated sulphuric acid and neutralized with an excess of alkali.

5. An alkali cyanide zinc plating bath comprising as an addition agent material obtainable by treating one or more ketones with a condensation catalyst selected from the group consisting of sulphuric acid and hydrochloric acid.

6. An alkali cyanide zinc plating bath comprising as an addition agent from 5 to 30 cc. per liter of material obtainable by treating methyl ethyl ketone with a condensation catalyst selected from the group consisting of sulphuric acid and hydrochloric acid.

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