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COATING PROCESS AND COATED ARTICLE

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12 Claims. (Cl. 91—68)

This invention relates to coating and coating processes, and more particularly to the coating of metallic surfaces and the like.

It has been found in the coating of surfaces, particularly metallic surfaces and the like, with enamel or lacquer that the coating adheres very poorly to the article if applied directly thereto. Coatings of this nature are often found to peel off in large sheets leaving the bare under-surface of the article exposed. Tests of such coatings in the salt spray have shown that an enamel coating, when applied directly to the article, soon becomes defective and peels, sometimes within a period of four days.

This invention comprises a process of treating the metal article prior to the application of coating thereto in such a manner as to insure a more tenacious retention of the coating on the article and to make the coating closely and tightly adherent, thereby greatly prolonging its useful life. Not only does the invention provide for obtaining a closely adhering coating on the article but also provides a very effective rust resisting surface such that rusting of the article, when exposed as a result of the coating being chipped off for example, is greatly retarded and entirely restricted to the exposed portion, showing no tendency to progress under the adjacent coated surface.

It is one of the principal objects of the invention therefore to provide in the coating of a metallic or like surface, with enamel or lacquer, a highly effective but inexpensively applied surfacing which is adapted for causing tenacious and satisfactory adherence of the enamel or lacquer to the article.

It is also an object to provide such a surfacing which is highly rust resisting, and which prevents progressive rusting under the enamel coating.

It is a further object to provide such a tenacity imparting surfacing to a metallic or like surface, comprising a finely divided electrolytic deposit of spongy material.

It is a further object to provide such a tenacity imparting surfacing comprising a finely divided metal-like material of electrolytic deposition characteristics.

In order to accomplish these objects, the invention includes the application to the article of an intermediate layer of a surfacing material having the desired tenacity imparting, and the desired rust resisting, characteristics. This material is applied through the use of a metal which is capable of producing a thin, spongy, metal-like layer, zinc being preferably used on account of its commercial availability at low cost.

As is well known, zinc has been applied heretofore to metal surfaces for the purpose of protecting the article against rust. The object in these cases has been to obtain a solid, firm, tightly adhering coating of zinc. Contrary to this teaching, and in accordance with the present invention, it has been found that entirely new and very desirable results are obtained if, in the zinc coating, a coating is formed which may be even so soft, spongy, and loosely-adherent that coating material can be easily rubbed off with the hand; in which event some of the coating seems nevertheless to remain upon the metal surface as especially effective to prevent subsequent rusting of the exposed portion. Strangely enough, and contrary to previous teaching and belief that such an under-coating should itself be hard and firmly attached, it has been found that this present type of coating is of such character that it has the effect that a more tenacious bond between the article and the outer coating is produced which gives greatly superior results. With this latter type of soft, spongy coating, metal articles have been surface-coated with enamel or lacquer and have shown greatly superior resistance to rust and deterioration. In one instance enameled samples treated in this manner were placed in the usual salt spray and survived for an extraordinary period without apparent deterioration,—upon examination after a period prolonged for 58 days the coating showing no tendency toward peeling off and being practically intact. On samples from which portions of the enamel had been purposely removed, rusting appeared only after a comparatively very long exposure in the salt spray,—in one instance a period of from 16 to 20 hours. Furthermore, even after the long period of 58 days mentioned above, the samples showed no tendency toward progressive rusting, and the enamel adjacent the exposed and rusted portion was in good condition.

In order to produce the desired type of undercoating on the article, the zinc is deposited on the metal article by an electroplating process. After the article is cleaned in the customary manner, either by an electrolytic anodical treatment or by acid etching solutions, it is made the cathode in an electrolytic bath including a zinc salt, and current is passed therethrough preferably from an anode comprising zinc metal. Within a short time, varying with the current density used, the desired spongy zinc coating will be formed

at the cathode and the article may be removed, washed, air or oven dried, and subjected to the enameling or lacquering process, the enamel etc. being applied by spraying or dipping in the customary manner.

It has been found that the character of the deposited surfacing layer may be improved by suitable "addition agents". Several forms of addition agents which have been used with good results are glycerin, molasses, glue, chestnut extract, and the waste cooking liquor resulting from the semi-chemical cooking process for pulping wood. These materials may be added in small amounts according to the usual practice, but their presence is not necessary and successful results can be obtained without the use of an addition agent. It will also be understood that materials may be added to increase the conductivity and the throwing power of the bath such as sodium chloride and ammonium chloride, respectively, when desired for any particular plating operation.

The following are specific examples of the process as carried out, each of which produced satisfactory results:

1. 266 g. of zinc sulfate were dissolved in one gallon of water. A zinc anode was used, the current density was 30 amperes per square foot, and time of plating was one minute.

2. 160 g. of zinc sulfate were dissolved in 2 liters of water. 300 cc. of glue solution containing 50 g. of solid flake glue were added as the addition agent.

The current density was approximately 3 amperes per square foot, and time of plating approximately 10 minutes.

3. To 800 g. of zinc sulfate first dissolved in 14 liters of water, 200 g. of sodium chloride were added to increase the conductivity of the solution. An addition agent of 47 g. of molasses was added. The current density and the time of plating for different articles were so regulated that the product of current and time was substantially constant at a value of 30 ampere minutes, this value giving the best results. It was found that good results could be obtained by varying the time between two and five minutes and proportionally varying the current density between fifteen and six amperes per square foot.

4. The addition agent comprising waste digestion liquor from the semi-chemical pulping process was diluted to contain 13% solids. Six pounds, four ounces of this diluted material were used and because slightly basic, 60 cc. of 10% sulfuric acid were added to make the solution slightly acid before the addition of the zinc salt which may be precipitated out of a basic solution. 200 g. of zinc sulfate were then added and the pH value was then adjusted to approximately 6 by the addition of 16.4 g. of 50% sodium hydroxide. It was found that good results were obtained with a pH value between 5.5 and 6.5. A pH value of 6.9 represented substantially the upper limit within which consistently good results were obtained but it was found that the value could be reduced below 5.5 without impairing the results. Ammonium chloride up to 400 g. was added to improve the throwing power.

From the above it is seen that, the constituents and other conditions of the electroplating process may vary over rather wide limits in the production of the desired type of coating and good results have been obtained with spongy coatings produced in different baths having substantially large variations in concentration of the metallic ion and of current densities. In general however it has been found that the quantity of zinc salt is materially less than that customarily used to form the hard, white zinc coating. For example satisfactory results have been consistently obtained with as little as one-third of the usual quantity of zinc salt.

Also, the time of plating varies inversely with the current density and the speed of the operation may be increased so that only a short time interval, of the order of one minute, is required for the deposition of the layer of zinc. This short period of time is important in commercial operations and represents one of the valuable features of the invention.

In all cases the outer non-metallic coating, of enamel or lacquer, is applied directly to the zinc coating, successive coatings being baked or dried in the customary manner. It was consistently found that coatings made in this manner adhered very tightly to the article and showed no tendency to peel off or rust even after long exposure in the salt spray. The process is exceedingly simple and inexpensive, each coating operation requiring only a short time and involving the use only of inexpensive materials.

While the method and product herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise method and product, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. The method of providing an enameled coating or the like upon an article which comprises forming a spongy coating of zinc on the article and applying the coating of enamel or the like directly thereon.

2. The method of providing a superior coating upon an article which comprises forming a thin, spongy, loosely-adhering coating of zinc on the article and applying a non-metallic coating thereover.

3. The method of providing a superior rust-resisting coating on a metal surface which comprises electroplating a layer of spongy, loosely-adhering zinc on the article and applying a non-metallic coating thereover.

4. The method of providing a superior coating on an article which comprises plating a layer of zinc on the article from an electrolytic bath in such a manner as to form a substantially uniform spongy deposit, and applying a coating of non-metallic material over the layer of zinc, whereby the non-metallic material is caused to adhere very tightly to the article.

5. A coated article comprising a base material having a spongy deposit of zinc thereon, and an overlying coating of a non-metallic substance such as enamel.

6. As a new article of manufacture, a base material having an overlying coating of enamel thereon and effectively bonded thereto through the action of an intermediate thin, spongy layer of zinc.

7. A metallic article having a layer of spongy zinc thereon and an overlying coating of enamel or the like, the layer of zinc being such that it is highly rust resisting upon exposure.

8. A metallic article having a layer of spongy zinc thereon and an overlying coating of enamel or the like, the layer of zinc having the characteristics of being highly rust resisting upon expo-

sure, and of preventing progressive rusting beyond the area exposed.

9. The method of preparing an article for the reception of an overlying coating of enamel which includes the step electroplating of a spongy layer of zinc from a bath in which the concentration of the zinc salt is substantially less than that used in the normal production of the hard, white coatings of zinc, said spongy layer of zinc forming a tenacity-imparting, rust-resisting intermediate layer for the overlying coating of enamel.

10. The method of coating an article with a tighly adhering rust-resisting layer of enamel or the like which comprises electroplating a spongy metal-like layer of zinc on the article from a bath containing substantially less zinc salt than that used in the normal production of hard, white coatings of zinc, and thereafter applying the enamel or the like over the layer of zinc.

11. The method of coating an article with a tightly adhering, rust-resisting layer of enamel or the like which comprises electroplating a spongy metal-like layer of zinc on the article from a bath in which the concentration of the zinc salt is of the order of one third that used in the normal production of hard, white coatings of zinc, and thereafter applying the enamel over the layer of zinc.

12. The method of coating an article with a tightly adhering rust-resisting layer of enamel or the like which comprises electroplating a spongy metal-like layer of zinc on the article from a bath in which the concentration of the zinc salt is of the order of 5% to 7% of the total weight of the bath, and thereafter applying enamel or the like over the layer of zinc.

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CERTIFICATE OF CORRECTION.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 5, claim 9, for the words "electroplating of" read of electroplating; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of December, A. D. 1936.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.