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COATING METAL

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10 Claims. (Cl. 148—7)

This invention relates to coating metal; and it comprises producing a bright colored surface on a metal article by making such article a cathode in an electroplating bath containing iron or a like metal, removing it upon formation of a thin film of metal showing interference colors and prior to the formation of a substantial coating of metal, washing, drying and heating to produce an oxid film displaying interference colors; all as more fully hereinafter set forth and as claimed.

Plating metal with nickel, cobalt or iron is a well known and well understood art. Nickel plating is the most extensively practiced, but cobalt plating and iron plating are in use. The article to be plated is carefully cleaned and made a cathode and the flow of current continued until a layer of metal of substantial thickness is formed.

"Interference colors" are those appearing with thin films where the film has a thickness of a few multiples of the wave length of light. Bright colors appear; these not, however, being due to any inherent color or pigmentary value of the film material; its inherent color, as a matter of fact, being more or less immaterial. These interference colors appear in a succession according to the increasing thickness of the film; the order being yellow, orange, red, purple, blue, blue-green, silver, yellow, gold, peach, rose, violet, green and green-yellow. As the film increases in thickness, a new progression of colors may appear in the same order; the colors developing with integral multiples of the original thickness.

It has been discovered that these bright interference colors can be produced on metal articles, forming a colored protective film coating of any desired hue, by the process of the present invention. An ordinary iron plating process is interrupted prior to the appearance of a substantial layer of metal, but when interference colors develop, these are, at this time, not very bright and are more or less fugitive on long exposure to air. The article is removed and the film is subjected to controlled oxidation to convert the deposited metal into oxid and brighter permanent colors of the same tint result. The wet coated article removed from the electrolytic bath is simply washed, dried and baked under controlled conditions. Similar results may be attained with alkaline baths containing cobalt, nickel, molybdenum, chromium or manganese, but iron will be mainly referred to hereinafter. The oxids of iron are deep colored bodies in mass; but in the very thin films contemplated in the present invention, films having a thickness of few multiples of wave lengths of light, their inherent color is immaterial; they display bright interference colors of hues depending on thickness alone.

In embodiments of the present invention, an article to be decorated is made a cathode in an alkaline solution containing iron. It is found advantageous to use special baths in which iron is kept in solution in aqueous alkali by the use of an organic body. An organic acid, such as tartaric or citric acid, is satisfactory. Satisfactory baths may be made by dissolving ferric chlorid in an alkaline solution of a tartrate. A solution of sodium tartrate, made alkaline with caustic soda and treated with a little ferric chlorid, makes a satisfactory bath. Instead of caustic soda, caustic potash is sometimes used. Ammonia gives satisfactory results.

In practicing the present invention with such a bath, an article to be decorated is cleaned and polished in the ordinary manner to obtain a true metallic surface free of grease, dirt and oxide and is then made a cathode in the solution opposite an anode, using current from any suitable source. An iron anode is satisfactory, though insoluble anodes can also be used. Iron is not much attacked as an anode in a caustic soda solution and replenishment of the bath is by addition of ferric compounds. Advantageously the lowest current density is used which will give satisfactory plating. Prior to the appearance of a substantial visible coating of metal, subvisible films are produced and these progressively change somewhat in appearance. The characteristic colors later developed are not now particularly bright, but there is sufficient change in the appearance of the article to guide the operator. When current is passed long enough to give a surface change that will later result in a blue color or a rose color, as the case may be, the article is removed, washed, dried and heated in an oxidizing atmosphere until the bright color wanted appears and becomes fixed. A temperature as high as 1200° F. is sometimes used. The article may be then simply cooled. The colors are permanent, withstanding action of air and of solvents; including weak fruit acids. It does not usually require varnishing or lacquering. Sometimes, however, the article after cooling is spray coated to give it a thin coating of colorless, transparent varnish or lacquer.

If desired, polychrome effects can be obtained by blocking out portions of the article with an insulating material, such as paraffin or beeswax, at various stages in the process. However decorative polychrome effects may also be achieved by simple manipulation of the article in the bath so as to obtain thicker coatings on some portions

of the contour than on others. Bright polychrome effects result in the subsequent baking.

In one specific embodiment of the present invention, a polychrome effect was secured; a white metal cigarette case being given a green tint with a monogram in pink. In so doing, the cigarette case was polished, cleaned and treated in the usual ways; those used in preparing metal for plating. A bath was made up by mixing 1 volume of a sodium tartrate solution, this containing 3.6 pounds of sodium tartrate per gallon, with one volume of a solution containing 4.2 pounds ferric chlorid per gallon. To this mixture was added one volume of a solution of caustic soda containing 3 pounds of NaOH per gallon. A precipitate formed at first but it redissolved with the addition of the caustic soda. The resulting clear solution with addition of water formed the plating bath. The cigarette case was made a cathode in this bath and flow of current continued until the whole surface assumed an appearance corresponding to the pink color to form the monogram later. At this time, the case was removed and the monogram "stopped-off" with wax. Flow of current was then resumed until the rest of the surface took on the appearance resulting later (after baking) in a green hue. The first coating, prior to stopping-off, required 1 minute with a voltage of .6–.7 volts and a cathode current density of 1.0–1.2 amperes per square decimeter. The second operation, at the same voltage and current density, required 1.5 minutes. An iron anode was used.

The treated cigarette case was finally removed from the bath, washed, dried and heated in a muffle with free access of air until the desired colors appeared. The final result was a green cigarette case carrying a pink monogram. In this particular instance, after the baking was completed, the cigarette case was removed, cooled and spray coated with a thin, colorless, transparent celluloid varnish.

In the bath, the successive colors appearing are dull but characteristic; there is enough change in the appearance of the cathode article to guide and serve the workman. The bright colors are developed in the subsequent heating.

What I claim is:—

1. In the decoration of metal articles the process which comprises making such an article a cathode in an alkaline solution containing a readily oxidizable metal, passing current for a time, interrupting the operation upon formation of a metal film thin enough to show subdued interference colors and prior to the development of a metal coating of substantial thickness, removing the article, washing, drying and oxidizing to develop a bright colored oxid film as a protective coating.

2. The process of claim 1 wherein the oxidizable metal is iron.

3. The process of claim 1 wherein the oxidizable metal is iron kept in solution in the alkaline liquid by the presence of organic matter.

4. The process of claim 1 wherein the oxidizable metal is cobalt.

5. The process of claim 1 wherein the oxidizable metal is nickel.

6. In the production of bright colored thin films on metal articles the process which comprises making such an article a cathode in an alkaline solution containing iron, transmitting current until the surface is provided with a film of metal sufficiently thin to show subdued interference colors and displays a succession of series of interference color changes, interrupting when a particular color occurs, removing, washing, drying and heating in an oxidizing atmosphere to develop the color wanted.

7. In the production of bright colored thin films on metal articles the process which comprises making such an article a cathode in an alkaline solution containing iron, transmitting current until the surface is provided with a film of metal sufficiently thin to show subdued interference colors and displays a succession of series of interference color changes, interrupting at a time when a color develops which has previously appeared in a prior series, removing, washing, drying and heating in an oxidizing atmosphere to develop the color wanted.

8. In the production of metal articles decorated in polychrome the process which comprises making such an article a cathode in an alkaline solution containing an oxidizable metal, passing current until a thin film is formed showing interference colors, interrupting passage of current with the appearance of a particular hue, removing the article, washing, drying, applying a design with stop-off varnish, returning the article to the bath, resuming passage of current until another particular color appears, removing the article, washing, drying and baking to develop two contrasting colors.

9. In the process of claim 8 utilizing a bath containing iron as the readily oxidizable metal.

10. In the electrolytic decoration of metal articles, the process which comprises making such an article a cathode in an alkaline solution containing a readily oxidizable metal, passing current at such potential and for such length of time that there is produced a very thin metal film showing subdued interference colors, interrupting the operation, removing the article and oxidizing the metal film to produce a uniform, colored, protective oxidic film.

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