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COATED METAL OBJECTS

Hiram S. Lukens, Philadelphia, Pa., assignor to the United States of America as represented by the Secretary of War

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7 Claims. (Cl. 29—195)

This application is a division of my copending application Serial No. 758,467, filed July 1, 1947, for "Metal Coating," now Patent No. 2,583,581.

This invention relates to metal coating, and more particularly to the application of an extremely thin metal coating to a base which completely seals the base against the outside.

It is well known in the art to protect a base from the outside by applying thereto a thin coat of a non-oxidizable or slowly oxidizable metal. An outstanding example of this is the application of a silver coat to an iron or steel base. By electrodeposition, thin non-porous coats of a thickness of the order of .0015 inch may be formed. However, if the coat is still thinner, it fails to protect the base because of the existence of pores in a coat below such thickness.

I have discovered a method for sealing the pores of an extremely thin metal coat, which makes possible the employment of a coat having only one-third to one-half the thickness of what has heretofore been considered the minimum thickness for complete protection of the base. This method essentially consists in applying an extremely thin, though porous, metal coat to the base, and polarizing the coated object in a suitable electrolyte solution to form on the surface of a porous metal coating a film of a compound of such properties that it can be subsequently fused, thereby sealing the pores in the porous metal coating.

Consequently, one of the principal objects of my invention is the formation of a metal coat of extreme thinness, whose pores are sealed by a compound of the coating metal.

A further object of my invention is the electrochemical formation of a fusible salt on the surface of an extremely thin metal coat, with subsequent fusion to seal the pores of the coat.

Another object of my invention is a saving in the cost of noble metals used for coating a base material.

A further object of my invention is the provision of an extremely thin non-porous coat on a base, which coat consists of a metal and of a water-insoluble salt of such metal, the color of the salt resembling the color of the metal so as to give the appearance of a homogeneous film.

Further objects and advantages of my invention will appear as the description of my process, the product produced thereby, and of several preferred examples proceeds.

In accordance with my invention, the base is first coated with a thin coat of the coating metal, preferably but not necessarily by electrodeposition. The coat is intentionally of such thinness that it is not free from pores. Thus, in the case of an electrodeposited silver coat, the coat may be kept below a thickness of .0015 inch, which latter thickness is commonly considered to be the lower limit for a non-porous electrodeposited silver coat. I then immerse the coated article in an electrolytic bath and connect it as the anode. The electrolytic bath is a solution of an ionizable compound whose negative ions or radicals are capable of combining with the coating metal at the anode to form a water-insoluble fusible salt. Thus, in the case of a silver-coated article, a suitable electrolytic bath is a water solution of hydrochloric acid or of sodium chloride which, upon passage of the current through the system, results in the formation of silver chloride on the silver coat. By selecting a solution of another

salide such as sodium bromide or sodium iodide, the corresponding halogen salt may be formed by combination with the silver coat at the anode; inasmuch as silver chloride, silver iodide, and silver bromide are water-insoluble and fusible, they are suitable for the purpose of my invention. On the other hand, silver fluoride is water-soluble, and consequently a fluoride solution is unsuitable for use as an electrolytic bath for the purpose of my invention.

After a brief passage of the current through the system, the coated article, which forms the anode, is withdrawn after part of the metal has been converted into the corresponding salt. The coated article is then subjected to a temperature above the melting point of the salt where the melting point of the salt is below that of the metal, or to a temperature above the melting point of the metal where the melting point of the salt is above the melting point of the metal. In the former case, i. e., where the melting point of the salt is below the melting point of the metal, the elevated temperature is kept below the melting point of the metal itself; this exposure causes the salt to melt and to flow into the pores of the thin metal coat. In the latter case, i. e., where the melting point of the salt is above that of the metal, the metal itself when heated above its melting point will evenly fill out the interstices between the electrochemically formed salt deposit.

After cooling, a non-porous coat is found to have formed on the base. It may be buffed or burnished to give it a metallic appearance.

Among numerous uses for my invention may be mentioned, for instance, the electroplating of "silverware."

The following specific examples illustrate various ways in which my invention may be practiced, but are not to be deemed to constitute an exclusive enumeration of the materials or methods suitable for the purposes of my invention.

Example I

A porous silver coat of a thickness of the order of .0005 to .00075 inch is electrodeposited upon steel. The coated object is immersed into an electrolytic bath consisting of a water solution of 50 cc. of concentrated hydrochloric acid in 450 cc. of water (or in a 10% sodium chloride solution in water). The coated object is polarized as the anode, and a current of .4 amp./sq. dcm. is permitted to flow through the system for 10 minutes at room temperature. The coated object is then removed, and a very thin film of silver chloride will be found to have formed on the silver coat. The coated object is washed, dried, and heated to a temperature of 455° C. (the melting point of silver chloride) or somewhat above, but below the melting point of silver (960.5° C.). The silver chloride becomes limpid and flows into the pores of the silver coat. The object is then removed from the source of heat and permitted to cool. Upon cooling, a non-porous, very thin film of silver and silver chloride of a metallic or white color, depending on the thickness of the fused silver chloride, has been formed upon the base. Any excess silver chloride is removed by burnishing or buffing, which gives the entire article a pleasing, silver-like metallic appearance.

Example II

A steel base is electro-coated with silver, as in Example I, and immersed in an electrolytic bath consisting of a 15% solution of sodium bromide in water. The same process is followed as in Example I. Sodium bromide forms on the silver coat. Upon heat fusion of the silver bromide at a temperature of or somewhat above 434° C. (the melting point of silver bromide), a yellowish film is formed due to the yellow color of the silver bromide. A metallic luster can be obtained by buffing or burnishing.

Example III

Example II is carried out by using a 20% solution of sodium iodide as the electrolytic bath. After removal from the bath, the silver- and silver iodide-cov-

ered object is heated to about 552° C., at which temperature the silver iodide fuses. The object is removed from the source of heat before any appreciable amount of the fused silver iodide has decomposed. Appearance and after-treatment of the object are the same as in Example II.

Obviously, other metals and salts may be used to carry out my invention in accordance with the principle set forth in this specification. It is necessary that the salt formed on the coat be water-insoluble, to prevent deterioration of the coat by leaching. The composition and concentration of the electrolytic bath may be varied to suit specific requirements of each individual case. My invention is thus not restricted to any specific materials or quantities, or duration and density of the current flow during the electrochemical treatment as set forth in the foregoing examples, but encompasses all such variations of my inventive thought as will readily occur to the expert. I thus intend to claim my invention broadly, and to be limited only by the appended claims.

I claim:

1. A metallic coated article comprising a base having a higher melting point than silver, a thin porous silver coat on said base, said silver coat being of a thinness of less than about .0015 inch, and a water-insoluble fused silver salt having a lower melting point than said metallic base, said silver salt being on the exterior of said silver coat and being retained in and closing the pores of said silver coat.

2. A metallic coated article comprising a base having a higher melting point than silver, a thin porous silver coat on said base, said silver coat being of a thinness of less than about .0015 inch, and a water-insoluble fused silver salt having a lower melting point than said metallic base and resembling the color of silver, said silver salt being on the exterior of said silver coat and being retained in and closing the pores of said silver coat.

3. A metallic coated article comprising a base having a higher melting point than silver, and a continuous non-porous silver and water-insoluble fused silver halide coat of a thickness of less than .0015 inch on said base, said silver having pores, and said fused silver halide being on the exterior of said silver coat and being retained in and closing the pores of said silver coat.

4. A metallic coated article comprising a base having a higher melting point than silver, and a continuous non-porous silver and water-insoluble fused silver halide coat of a thickness of the order of about .0005 to .00075 inch on said base, said silver having pores, and said fused silver halide being on the exterior of said silver coat and being retained in and closing the pores of said silver coat.

5. A metallic coated article comprising a base having a higher melting point than silver, a thin porous silver coat on said base, said silver coat being of a thinness of less than about .0015 inch, and fused silver chloride on the exterior of said silver coat and being retained in and closing the pores of said silver coat.

6. A coated article comprising a ferrous base, and a continuous non-porous silver and water-insoluble fused silver halide coat of a thinness of less than .0015 inch on said ferrous base, said silver having pores, and said fused silver halide being on the exterior of said silver coat and being retained in and closing the pores of said silver coat.

7. A metallic coated article according to claim 1, wherein said base is ferrous.

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