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ELECTROCLEANING.

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This invention relates to methods of electro-cleaning metals and to electrolytes used in such methods.

An object of the invention is to improve anodic methods of electro-cleaning metallic surfaces.

A related object is to provide an electrolyte which is particularly well adapted to the anodic electro-cleaning of ferrous metals preparatory to nickel plating.

The invention is particularly applicable to the electro-cleaning of ferrous metals preparatory to nickel plating although it is not limited to this class of metals and type of plating alone.

It is commonly known that metallic surfaces which have been electro-plated, particularly ferous surfaces coated with a nickel plating, often become corroded at points beneath the coating and that the electro-plated coating itself often becomes fractured. One cause of such corrosion has been found to be the presence of pin-holes and other imperfections in the electro-plated coating. As one cause of the presence of pin-holes may be the chemical and physical discontinuities of the metallic surface being plated, this invention provides a simple and effective means of preventing the harmful effects of corrosion as above described by suitably treating the metallic surfaces before electro-plating, to prevent the occurrence of such pin-holes.

In accordance with a feature of the invention, there is provided an electrolyte composed of concentrated ortho-phosphoric acid, H_3PO_4, which may be satisfactorily employed at temperatures ranging from 50 to 100° C., as an electrolyte in the anodic electro-cleaning of metallic surfaces.

Any of the ordinary types of direct current electrolytic cells comprising, for example, an insulated casing, a cover for said casing and electrodes suspended from said cover and attached to terminals in the cover, may be employed with the invention. The metal to be treated forms the anode in the cell and as cathodes, any suitable inert material, such as carbon, chromium or duriron, have been found satisfactory.

In the subjection of a metal as an anode in an electrolyte to the action of electrical current, the treatment consists substantially of a combination of the loosening of foreign matter by the evolution of gas at the anode and of the solution of some metal from the surface of the anode. This solution of metal has been found to produce an etched surface and it has been found that the characteristics of this etch are substantially affected by the temperature and concentration of the electrolyte employed.

It has been found that electrolytes composed of phosphoric acid, when employed in an anodic electro-cleaning process, produce an etched surface having the characteristics desired for electro-plating and when the electrolyte temperature and concentration are properly regulated, a brightly polished, unformly etched surface is produced.

The concentrations and temperatures of the electrolyte which may be employed may be considerably varied, changes in such proportions, of course, varying the depth and uniformity of the etched surface produced. It has been found that as a general rule the higher the concentration of the electrolyte employed, the higher should be the temperature which is desirable for the production of a substantially uniform smooth etch and therefore of a surface which may be electro-plated without appreciable occurrence of pin-holes; and furthermore, that higher concentrations with comparatively higher temperature produce the more satisfactorily etched surfaces. Electrolytes comprising 70% to 100% of phosphoric acid and having a temperature varying in accordance with the above general rule from 50 to 100° C. have been found preferable. It will be appreciated, however, that it is not intended to impose any restrictions upon the composition and temperature of the particular electrolyte employed other than those set forth in the claim.

It has been found that the production of a smooth, polished and uniformly etched surface depends primarily upon an electro-chemical cleaning action rather than a direct chemical attack or solution. Where a surface of this type is desired low concentrations of electrolytes should not be used since they have been found to cause a direct chemical attack rather than an electro-chemical action and thereby produce uniform but more deeply etched surfaces. The term "electro-chemical action," as employed herein, is intended to define a combination of

an anodic solution and an evolution of gas at the anode.

The value of the current density employed with the electrolytes of this invention has been found to substantially affect only the rate at which the etched surface may be obtained. A current density of 100 amperes per square foot, for example, has been found to produce the desired etch in about three minutes.

The time during which the metallic surface is subjected to the action of the electric current has been found to substantially affect only the brightness of the etch, long periods of cleaning producing brighter surfaces.

The term "concentration" as applied herein is intended to define the weight per cent of 100% phosphoric acid in the solution.

Actual practice has shown that metallic coatings electro-plated on metallic surfaces which have been treated by the process of this invention are substantially more adherent and contain fewer pin holes than coatings of the same thickness produced heretofore.

While reference has been made to the cleaning of ferrous surfaces, it is evident that the invention is not limited to this class of surface alone, but is susceptible of various modifications and adaptations within the scope of the appended claim.

What is claimed is:

The method of treating metallic surfaces which comprises immersing said surfaces in an electrolyte comprising phosphoric acid, controlling the temperature of said electrolyte so that it is as high as 50° C., controlling the concentration of said electrolyte so that it is as high as 70%, and passing an electric current from said surfaces as anodes to suitable cathodes immersed in said electrolyte.

In witness whereof, we hereunto subscribe our names this 6th day of February A. D., 1925.

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