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PROCESS FOR ANODIC REMOVAL OF SURFACE METAL FILM

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This invention relates to improvements in processes for defilming or for the removal of thin metallic films by anodic treatment in an aqueous electrolytic bath. My invention specifically pertains to the removal of such metal films as are deposited by my process as disclosed in my prior Patent No. 1,775,671. This process, for example, consists in the removal of scale, rust or other surface foreign matter by suspending the article to be cleaned as cathode in an electrolyte, generating an excess of hydrogen at the surface of the work and simultaneously depositing a continuous coating of lead or other metal on the surface of the work, the metal coating or film preventing acid pitting and hydrogen embrittlement.

According to my present invention the work with the metal film on its surface is made anode in an alkaline or acid bath. I am aware that electrolytic cleaning processes have been suggested in the past, but, aside from my above-mentioned process, the only electrolytic cleaning method which is in use today is one in which the article is made cathode in an alkaline bath for the purpose of removing superficial grease or oil. One well known objection to this method is the serious embrittlement of the steel. In my present process I use a solution in which the metal film is electrolytically soluble; as the metal of the film passes into solution, it interacts with the anions, such as phosphate, and thereby provides a new surface film which is both electrical current resisting and corrosion resisting. In this way the original film is completely removed without deleteriously affecting such as by etch the structure or quality of the underlying surface of the metal of the article.

An important step in my invention embodies the incorporation in the electrolyte of salts or acids which will form comparatively insoluble products on the surface of the metallic article as fast as the metal film is removed therefrom.

As an illustration of my invention I shall now describe the application to the removal of lead films from iron and steel articles. For this purpose I employ an alkaline solution in which iron when serving as anode is almost insoluble. To further increase the insolubility of the iron, I incorporate in the solution small quantities of phosphates, borates, silicates, or similar salts or acids the anions of which form relatively insoluble compounds. The iron or steel article from which the lead coating is to be removed is made anode in this alkaline bath containing alkali phosphates and a current of from 50 to 150 amp. per sq. ft. of anode surface is applied.

The solution can be cold but I prefer to have it at or near its boiling point since the process works faster at elevated temperatures. The thin film of phosphate produced protects the underlying iron and steel from further anodic action due partially to the high electrical resistance of these films diverting the current to such points or areas where the lead film has not yet been removed. If, in place of a lead or a zinc film, a tin film is to be removed, I prefer to substitute sodium carbonate for the sodium hydrate in the above bath. In place of an alkaline phosphate in the solution I can use borates, silicates, arsenates, antimonates.

As a second illustration I cite the removal of copper films from iron or steel surfaces. Although I may employ an acid solution such as sulfuric acid solution containing phosphoric or boric acid, I prefer to employ an ammoniacal solution containing a soluble phosphate and ammonium carbonate. Here, again, the work is made anode and, as soon as the copper is removed and the bare iron or steel exposed underneath, a protective film of phosphate is formed as in the first illustration.

The above ammoniacal solution can be used likewise for silver. In the case of nickel I prefer to add a small quantity of a soluble chloride to the ammoniacal solution.

In general, then, I select my solution in such a way that the metal of the film will form compounds, in which the metal or metals of the article proper will be insoluble.

In my process the two reactions are of a purely anodic, electrolytic character, the metal of the film passing into solution, and the exposed metal underneath the film being si-

multaneously protected by a dense, though thin, film having a relatively high electrical resistance, besides the valuable corrosion-resistant property.

Having thus described my invention I claim:

1. A process for the removal of metallic surface film which is characterized by the subjection of the work to two simultaneous reactions namely, the anodic dissolution of the metal composing the film and the simultaneous reaction of part of the ions of the metal film with such anions of the electrolyte as to produce a new insoluble film protecting the metal of the work from etching or corrosion.

2. A process for the removing of lead surface films from iron and steel castings which is characterized by the subjection of the work to two simultaneous anodic electrolytic actions in an alkaline phosphate bath whereby the lead film is dissolved and simultaneous therewith lead ions formed by the dissolution of film react to produce upon the denuded article an electric current and corrosion resisting film.

3. A process for the removal of metallic surface film which is characterized by the subjection of the work to two simultaneous reactions in an alkaline electrolyte, namely, the anodic dissolution of the metal composing the film and the simultaneous reaction of part of the ions of the metal film with such anions of the electrolyte as to produce a new, insoluble film protecting the metal of the work.

4. A process for the removal of metallic surface film which is characterized by the subjection of the work to two simultaneous reactions in an alkaline solution containing anions of the group including phosphates, borates, and silicates, namely: the anodic dissolution of the metal composing the film and the simultaneous reaction of part of the ions of the metal film with such anions of the electrolyte as to produce a new insoluble film protecting the metal of the work.

Signed at Bridgeport in the county of Fairfield and State of Connecticut this 9th day of April, A. D. 1930.

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