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# UNITED STATES PATENT OFFICE

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## PROCESS FOR PROTECTING ARTICLES MADE OF LIGHT METALS

Jean Frasch, Clichy, France; vested in the Alien Property Custodian

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2 Claims. (Cl. 204—58)

Reference is made to applicant's co-pending Patent 2,196,161, granted April 2, 1940.

The present invention has for its object a process for protecting articles made of light metals such as aluminum, magnesium or alloys of same.

In certain processes used for protecting these metals, in particular aluminum, by electrolytic treatment, a protecting layer of oxide, for example of alumina, is produced on the surface of the article. But at the same time as oxide forms on the article placed at the anode, anions of the electrolytic bath are also deposited thereon in a more or less large quantity. Said anions, in general, react on the oxide and produce salts which most of the time dissolve in the bath. Thus, the anions of the bath neutralize a part of the oxidation of the article, thereby decreasing the efficiency of the electrolytic operation and the density and the uniformity of the protecting layer.

The object of the present invention is in particular to eliminate this drawback, and consists in using a bath wherein the anion not only does not have the harmful effect mentioned above, but on the contrary also contributes to decreasing the porosity of the oxide layer. In order to obtain this result, an electrolytic bath containing an aluminate is used. This bath produces an anion which forms an aluminate with the alumina or magnesia present on the article treated. Thus, in the present case, the anions of the bath contribute to reinforcing the protecting layer of the article.

In order to improve the conductivity of the bath, it is advantageous to add to the aluminate a small quantity of an alkaline base, but the quantity of base must not exceed 20% of that of the aluminate present in the bath.

It is also possible to add silicates, either to the aluminate, or to the mixture formed by the aluminate and the bases.

To prevent the polarization of the article, it is advantageous to add a depolarizer to the bath if direct current is used; it is also possible to use alternating current.

Preferably current will be used at a voltage greater than 30 volts, by example of 110 volts and of a strength which will be greater as the bath is more concentrated and more alkaline; said strength may, for example, reach 70 to 80 amperes per square decimetre of area of the article to be treated with concentrated or alkaline solutions, and fall to 1 to 4 amperes per square decimetre in dilute and slightly alkaline solutions.

The bath must have a pH which is greater than 8.5 and is less than a limiting pH. Said limiting pH is the greatest pH for which the strength of the current can fall substantially to zero as after any time.

The article which has been treated in the above indicated manner, is advantageously washed with ammoniacal water in order to precipitate the alumina $Al_2O_3$, $nH_2O$ which might remain in the remaining porosities of the layer that might exist.

This washing may be replaced, or followed, by a chemical treatment consisting in immersing the treated article in a similar solution to the one which served for the electrolytic operation and which is kept at a high temperature, for example 95° C., so as to stop up the few porosities that might remain after the first operation and thus to make the protecting layer completely insulating.

The present invention also covers any electrolytic bath for protecting light metals, in particular aluminum, or magnesium and containing aluminate.

By way of example, the process may be carried out as follows:

After scouring by sand-blasting, polishing, brushing or immersing in nitric acid ($HNO_3$) or soda (NaOH), a polished aluminum part to be treated is degreased either electrolytically or in a 5 to 10% solution of sodium carbonate ($Na_2CO_3$) or with ethylene trichloride ($Cl_3C_2H$). The part is then abundantly rinsed with ordinary water. The part is then placed as an electrode in an electrolytic tank, the bath of which contains per litre:

| | Grams |
|---|---|
| Sodium aluminate | 30 |
| Sodium silicate | 10 |
| Caustic soda | 8 |

If the article to be treated is of magnesium or magnesium alloy, the before mentioned bath can be replaced by the following:

| | Grams |
|---|---|
| Sodium aluminate | 30 |
| Caustic soda | 5 |

per 1 litre of water.

Alternating current is passed through the bath, into which compressed air is blown in order to keep its temperature at about 15° C. The current is supplied from the outset at a voltage of 110 volts and its initial strength is 15

amperes per square decimetre of area of the article to be treated. In less than two minutes, the intensity of the current decreases to about 2 amperes and after fifteen minutes no more current practically flows. The part is then withdrawn from the bath, rinsed with running water, then with ammoniacal water, and then with running water.

Although direct current, in the presence of a depolarizer, may give good results in certain cases, I prefer to use alternating current.

In order to increase its resistance to corrosion, the part while still in the damp state may be immersed in a bath which is at a temperature of 95° C. and containing per litre:

| | Grams |
|---|---|
| Sodium aluminate | 20 |
| Sodium silicate | 20 |
| Soda | 8 |

The part is withdrawn from this bath after five minutes, and dried. The part is covered with a protecting layer chiefly composed of $Al_2O_3$.

It is also possible to apply a coat of paint on the articles made of light metals which are protected by the present process. In this case, it is preferable to apply said coat of paint without affecting the second treatment by immersion in a hot solution of silicates and of aluminates.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is performed, I declare that what I claim is:

1. A process for protecting an aluminum or an aluminum alloy article against corrosion comprising immersing the article to be protected in a bath consisting of approximately 30 grams of sodium aluminate, 10 grams of sodium silicate and 8 grams of caustic soda per liter of solution having a pH between 8.5 and 12 and then passing between said article serving as an electrode in said bath and another electrode therein an electric current having an initial potential greater than 30 volts.

2. The process of claim 1 wherein the article after having been withdrawn from the said electrolytic bath is subjected to a chemical treatment by immersion in a hot bath containing 20 grams of sodium aluminate, 20 grams of sodium silicate and 8 grams of soda per liter.

JEAN FRASCH.