This invention relates to the treating of light metals, particularly magnesium and magnesium-base alloys, i.e., those wherein magnesium is the predominant constituent, the object of the invention being to provide a protective treatment for increasing the resistance of the metal surface to deterioration where subjected to exposure to the atmosphere or other more unfavorable media. The protective coating thus provided is also adapted to receive and retain a film of paint, varnish or lacquer better than the bare metal surface. Other objects and advantages will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the steps and product resulting therefrom hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain procedure embodying the invention, such details however being illustrative of but several of the various ways in which the principle of the invention may be applied.

As hereinbefore indicated, the present improved process relates particularly to the production of a protective coating on the surface of an article composed of magnesium or a magnesium base alloy, such for example as one composed of approximately 92% magnesium and 8% aluminum, with or without a small percentage of other ingredients. In proceeding in accordance with the invention the article in question is preferably first cleaned by dipping it in a solution of sulphuric acid. Following this, such article is subjected in any suitable manner to the action of an acid phosphate containing two hydrogen atoms or their equivalent in the molecule. The acid phosphate of magnesium Mg\((\text{H}_2\text{PO}_4)\)_2 and the acid phosphates of the alkali metals, e.g., sodium acid phosphate NaH\(_2\)PO\(_4\), are generally preferred, although other acid phosphates may be used. The treatment of the article can be carried out with the phosphate in cold solution but the reaction proceeds to its end more promptly and advantageously where a boiling solution is employed.

Hydrogen is initially given off at the surface of the metal when dipped in or otherwise exposed to contact with the acid phosphate solution, but this ceases after a few minutes particularly where the solution is heated; and the coating that is formed as a result of the action of the acid phosphate with the metal is then complete. Thereupon, the article is rinsed off with fresh water and dried. In some instances, it may be found desirable and convenient to subject an article to several successive treatments since imperfections in the coating initially deposited may be exposed following drying, and the further treatment in such case as evidenced by evolution of more hydrogen although to a lesser extent than in the first treatment will indicate whether the coating is complete or not.

The surface of the metal after it has been treated in the foregoing manner presents a white frosted appearance although where a heavy metal such as copper is present in the alloy, the color of the coating is somewhat darker. I have not determined the precise composition of the coating that is thus formed by the reaction of the acid phosphate, but have discovered that it is readily soluble in phosphoric acid containing three hydrogen atoms in the molecule so that the use of normal phosphoric acid for producing the coating is out of the question. Conversely the mono-hydrogen phosphate has substantially no effect on the metal i.e., does not react therewith to form a surface coating as does the di-hydrogen phosphate. The di-hydrogen phosphate of other alkali metals may, of course, be employed with just as satisfactory results as the sodium salt specifically referred to.

As indicated above either the sodium or magnesium di-hydrogen phosphate is especially practicable as treating agents, and particularly the latter which may be conveniently prepared as follows, viz., 15 parts of calcined MgO is dissolved in 85 parts of commercial (85%) phosphoric acid and water then added up to about 300 parts, this giving a solution of satisfactory strength for use in the process. After a period of such use, however, the solution becomes cloudy due to precipitation of magnesium mono-hydrogen phosphate, but it can be readily regenerated by adding fresh phosphoric acid.

A coating produced by the use of di-hydrogen phosphate in the manner hereinbefore described apparently possesses a considerable degree of permanence when the article is subjected to ordinary atmospheric conditions, even to an atmosphere which has a relatively large moisture content. The resistance of such articles to salt water or
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other corrosive solutions is also increased to a marked degree. Furthermore, and of particular importance, the coating as produced constitutes an admirable base for a

paint, varnish or lacquer in that the latter may not only be readily applied to the treated surface, but becomes firmly adherent thereto.

Other modes of applying the principle of the invention may be employed, change being made as regards the details disclosed, provided the steps or characteristics stated in any of the following claims or the equivalent of such, be employed.

I, therefore, particularly point out and distinctly claim as my invention:—

1. A process of the character described, which comprises treating a magnesium-containing surface with a di-hydrogen phosphate.

2. A process of the character described, which comprises treating a magnesium-containing surface with a solution of a di-hydrogen phosphate.

3. A process of the character described, which comprises treating a magnesium-containing surface with a solution of magnesium acid phosphate.

4. A process of the character described, which comprises treating a magnesium-containing surface with a solution of a di-hydrogen phosphate at approximately boiling temperature.

5. A process of the character described, which comprises treating a magnesium-containing surface with a solution of magnesium acid phosphate at approximately boiling temperature.

6. A magnesium or magnesium alloy article having on its surface an adherent coating formed integrally therewith by the reaction of a di-hydrogen phosphate.

7. A magnesium or magnesium alloy article having on its surface an adherent coating formed integrally therewith by the reaction of magnesium acid phosphate.

Signed by me this 8th day of January 1927.

EDWARD C. BURDICK.