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UNITED STATES PATENT OFFICE.

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PROTECTIVE COATING FOR MAGNESIUM.

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To all whom it may concern:

Be it known that I, LEWIS J. KEELER, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Protective Coatings for Magnesium, of which the following is a specification.

My invention relates to a protective coating for magnesium metal and high magnesium alloys. The coating which I produce by my process is practically transparent and microscopic in depth and presents a surface having the characteristic appearance of magnesium. This coating prevents the metal from tarnishing even under severe atmospheric conditions.

The coating is produced by immersing the metal in a solution of hydrofluoric acid. This is preferably done by making the metal to be coated the anode in an electrolytic cell, in which the electrolyte is a hydrofluoric acid solution. Although various strengths of the acid may be used, an approximately 48% acid solution has been found to be the most suitable. The metal to be coated is first cleaned by some suitable means such as by scratch brushing or by dipping in acids, preferably in dilute nitric acid. The nitric acid has the special advantage of giving the metal a very bright luster. If acid is used in cleaning, the metal must subsequently be washed well with running water. It is then ready for the coating operation. The article is then made the positive pole and serves as the anode of the electrolytic cell. The cathode of this cell may be constructed of any material which is an electrical conductor. I have found magnesium metal or carbon to be best adapted for this purpose.

At the beginning of the coating operation, the resistance of the cell is comparatively low. As the coating operation proceeds, the resistance increases rapidly and for this reason it has been found advisable to choose a potential of 110 volts or higher. A variable resistance must be placed in series with the cell in order to control the anode current density. Although I do not limit myself to any definite anode current density, a density of one ampere per 100 square inches of anode surface has been found to be very satisfactory. Due to change in voltage across the cell, as explained above, it will be evident that the current will change correspondingly unless the variable resistance is adjusted. For instance, it has been found that if the resistance is not adjusted, the current will rapidly drop from one ampere per 100 square inches of anode surface to practically zero in a period of two to five minutes after starting the current.

The coating as formed on the metal from present information is believed to be either magnesium fluoride or oxy-fluoride or possibly a mixture of the two. The coating may also be obtained by simply allowing the metal to remain in a solution of hydrofluoric acid. The action is very slow, taking several weeks to obtain a fairly good protective coating, but the characteristics of the coating seem to be the same as those obtained in the electrolytic bath. Water soluble fluoride salts, such as potassium fluoride, may also be used as an electrolyte in place of hydrofluoric acid. In fact, any composition may be used which under suitable conditions will liberate nascent fluorine in contact with the metal to be coated. Although I prefer to use direct current in the electrolytic cell, alternating current can also be used.

Having described the various phenomena which take place in my process, I will now outline the details of procedure in coating a rod of magnesium or magnesium alloy. The rod is first cleaned by dipping in dilute nitric acid for approximately one half minute. The nitric acid solution remaining on the rod is then quickly washed off in running water and the rod at once submerged in the hydrofluoric acid electrolyte of the cell. The positive terminal of a 110 volt direct current circuit is attached to the rod and the current regulated by the variable resistance to the proper density. The rod should remain in the cell for a period of two to five minutes when it will be found that in spite of adjustment of the variable resistance the current has dropped to practically zero. The rod is now removed, dried, but not necessarily washed.

I claim:

1. The process of coating magnesium and its alloys comprising bringing the metal in contact with nascent fluorine.

2. The process of coating magnesium and

its alloys comprising bringing the metal in contact with an aqueous solution containing hydrofluoric acid.

3. The process of forming a coating on an article of magnesium or its alloys, comprising employing the article as anode in the electrolysis of an aqueous solution containing a compound of fluorine.

4. The process of forming a coating on an article of magnesium or its alloys, comprising employing the article as anode in the electrolysis of an aqueous solution containing hydrofluoric acid.

5. A magnesium or magnesium alloy article having on its surface an adherent coating comprising magnesium fluoride, which is resistant to atmospheric corrosion.

In testimony whereof I affix my signature.

LEWIS J. KEELER.