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METHOD OF COLORING MAGNESIUM AND MAGNESIUM ALLOYS BY ETCHING.

No Drawing.

Application filed August 24, 1921. Serial No. 494,948.

To all whom it may concern:

Be it known that FELIX THOMAS, a citizen of the German Republic, residing at 53 Paul Ehrlichstrasse, Frankfort-on-the-Main, Germany, has invented certain new and useful Improvements in the Method of Coloring Magnesium and Magnesium Alloys by Etching (for which I have filed application in Germany Aug. 26, 1919, application No. C28,289), of which the following is a specification.

This invention relates to a method of coloring magnesium and magnesium alloys by etching.

In the following specification and claims the term coloring comprises superficially etching the metal in such a way that a small amount of the magnesium metal or magnesium alloy is dissolved out and is replaced by a firmly adherent complex deposit of a color differing from that of the metal or metal alloy and consisting of oxides and metals of the salts contained in the etching bath.

The only methods hitherto known for coloring metallic magnesium or alloys of magnesium containing small amounts of zinc or aluminium, or both these metals together, known under the name of "electron metal," by means of the so-called etching agents are those based on the deposition of another metal such as cobalt followed by baking. The self-evident attempt to apply to magnesium the methods of metal coloring which are used for coloring aluminium, has not proved very successful. Also the method which is used for aluminium, that is to first provide same with a coating of copper, silver or zinc, and then to color with the aid of the methods known for these metals has been recognized to be too roundabout.

The known etching baths used for coloring metals cannot moreover be directly applied to magnesium and its alloys, for the reason that they have a too powerful acid reaction, and thereby corrode the metal too strongly, and, at best, only a spongy deposit of the metal is effected.

Experiments have shown that with magnesium and electron metal, good and durable colorations can be attained in a very simple manner, by etching. It has been found that in the case of magnesium and its alloys chromic acid, in contradistinction to the

other acids, does not effect a continuous liberation of hydrogen, but that after a very short time, a kind of passive resistance takes place, the metal becoming covered with a brass-yellow skin. When heavy metal salts are also present, this skin adheres and becomes darker in coloration. The shade of the color is influenced by the nature of the heavy metal (copper, zinc, manganese, chromium, iron, cobalt and the like) as well as by the kind of the alloy; for example, the depth of the coloration in an alloy of magnesium with 3 to 8% zinc changes, with increasing content of zinc and the employment of copper salts, from a light brown tone to a bronze brown.

The colorations which as a rule are between brass and bronze, may also be more finely graduated, the etching bath remaining the same, by the addition of small amounts of other acids and by modifying the duration of etching.

Apart from the aforesaid variegated colorings, a deep black also can be obtained by adding to the bath a considerable excess of acid, instead of the addition of the heavy metal salt.

According to the kind and composition of the baths and the kind of the alloys to be colored, warm or cold baths must be used.

The adhesion of the coloring to the metallic base is with most baths considerably increased by keeping the object for some time in an air bath, at a temperature between 100 and 150° C., after washing off the etching liquor, and washing thereafter with boiling water and drying in the air.

EXAMPLE 1.

Brown coloring of an electron metal, consisting of an alloy of magnesium with 3-8% of zinc.

The object to be colored must be perfectly clean, (especially free from fat), and suitably prepared, and is suspended in a bath which is composed as follows:

350 grammes sodium bichromate.
94 grammes copper nitrate.
100 cc. chemically pure nitric acid, of 1.36 specific gravity.
9,500 cc. water.

The temperature of the bath is 85-90° C. By frequently moving the object any gas

bubbles which may adhere are dislodged, and dead corners of impoverished bath liquor are prevented. The alteration of the tone of the color is observed by withdrawing the object for a short time. The coloring is generally complete in 20 seconds to 3 minutes. The object is then immediately quickly rinsed in cold running water, dipped for a few seconds in pure boiling water and dried by rubbing with a soft cloth, or placed in an air bath at a temperature in the neighbourhood of that of boiling water for a quarter of an hour. To increase the lustre and strengthen the tone, a light greasing with mineral oils is advantageous.

The following examples relate to the coloring of magnesium and magnesium alloys by means of bath liquors containing salts of manganese and iron.

EXAMPLE 2.

Horn coloring.

180 grammes sodium bichromate.
133 grammes manganese sulphate crystals.
20 ccm. nitric acid, (specific gravity 1.36).
Water up to 5 litres.

The bath is used cold. The etching takes about 1 minute. After thoroughly washing the object can be dried at once in a stove at 100–120° C., or by wiping with a soft cloth.

EXAMPLE 3.

Brass coloring.

180 grammes sodium bichromate.
35 grammes ferrous nitrate crystals.
2.5 ccm. nitric acid (specific gravity 1.36).
Water up to 5 litres.

The etching bath is used cold and is especially adapted for polished articles. The etching takes about half to one minute. The after treatment is the same as in Example 2.

EXAMPLE 4.

Black etching liquor for electron metal.

37.5 grammes sodium bichromate.
123 grammes nitric acid (specific gravity 1.16).
Water up to 1 litre.

The bath is used cold. The objects are dipped into the bath, kept in constant movement, taken out after a few seconds, and when the adherent liquid of the bath no longer reacts with the metal (but not until then), are thoroughly cleaned with water. The reaction is completed when the evolution of gas is no longer visible. After drying, which is effected very quickly after a short dipping in boiling water, the objects are lightly greased or coated with colorless spirit varnish or a special lacquer for electron metal.

Finally the etched objects can be heated

to a higher temperature (300 to 400° C.) in order to still further darken the tone. A dark brown coloration, for example can thereby be transformed into a brownish black.

What I claim and desire to secure by Letters Patent is:—

1. The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of a heavy metal.

2. The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of a heavy metal, with the addition of small amounts of another acid.

3. The method of producing a black color on magnesium and magnesium alloys, which comprises the treatment of said metal with chromic acid and a considerable excess of another acid.

4. The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of heavy metal, and the subsequent heat treatment of the colored object.

5. The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of a heavy metal, with the addition of small amounts of another acid, and the subsequent heat treatment of the colored object.

6. The method of producing a black color on magnesium and magnesium alloys, which comprises the treatment of said metal with chromic acid and a considerable excess of another acid, and the subsequent heat treatment of the colored object.

7. The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of a heavy metal, and the subsequent darkening of the shade of the colored object by heat treatment at a temperature up to about 400° C.

8. The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of a heavy metal, with the addition of small amounts of another acid, and the subsequent darkening of the shade of the colored object by heat treatment at a temperature up to about 400° C.

9. The method of producing a black color on magnesium and magnesium alloys, which comprises the treatment of said metal with chromic acid and a considerable excess of another acid and the subsequent darkening

of the shade of the colored object by heat treatment at a temperature up to about 400° C.

5 10. The method of producing a brass yellow skin by etching magnesium and magnesium alloys, which comprises treating said metal with chromic acid, and causing said skin to adhere by treatment with a solution of a salt of a heavy metal.

10 11. The method of producing a brass yellow skin by etching magnesium and magnesium alloys, which comprises treating said metal with chromic acid, causing said skin to adhere by treatment with a salt of a heavy metal and influencing the shade of the color by the suitable choice of said heavy metal salt.

15 12. The method of coloring magnesium alloys containing zinc by etching, which comprises simultaneously treating said metal with chromic acid, a solution of a salt of a heavy metal, and a zinc salt, and adapting the zinc contents of the coloring bath to the zinc contents of the alloy.

20 13. The method of coloring magnesium and magnesium alloys by etching which comprises the simultaneous treatment at a temperature above the normal of said metal with chromic acid and a solution of a salt of a heavy metal.

25 14. The method of coloring magnesium alloys containing zinc by etching which comprises increasing the contents of zinc in the solution with the object of altering the depth of the coloration when said alloy is subsequently simultaneously treated with chromic acid and a solution of copper salt and a zinc salt.

30 15. The method of coloring magnesium and magnesium alloys by etching which com-

prises simultaneously treating said metal with chromic acid and a solution of a salt of a heavy metal and modifying the duration of the treatment.

16. The method of providing an alloy of 45 magnesium with 3% to 8% of zinc with a brown color which comprises freeing the metal from fat by cleaning, thereupon constantly moving same in a bath containing sodium bichromate, copper nitrate, nitric acid and water at a temperature of between 85-90° C. and as soon as the required coloration has been obtained quickly rinsing the object in cold running water, immersing it in pure boiling water, and drying the object. 50

17. The method of providing an alloy of magnesium with a horn color which comprises cleaning the metal and constantly moving same in a cold bath comprising sodium bichromate, manganese sulphate, nitric acid and water, thereupon washing the object in water and drying same in a stove at a temperature of 100-120° C. 55

18. The method of providing polished magnesium alloys with a brass color which comprises moving the metal in a bath containing sodium bichromate, ferrous nitrate, nitric acid and water and thereupon washing and drying the object.

19. The method of providing electron metal with a black color which comprises moving the metal in a bath containing sodium bichromate, nitric acid and water for a few seconds and as soon as the bath liquor no longer reacts with the metal, but not until then, thoroughly cleaning the metal with water drying the object after dipping in boiling water and varnishing the object. 70

In testimony whereof I affix my signature.

DR. FELIX THOMAS.