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PROCESS FOR THE SURFACE TREATMENT OF WORKPIECES OF MAGNESIUM AND MAGNESIUM BASE ALLOYS

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This invention relates to a process for the surface treatment of workpieces of magnesium and magnesium base alloys for the purpose of forming a protective coating thereon.

Known processes for building up corrosion-resisting coatings on magnesium and magnesium base alloys, consist in treating the metal to be protected with solutions of inorganic compounds, particularly chromates, fluorides or phosphates. The resulting coatings are generally very thin and easily damaged; if it be possible at all to produce thicker layers, these are porous and brittle and therefore readily flake off from the metal.

A long time ago it was pointed out that coatings of magnesium oleate or resinate produced on magnesium or magnesium base alloys possessed an extremely high resistance to chemical and mechanical influences, and could also be coloured and polished. As regards the production of such coatings, however, there was merely an indication that this could be done by heating the parts to be coated for a prolonged period in an oil-water-soap emulsion.

According to the present invention corrosion resisting layers are produced on magnesium and magnesium base alloys by treating the metal with aqueous solutions of those salts of carboxylic acid or phenolates which react with magnesium to form substantially insoluble compounds, at temperatures in the vicinity of the boiling point of the solutions, but preferably at higher temperatures and in such case, under pressure.

The alkali metal salts, including the ammonium salts, of the saturated and unsaturated fatty acids (including the iso-fatty acids) and oxy-fatty acids containing eight or more carbon atoms, and also alkali metal salts, including the ammonium salts, of aromatic carboxylic acids having two or more carbon rings, and the substitution products thereof, are particularly suitable for use in carrying out the present invention. The use of the free fatty and oxy-fatty acids and also of the aromatic carboxylic acids themselves usually fails either because such acids form readily soluble magnesium salts or because they are not water-soluble.

The solutions employed in carrying out the invention may, if desired, also contain other suitable solvents, such as ethanol, in addition to water.

It has been found that the presence in the solutions, of water-soluble sulphates or nitrates accelerates the building up of the protective coatings, while the presence of water-soluble silicates or of water-soluble salts of chromium and manganese, renders the coatings harder and/or more resistant to corrosion. In a similar manner, the nature of the coatings can be graduated by varying the temperature and pressure.

The coatings produced in accordance with the present invention can be coloured by adding colouring substances to the solution employed for the treatment; the colouring substances may, however, be produced directly in the coating formed, by employing for the production of the latter a substance suitable in accordance with the invention, which substance also acts as a dye component and subsequently allowing the solution of a suitable coupling component to act on the coating.

The hereindescribed process may also be applied to articles which have previously been subjected to a surface treatment, for example by a dipping process.

When treating magnesium base alloys the thickness and quality of the coatings depend to a certain extent, on the proportion of the alloying constituents contained in the magnesium, in the sense that the thickness of the coating which can be built up varies inversely with the content of alloying constituents. However, the quality of the layer is largely independent of the concentration of the solutions employed.

The following examples illustrate the invention:

1. A sheet of an alloy containing 2% of manganese, remainder magnesium, is heated in an autoclave in a 3% aqueous solution of potassium palmitate for 15 minutes at a temperature of about 170° C. A uniformly yellow coating about 0.02 mm. in thickness and possessing great resistance to abrasion is formed on the sheet, and imparts to the latter good resistance to corrosion, including corrosion by sea water.

The addition of 1% of sodium sulphate to the foregoing solution enables the duration of the treatment required to produce a coating of the same thickness to be reduced to 5 minutes.

Similar coatings are obtained in the same manner by using aqueous solutions of the alkali

metal or ammonium salts of stearic acid, oleic acid or linoleic acid.

2. A sheet of an alloy containing 2% of manganese and 0.4% of cerium, remainder magnesium, is treated in an autoclave with an aqueous solution of sulphoricinoleate (Turkey-red oil) for at least 20 minutes at a temperature of 180° C. The appearance and properties of the coating produced are similar to those of the coating produced in accordance with Example 1.

3. A sheet of an alloy containing 6% of aluminium, 1% of zinc, remainder magnesium is heated at 180° C. for 15 minutes in an autoclave in a 5% aqueous solution of potassium abietate (produced by dissolving pine resin or colophony in hot dilute caustic potash solution). The resulting coating is brown and adheres very securely to the metal. In the polished state it possesses a high gloss and can, if required, be coated with a firmly adherent layer of synthetic resin lacquer for the purpose of further increasing the resistance to corrosion.

4. A casting of an alloy containing 4% of aluminium, 3% of zinc, remainder magnesium, is treated for two hours under normal pressure at boiling temperature with a 10% aqueous solution of potassium naphthenate (produced by saponification of a suitable petroleum fraction). The resulting coating, of a nature similar to that of asphalt lacquer, adheres firmly to the metal and is also suitable as a foundation for a coating of asphalt lacquer.

The same result is obtained by treatment with the same solution for 15 minutes at a temperature of 170° C. in an autoclave.

5. A sheet of an alloy containing 2% of manganese, remainder magnesium, is treated in accordance with Example 1, with an 8% aqueous solution of potassium β-oxynaphthoate, whereby a firmly adherent coating is produced.

6. A sheet of an alloy containing 6% of aluminium, 1% of zinc, remainder magnesium, is treated under the conditions described in Example 1, with a 6% aqueous solution of the potassium salt of β-oxynaphthoic acid anilide. The resulting layer, yellow to green in colour, assumed a bright red colour of great fastness when dipped in a 1% aqueous solution of KB fast red salt.

The chemical resistance of the layer can be increased by using only a 5% solution of the potassium salt of β-oxynaphthoic acid anilide, instead of a 6% solution, which also contains 2% of sodium palmitate.

7. A sheet of an alloy containing 6% of aluminium, 1% of zinc, remainder magnesium, is heated in a solution of 40 grams of o-oxyquinoline and 11 grams of caustic soda solution in 1 litre of water, for about 30 minutes at a temperature of 160° C. in an autoclave. A hard, firmly adherent yellow coating, which can be polished and which imparts good protection against corrosion, is produced on the metal, and can, if desired, be subsequently compacted in known manner.

What we claim is:

1. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of a salt of an aliphatic carboxylic acid containing at least eight carbon atoms, at temperatures at least so high as to be in the vicinity of the boiling point of said solution.

2. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of an ammonium salt of an aliphatic carboxylic acid containing at least eight carbon atoms, at temperatures at least so high as to be in the vicinity of the boiling point of said solution.

3. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of an alkali metal salt of an aromatic carboxylic acid containing at least two carbon rings, at temperatures at least so high as to be in the vicinity of the boiling point of said solution.

4. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of an ammonium salt of an aromatic carboxylic acid containing at least two carbon rings, at temperatures at least so high as to be in the vicinity of the boiling point of said solution.

5. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of an alkali metal salt of an aromatic carboxylic acid containing at least two carbon rings and adapted to act as a dye-stuff component, at temperatures at least so high as to be in the vicinity of the boiling point of said solution, and thereafter treating the workpiece with a solution of a component adapted to produce a dye-stuff.

6. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of at least one of those easily water-soluble substances of the group consisting of the salts of aliphatic and aromatic carboxylic acids and of the phenolates which react with magnesium to form substantially water-insoluble compounds, at temperatures at least so high as to be in the vicinity of the boiling point of said solution.

7. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of at least one of those easily water-soluble substances of the group consisting of the salts of aliphatic and aromatic carboxylic acids and of the phenolates which react with magnesium to form substantially water-insoluble compounds, at temperatures at least so high as to be in the vicinity of the boiling point of the solution, said solution also containing at least one water-soluble salt of the group consisting of sulphates, nitrates, and silicates.

8. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of at least one of those easily water-soluble substances of the group consisting of the salts of aliphatic and aromatic carboxylic acids and of the phenolates which react with magnesium to form substantially water-insoluble compounds, at temperatures at least so high as to be in the vicinity of the boiling point of the solution, said solution also containing a water-soluble chromium salt.

9. A process for the production of protective coatings upon workpieces of magnesium and magnesium base alloys, which comprises treating the workpiece with an aqueous solution of at least

one of those easily water-soluble substances of the group consisting of the salts of aliphatic and aromatic carboxylic acids and of the phenolates which react with magnesium to form substantially water-insoluble compounds, at temperatures at least so high as to be in the vicinity of the boiling point of the solution, said solution also containing a water-soluble manganese salt.

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