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PROCESS OF PRODUCING BLACK-COLORED
ALUMINUM OR ALUMINUM ALLOYS

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This invention relates to a process of producing black-colored corrosion-resisting protective layers on the surface of objects made from aluminum or aluminum alloys.

It is known to produce colored protective films on aluminum or aluminum alloys by developing thereon in any desired manner an oxide film and then coloring it with the aid of organic dyestuffs or of weak metal bases. It has further been proposed to blacken aluminum by immersing it at increased temperature in an acidified permanganate solution, but it was found that the rather grayish-black coatings thus produced did not stick to the basic metal and chipped off either during rinsing or, without fail, when subjected to deformations or frictional stressing. This drawback cannot be completely eliminated even by subsequently treating these somewhat dark-gray protective films with steeping agents, as resins, varnishes, oils, waxes, fats, etc.

According to the invention, aluminum and aluminum alloys are provided with a black color in the form of a layer capable of resisting deformation, and particularly bending, by subjecting them to the steps of preliminarily treating the metal parts with an aqueous aluminum chloride solution, imparting a black color to them through the medium of a potassium permanganate solution acidified with sulfuric acid, and finally giving them an after-treatment in an alkaline solution of chromates or bichromates.

During the application of this three-step process the preferably polished parts of aluminum or an aluminum alloy to be colored are degreased in the usual manner and placed in the first bath of preliminary pickle. This bath advantageously consists of a, say, 25 per cent. aqueous solution of $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ heated so as to provide for sufficient reaction velocity of the electrolyte of the preliminary pickle on the one hand and the immersed metal on the other. This is usually attained by heating the preliminary pickle up to 60° to 70° C. The average period of immersion amounts to 1 to 5 minutes.

Having been preliminarily pickled in the aqueous aluminum chloride solution and washed off, the aluminum parts are placed in a dye bath consisting, according to the invention, of potassium permanganate and sulfuric acid, e. g. 60 g. KMnO_4 in 11.7% H_2SO_4 . The manganese dioxide produced when the preparatorily pickled parts are immersed in the dye bath imparting to them the black color is apparently precipitated in a highly favorable manner on the aluminum hydroxide formed on the metal by the

first bath, and at any rate adheres thereto very firmly. The black layer obtained after the second bath is friction-proof but does not yet resist bending, i. e. it cannot be rubbed off without deformation but will come off with comparative ease when subjected to sufficient deformation.

To render the black coating on the metal indeformable, the aluminum is subjected to the third step of the process according to the invention by being immersed in a so-called "MBV" bath which is sold by the trade and has for instance the following composition:

Na_2CO_3	grams..	50
Na_2CrO_4	do.....	15
Water	liter..	1

The temperature of the bath is preferably 95° to 98° C., and each piece of work to be treated should be immersed about 10 minutes on the average.

The fact that after the application of the third step of the process the black protective layer formed on the aluminum or aluminum alloy fully resists deformation, for instance bending, can probably be explained by the assumption that the initially formed aluminum hydroxide is at first a gel which solidifies only after having previously enveloped the manganese dioxide. Whether this involves also a rearrangement and growth of the oxide crystals in consequence whereof the pores are closed could not be fully ascertained as yet.

The black coatings produced on aluminum and aluminum alloys according to the invention have a pleasing deep black appearance and may serve as corrosion-resisting protective layers as well as for insulating purposes in the field of electricity. Although the protective layers according to the invention are not porous and adsorbent any more, particularly after the third step of the process, and liquids which would attack the basic metal cannot penetrate thereto through the layers, the latter can nevertheless, to a slight degree, be soaked with oil, etc. for the sake of appearance or in order to prevent corrosion even in aggravated cases.

I claim:

1. The process of producing black-colored corrosion-resisting protective layers on the surface of aluminum and aluminum alloys, consisting in preliminarily treating the metal with an aqueous aluminum chloride solution at increased temperature, then imparting a black color to it by immersing it in a heated potassium permanganate solution acidified with sulfuric acid, and

then subjecting it to an after-treatment by immersing it in an alkaline chromate solution at increased temperature.

2. The process according to claim 1, in which the solution used for the preliminary treatment comprises 20% to 30% $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ and 1 l. water, and is heated to 60° to 70° C.

3. The process according to claim 1, in which the solution used for imparting a black color comprises 40 to 80 g. KMnO_4 and 1 l. 7% H_2SO_4 , and is heated to approximately 60° C.

4. The process according to claim 1, in which the solution used for after-treatment comprises 30 to 80 g. Na_2CO_3 , 10 to 20 g. Na_2CrO_4 and 1 l. water, and is heated to 95° to 98° C.

5. The process of producing a black-colored corrosion-resisting protective coating on an article of aluminum or its alloys, comprising forming on the metal surface an aluminum hydroxide coating, then treating said surface with a solu-

tion to precipitate manganese dioxide thereon, and then treating said surface with an alkaline chromate solution.

6. The process of producing a black-colored corrosion-resisting protective coating on an article of aluminum or its alloys, comprising treating the metal surface with a solution to form thereon an aluminum hydroxide coating, then treating said surface with an acidified potassium permanganate solution, and then treating said surface with an alkaline chromate solution.

7. The process of producing a black-colored corrosion-resisting protective coating on an article of aluminum or its alloys, comprising treating the metal surface with an aqueous aluminum chloride solution, then treating said surface with an acidified potassium permanganate solution, and then treating said surface with an alkaline chromate solution.

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