OXALATE COATING ON NONFERROUS METAL

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No Drawing. Application January 31, 1933. Serial No. 554,551

3 Claims. (Cl. 149—6)

In an application Serial No. 591,982, filed February 8, 1932, issued January 31, 1933, as U. S. Patent No. 1,835,582, in the name of Leo P. Curtin and Bernard L. Klips, there is described a method of producing protective coatings on iron and steel articles by subjecting them to the action of a bath in which ferric oxalate is the principal component.

Most of the non-ferrous metals below calcium in the electromotive series acquire coatings as a result of oxidation by air, these coatings in some instances, because of their impervious nature, providing the underlying metal with partial or complete protection against further oxidation.

It is often the case, however, that such coatings fail to give the expected protection and oxidation of the metal continues at a rapid rate. This is especially true in the case of zinc and some of the new alloys which contain magnesium.

Furthermore, it is sometimes desired to apply a lacquer, enamel or paint coating over such metals, and if oxidation takes place after the application of such a coating, the enamel or lacquer film is disrupted. In addition, the physical nature of such metallic surfaces is often such that the lacquer or other coating material does not make a satisfactory bond with the metal. This is particularly the case with zinc, whether it be zinc sheets or castings or the thin coating of metallic zinc over iron produced by the galvanizing process.

Now I have discovered that similar coatings may be formed in a similar manner on non-ferrous metals. The invention will be described and illustrated hereinafter by reference to the coating of zinc, it being understood that the invention is not limited thereto but is applicable generally for coating metals which react with ferric oxalate to the formation of ferrous oxalate and the oxalate of the metal.

The surface of freshly galvanized material or of newly made zinc castings is particularly difficult to paint or lacquer. The coating liquid appears to make a good bond at the time of its application, but some time later it frequently peels off in large flakes showing the underlying zinc metal as bright and clean as though the paint or lacquer had never been applied. Furthermore, solid zinc objects and galvanized materials are subject to a form of oxidation known as white rust which seems to take place as well when such articles are held in storage as when exposed to the elements. This white rust, which is supposed to consist of oxides and carbonates of zinc, is the cause of many rejections by purchasers.

I have found that, if zinc is immersed in a hot aqueous solution of ferric oxalate containing barely enough free oxalic acid to inhibit hydrolysis of the ferric salt, the zinc receives a light but continuous coating which very slightly roughens the surface and provides an admirable base for a subsequent coating of enamel, lacquer, paint or oil. When zinc is so treated the lacquer or other coating clings tenaciously and shows no disposition to peel off as is the case when it is applied directly over the bright metal.

The coating consists of a complex mixture of oxalates of iron and zinc. The following chemical reaction illustrates how the coating may be produced on the surface of the metal, although other reactions may occur.

$$\text{Fe}_2(\text{CrO}_4)_3 + \text{Zn} = 2\text{FeCrO}_4 + \text{ZnCrO}_4$$

It will be noticed that the coating consists of a mixture of insoluble oxalates of zinc and iron and that according to the foregoing equation the zinc metal provides only one-third of the metal going into the coating, the remaining two-thirds being obtained from the iron oxalate in solution. This is an important advantage particularly in the case of galvanized materials. It is known that it is possible to produce a coating on metallic zinc by means of oxalic acid coating is not nearly so adherent or otherwise satisfactory, however, and it consumes three times as much of the zinc metal in its formation as when ferric oxalate is used. The coating formed by oxalic acid is quite likely to be non-adherent and in such cases can be removed from the metal by brushing or wiping. This difficulty has not been encountered with the ferric oxalate type of bath. The temperature of the bath is not at all critical, good results being obtained at temperatures from 90° C. to 99° C. The concentration of ferric oxalate may vary within considerable limits, say from 1% to 10%. I prefer to use, however, a bath containing 4% to 5% of ferric oxalate and 0.5% to 1.0% of free oxalic acid.

Among other non-ferrous metals capable of being coated by this process may be mentioned aluminum, magnesium and lead.

I claim:

1. The process of coating a non-ferrous metal of the class consisting of zinc, aluminum, magnesium and lead, which comprises exposing a surface of the metal to the action of an aqueous...
solution containing from 1 to 10 per cent of ferric oxalate, until a coating of the desired thickness is formed thereon.

2. A process as set forth in claim 1, wherein the solution of ferric oxalate is acidulated merely to such extent as to prevent hydrolysis of the ferric oxalate.

3. The process of coating a non-ferrous metal of the class consisting of zinc, aluminum, magnesium and lead, which comprises exposing a surface of the metal to the action of an aqueous solution containing from 4 to 5 per cent of ferric oxalate and from 0.5 to 1.0 per cent of oxalic acid, until a coating of the desired thickness is formed thereon.

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