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COATING METAL WITH ZINC PHOSPHATE

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15 Claims. (Cl. 148—6.5)

This invention relates to producing a phosphate coating on surfaces of iron, steel, zinc or magnesium or their alloys by means of zinc phosphate, and more particularly by means of such a phosphate when its action is accelerated.

The object of the invention is to produce a method and solution by which a coating of the character desired may be produced in reduced time and at a reduced temperature.

The material and method of treatment is susceptible to various modifications, but the preferred form of the invention will be described first and then modifications will be discussed later.

In the preferred form of the invention a bath is formed by introducing therein zinc dihydrogen phosphate and zinc cyanide, preferably about 3% by weight of zinc cyanide to the zinc phosphate powder introduced in the bath. The work to be coated is then introduced into the bath, the bath being kept at a suitable temperature. The zinc cyanide acts as an accelerator and under favorable conditions a complete coating on iron surfaces may be produced in as little as three minutes but under ordinary working conditions a time from seven to fifteen minutes may be expected to give complete coating upon ordinary work. The quality of the coating is not injured in any way by the accelerating compound. The bath may be replenished by adding the material in the same proportions as originally introduced.

It has been found that this accelerated solution of zinc dihydrogen phosphate operates nearly as rapidly at 75° centigrade as at from 95° to 98° centigrade, the usual temperature at which the bath has been kept hitherto. This possibility of acting at a reduced temperature is a considerable convenience under many circumstances.

Zinc cyanide added to other phosphate baths suitable for coating also has an accelerating action but is not as effective in baths made up of manganese and iron phosphates as where zinc phosphate is used to form and replenish the bath. The presence of zinc ions in the bath seems to render the zinc cyanide much more effective.

Soluble cyanides, such as potassium cyanide, sodium cyanide and ammonium cyanide, may be used to produce an accelerating effect upon a phosphate bath, whether of phosphates of iron and manganese phosphate or zinc phosphate, but is most effective in the bath containing zinc phosphate. However, the soluble cyanides quickly form insoluble compounds, apparently mostly with the phosphates of iron in the bath, and thereby the cyanides lose their accelerating effect. For this reason addition of a soluble cyanide to a bath has only a temporary accelerating effect.

Zinc cyanide, as well as other slightly soluble cyanides such as cyanides of copper, barium and manganese, go into the solution slowly, and, therefore, have a more permanent accelerating action. Of these less soluble cyanides, the zinc cyanide appears to be most active and at the same time maintains its effect.

A less amount of cyanide than 3% may be added and obtain a degree of acceleration, and considerably greater amounts may be used if desired without injurious results.

Soluble cyanides, such as sodium cyanide, when mixed with acid phosphates of iron, manganese or zinc, react therewith and give off HCN gas, which is very objectionable. For this reason if the soluble cyanides are to be used they should be added to the bath separately and not mixed with the powdered phosphates before being placed in the bath. The reaction with zinc phosphate is less than with the other phosphates but even in that case it is inadvisable to mix a soluble cyanide with acid zinc phosphate.

The reaction of the less soluble cyanides is much less than that of the soluble cyanides when mixed with acid phosphates and the reaction of zinc cyanide with zinc phosphate is comparatively slight, if it occurs at all. Apparently the zinc cyanide may be mixed with the zinc phosphate powder for sometime without losing its accelerating effect and without producing a perceptible amount of HCN gas.

Zinc carbonate also has some accelerating effect upon a zinc phosphate bath and may be added in amounts up to 4% of the phosphate in powder form. The addition of zinc carbonate to the zinc phosphate powder aids somewhat also in preventing the caking of the powder and, if mixed with zinc cyanide before being mixed with the phosphate, lessens the contact of the cyanide with the phosphate and reduces the danger of objectionable reaction. For these reasons it is advisable to mix zinc carbonate and zinc cyanide and add this mixture to zinc phosphate, if the powders are to be mixed before being added to the bath. It will be understood that the addition of the cyanide will be just as effective if the bath is prepared by introducing zinc phosphate in some other way than by first producing the zinc phosphate crystals,

providing the same composition of bath is obtained. In such cases the same amount of zinc cyanide should be used in proportion to the zinc phosphate in the bath, regardless of how this phosphate is introduced.

While the specific invention relates to the addition of zinc cyanide to a bath containing zinc phosphate it will be readily understood from the foregoing that various modifications and substitutions may be made within the scope of the appended claims.

What is claimed is:

1. A method of coating surfaces of metal in the group consisting of iron, zinc, magnesium and their alloys, which consists in forming a solution containing acid phosphates of metal in the group consisting of zinc, manganese and iron and a cyanide compound, and subjecting the surface to be coated to the action of the solution.

2. A method in accordance with claim 1, in which the acid phosphate includes zinc phosphate.

3. A method in accordance with claim 1, in which the cyanide compound is a metal cyanide that is only slightly soluble in the phosphate solution.

4. A method in accordance with claim 1, in which the acid phosphate includes zinc phosphate, and the cyanide compound is zinc cyanide.

5. A method of coating surfaces of metal in the group consisting of iron, zinc, magnesium and their alloys, which consists in forming a solution containing acid phosphates, including zinc dihydrogen phosphate, zinc carbonate and zinc cyanide, and subjecting the surface to be coated to the action of the solution.

6. A solution for coating surfaces of metal in the group consisting of iron, zinc, magnesium and their alloys, which comprises acid phosphates of metal in the group consisting of zinc, manganese, and iron, and a cyanide compound.

7. A solution as claimed in claim 6 in which the acid phosphates include zinc dihydrogen phosphate.

8. A solution as claimed in claim 6, in which the cyanide compound is a metal cyanide slightly soluble in the phosphate solution.

9. A solution in accordance with claim 6, in which the cyanide is zinc cyanide.

10. A solution in accordance with claim 6, in which zinc dihydrogen phosphate is included in the acid phosphates and the cyanide is zinc cyanide.

11. A solution in accordance with claim 6, and which contains zinc carbonate.

12. A solution for coating surfaces of metal in the group consisting of iron, zinc, magnesium and their alloys, which comprises acid phosphates including zinc dihydrogen phosphate, zinc carbonate, and zinc cyanide.

13. A compound for replenishing coating baths, comprising dry zinc dihydrogen phosphate as its major constituent, zinc carbonate and zinc cyanide.

14. A compound in accordance with claim 12, and in which the zinc carbonate forms about 4% and the zinc cyanide about 3%.

15. A method of coating surfaces of metal of the group consisting of iron, zinc, magnesium and their alloys, which consists in forming a solution containing acid phosphates of metal in the group consisting of zinc, manganese and iron, and a cyanide compound, subjecting surfaces to be coated to the action of the solution, and replenishing the solution by the addition of zinc di-hydrogen phosphate and zinc cyanide, the amount of the cyanide being about 3% of the amount of phosphate.

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