

UNITED STATES PATENT OFFICE

2,471,907

METHOD OF AND MATERIAL FOR INCREASING THE CORROSION RESISTANCE OF FERRIFEROUS METALS

Eugene Snyder, Philadelphia, Pa., assignor to American Chemical Paint Company, Ambler, Pa., a corporation of Delaware

No Drawing. Application April 1, 1948,
Serial No. 18,506

7 Claims. (Cl. 148—3.15)

1

This invention relates to the art of finishing ferriferous metals especially where such metals are to be covered with paint, varnish, enamel, japan or other siccative coating.

The principal objects of the invention are to increase the corrosion resistance of the surface and to improve the adherence and increase the life of the siccative coating especially under corrosive influences such as those which are associated with humid atmospheres, salt water, acid fumes and the like.

The invention relates generally to the phosphate coating art and before describing the details of my process I wish to point out that it has been known heretofore that a phosphate film with definite protective value can be formed on the surface of ferriferous metals by treating them with an aqueous solution containing primary or secondary phosphates of one or more of the alkali metals and of ammonium or, preferably, combinations of both primary and secondary phosphate. One example of such a metal coating process is found in the United States patent to Douty and Romig No. 2,403,426. Due to their cheapness and ease of control such phosphate coating systems have become increasingly important although, due to the thinness of the phosphate coating, they leave something to be desired.

With the foregoing in mind it is one of the principal objects of the present invention to produce coatings by means of the phosphates mentioned which are very much heavier thereby affording greatly enhanced protection against corrosion especially after the siccative coat is subsequently applied. Another object is to greatly accelerate the formation of coatings produced by such solutions.

I have discovered that the coating time can be greatly decreased and the weight of the coating greatly increased if there be added to phosphate coating solutions of the character described a very small quantity of a soluble chlorite. The form in which the chlorite radical is introduced into the coating system seems to make little or no difference although I prefer to use sodium chlorite due to its cheapness and availability. The chlorite should be present in the coating solution in an amount not less than approximately 0.0005% by weight nor greater than approximately 0.05% by weight calculated as NaClO_2 . I have found that the optimum concentration for the chlorite is approximately 0.001% and that by using the chlorite at this concentration it is possible to produce coatings by

2

using mixtures of materials which would not normally produce phosphate coatings except after a great length of time.

If the concentration of chlorite is below 0.0005% there is little or no beneficial effect and above the maximum of approximately 0.05% just mentioned the chlorite loses its value and may even become detrimental to the coating system in that the coating tends to become powdery and affords substantially no protection whatsoever.

By way of specific example I cite the following: To a coating solution consisting of

	Mono ammonium phosphate.....	ounces... 1.85
	Disodium phosphate.....	do... 0.15
15	Water	gallons... 1.00

I add approximately 0.001% by weight of a chlorite such as sodium chlorite. When this solution is sprayed on a piece of mild steel for approximately two minutes a phosphate coating will be produced which weighs approximately 50% more per unit of area than would a coating produced in the same time by the same solution without the chlorite. This is a remarkable improvement in result because it means either that the coating can be made heavier in the same space of time or that a coating having the weight of the prior coatings can be produced in much less time. These advantages, of course, will vary depending upon the type of steel which is being treated, the pH of the coating system, the temperature of the treating solution, etc. but the foregoing example is typical of the improvement.

A solution such as above described will have a pH in the range of 4.5 to 6.5 and I prefer solutions which lie within this range as they seem to have the widest general applicability. I also wish to note the fact that with my invention it is possible to somewhat increase the range of pH within which the solution is operative by slightly decreasing the lower limit. For instance, the range given in the above mentioned United States patent is between 4.7 and 6.5 whereas the range which is practical with my invention lies between approximately 4.5 and 6.5.

While the solution that I have just described is very good I have found that it is possible to improve it even further especially with respect to acceleration in coating time by incorporating in the solution a small amount of insoluble metallic phosphate from the class of aluminum and ferric phosphates. The quantity employed seems to be entirely unimportant because very small amounts will produce the desired effect and larger amounts make no difference in the results at-

3

tained. Just what the action of such insoluble phosphates may be is not fully understood but coating solutions which contain them produce an extremely hard, grayish, glassy phosphate coating which possesses unusually excellent qualities for bonding the final siccative coating to the metal.

For convenience in storage and transportation I prefer to prepare concentrated admixtures which may be either solid or liquid and these may be formulated in such a way as to serve both for making up and replenishing the working solutions. Such concentrated admixtures or materials should be prepared with the following points in mind. Although my improved coating process is relatively insensitive to the presence of dissolved or suspended impurities yet the continued replenishment of the operating solution with materials containing large amounts of diluents or inert ingredients whether soluble or insoluble will lead, of course, to an accumulation of large quantities of such inert materials for which reason I have found that such concentrated admixtures or materials for making up or replenishing the working solution should contain at least 75% of the primary and secondary phosphates from the class described. With materials containing at least 75% of phosphate from this class suitable coating or working solutions may be prepared by using from one to four ounces of the concentrate per gallon of water. Additionally the concentrate should include from about 0.066% to 1.67% by weight of chlorite calculated as NaClO_2 . With this quantity of chlorite the diluted working solution will contain chlorite within the range specified above.

The foregoing materials, of course, constitute the essential coating-producing ingredients of the concentrate and the balance can be made up of inert ingredients of one kind or another which have no substantial effect on the phosphating qualities of the working solution.

By way of specific example of a concentration which is suitable for use in preparing or replenishing a working solution attention is directed to the following:

	Pounds
Aluminum phosphate	0.010
Monoammonium dihydrogen phosphate ..	0.930
Disodium monohydrogen phosphate	0.050
Sodium chlorite	0.010
	1.000

The foregoing, of course, can be prepared as a solution if so desired but for ease in storage and transportation the dry material is preferable. The strength of the final coating solution may vary widely depending upon the conditions of use although I have found that a one to four ounce per gallon solution gives excellent results especially when sprayed for a period of approximately one to two minutes at a temperature of approximately 160° F.

In conclusion I wish to refer to the fact that solutions according to the present invention have

4

a considerable ability to remove some small amount of grease and oil from the surfaces being treated. In other words, they lend themselves to simultaneous cleaning and coating but this effect can be substantially augmented if there be added to the working solution a water soluble wetting and emulsifying agent whereupon they will act to simultaneously clean and phosphate coat even very highly or grossly contaminated surfaces. For example, to attain the effect just described, there can be added to the working solution a small amount of a water soluble wetting and emulsifying agent such a derivative of polyethylene glycol.

I claim:

1. In the art of coating ferrous metal to increase its corrosion resistance the method which includes the step of treating the surface with a bath the essential coating-producing ingredients of which consist of an aqueous solution of phosphate from the class which consists of alkali metals and ammonium, said solution also containing from about 0.0005% to 0.05% by weight of the total treating solution of soluble chlorite calculated as NaClO_2 and the pH of said solution being from approximately 4.5 to approximately 6.5.

2. The method of claim 1 where the quantity of chlorite in the treating solution is 0.001% by weight.

3. The method of claim 1 where the chlorite is sodium chlorite.

4. The method of claim 1 where the treating solution also contains a small quantity of phosphate from the class consisting of ferric and aluminum phosphate.

5. A material for preparing and replenishing a metal-coating solution the essential coating-producing ingredients of which material consist of phosphate from the class of alkali metal phosphates and ammonium phosphate, together with soluble chlorite, the said phosphate constituting at least 75% by weight of the material and the said chlorite being present in an amount from about 0.066% to about 1.67% by weight calculated as NaClO_2 , with the remainder of the material being made up of substantially inert ingredients.

6. The material of claim 5 which also includes a small amount of insoluble phosphate from the class of aluminum and ferric phosphates.

7. The material of claim 5 in which the chlorite is sodium chlorite.

EUGENE SNYDER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,298,312	Romig	Oct. 13, 1942
2,326,309	Romig	Aug. 10, 1943
2,403,426	Douty et al.	July 2, 1946
2,437,441	Rogers	Mar. 9, 1948

Certificate of Correction

Patent No. 2,471,907.

May 31, 1949.

EUGENE SNYDER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 53, for the word "chloride" read *chlorite*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of November, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.