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METHOD OF BONDING SICCATIVE
COATS TO METAL

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This invention relates to coating metal and more particularly it relates to an improvement in methods by which a substantially integral coating is produced by chemical means upon a metal surface which is thereafter covered with a coat of paint, varnish, enamel or the like which dries or hardens over the chemical coat and is hereinafter referred to for brevity as a siccative coat.

It is known that various treatments will produce a substantially integral coat upon metal by chemical changes in the surface of the metal which result in firmer adherence of a siccative coat thereto than can be obtained by direct application of the siccative coat upon bare metal. This has been practiced to a considerable extent, particularly with iron and steel, by the production on iron and steel of a phosphate coating as a foundation or bond for paint or the like. Similar phosphate coats may be produced upon zinc or magnesium, and by somewhat similar treatments substantially insoluble salts of the metals may be produced by treatment with organic acids including the dicarboxylic and hydroxy-dicarboxylic acids of the aliphatic series and carboxylic acids, having but one carboxyl group, and sulphonic acids of the aromatic series, particularly where oxidizing agents and copper compounds or the like are employed as accelerators. By proper manipulation, such salt coatings can be produced not only upon iron and zinc, but also upon tin, lead and copper. These various coatings, when formed so that they are firmly adherent and substantially integral coatings upon the metal, greatly increase the adherence of siccative coats to the metal. Also proper chemical treatment produces oxide coats on substantially all metals, and siccative coats adhere to such oxide coats better than to the bare metal. Similar increased adherence may be secured on aluminum by a coating of lithium aluminate or aluminum fluoride. The nitric acid radical generally facilitates the production of oxide coatings on metal and also the production of integral salt coats of the kind described above. These various bonding coats are hereinafter referred to for brevity as chemical coats.

While the adherence of siccative coats to the metal is greatly increased by the bonding effect of a chemical coat, it has been found difficult to avoid blisters between the chemical coat and the siccative coat, particularly when the finished surface is subjected to humidity tests. Such blisters are especially troublesome where the chemical coat has been produced with the aid of the nitric acid radical.

The object of the present invention is to provide an intermediate treatment after the production of the chemical coat and before the application of the siccative coat, whereby this blistering under the siccative coat is minimized or eliminated.

The cause of this blistering has not been discovered, but there has been discovered a treatment by which it may be avoided.

After the production of the chemical coat, it is customary to rinse the surface to remove remnants of the chemicals used to produce the coating. In accordance with the present invention, the chemical coat is preferably rinsed in the usual manner and is thereafter treated in a hot dilute solution of a salt of iron, chromium or aluminum. Good results have been obtained by one minute treatment in a hot solution of 15 grams of ferric or chromic nitrate or 30 grams aluminum nitrate to 8 gallons of water. The reason for the beneficial results of such salt solutions is not understood. For example, ferric nitrate or aluminum nitrate obviously hydrolyze to produce apparently free nitric acid in the solution, and still have a very beneficial effect in eliminating blisters, while a nitric acid rinse of apparently equal strength in nitric acid, but introduced as free nitric acid, has a detrimental effect, increasing the blistering.

The strength of the solution can be varied widely, but it seems an unnecessary waste of chemicals to increase the strength greatly above that suggested above, and reduction in the strength lessens the effectiveness unless there is a corresponding increase in the duration of the treatment.

Apparently the effectiveness of these salts is largely dependent upon the metal radical, and if sulphates or other salts of the metals named are employed, the amount to be used may be determined with sufficient accuracy by determining the metal content of the salt.

The aluminum salts are preferred. There is not much choice between the chromic salts and the ferric salts.

The above treatment is particularly effective with phosphate coatings and with all chemical coats produced with the aid of the nitric acid radical, but is helpful also with the other varieties of chemical coats indicated above.

What is claimed is:—

1. The method which consists in forming on a surface of metal a chemical coat of the group consisting of coatings on metal of oxide of the metal coated, on iron, steel, zinc and magnesium,

of substantially insoluble phosphates, on iron, steel, zinc, magnesium, tin, lead and copper, of a substantially insoluble salt of an acid in the group consisting of the dicarboxylic and hydroxy-

- 5 dicarboxylic acids of the aliphatic series and carboxylic acids having but one carboxyl group and sulphonic acids of the aromatic series, and, on aluminum, of lithium aluminate and aluminum fluoride, rinsing the chemical coat with a
10 dilute solution of a salt having as a base one of the metals aluminum, iron and chromium, and covering the rinsed chemical coat with a siccative coat.

2. A method in accordance with claim 1, and
15 in which the rinse solution comprises a salt having a metal content of the order of that of 30 grams of aluminum nitrate to 8 gallons of water.

3. A method in accordance with claim 1, and in which the rinse solution is of aluminum nitrate in water.

4. The method of preparing a chemical coat on metal for the reception of a siccative coat, which consists in rinsing with a dilute solution of a salt having as a base one of the metals aluminum, iron and chromium, a chemical coat of
25 the group consisting of oxide coatings on metal, phosphate coatings on iron, steel, zinc and magnesium, and coatings on iron, steel, zinc, magnesium, tin, lead and copper of salts of acids of
30 the group consisting of the dicarboxylic and hydroxy-dicarboxylic acids of the aliphatic series

and carboxylic acids having but one carboxyl group and sulphonic acids of the aromatic series, and coatings on aluminum of lithium aluminate and aluminum fluoride.

5. A method in accordance with claim 4, and in which the acid rinse is a hot solution of aluminum nitrate.

6. A method in accordance with claim 4, and in which the chemical coat treated is one produced with the aid of the nitric acid radical.

7. A method in accordance with claim 4, and in which the chemical coat treated is a phosphate coating produced with the aid of nitrate.

8. The method of preparing a phosphate coat on iron or steel for the reception of a siccative coat, which consists in rinsing said phosphate coat with a hot dilute solution of a salt having as a base one of the metals aluminum, iron and chromium.

9. The method which consists in treating a surface of iron or steel with a dilute phosphate solution and thereby forming on said surface a substantially integral coat of phosphates, rinsing the phosphate solution from the coated surface, and thereafter rinsing said surface with a hot
25 solution of an aluminum salt having an aluminum content of the order of a solution of 30 grams of aluminum nitrate in 8 gallons of water.

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