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METHOD AND MATERIAL FOR PRODUCING
PHOSPHATE COATING

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This invention relates to an improvement in the production of phosphate coatings, and particularly to the production of a coating on iron or steel adapted to bond paint or the like to the metal.

The production of phosphate coatings on iron and steel by means of a dilute phosphate bath has been common for many years. A comparatively recent discovery is that the formation of the coating can be very materially expedited by including in the treating solution sodium nitrate or an equivalent material. Where the treatment is by immersing the articles in a bath, the continued addition of sodium nitrate to replenish the bath sometimes unduly builds up the sodium in the bath so that the bath becomes so low in phosphates of iron or manganese as to make it ineffective. For this reason the addition of a nitrate of a material that will either enter into the coating, or form an insoluble compound with the ingredients of the solution and so be precipitated out, or will be volatilized and so driven off, is preferable for replenishing the bath. In other words, it is desirable to add a nitrate which does not introduce a material that builds up deleteriously in the bath.

It is also desirable to have a high manganese content in the bath, as manganese phosphate forms a very desirable coating upon the metal.

A specific example of the formation and replenishment of a bath will be described next, and then some principles upon which the modifications may be based will be set forth.

Sodium nitrate is readily available and is suitable for use with phosphates for starting a bath. Varying amounts of the sodium nitrate may be mixed with phosphates and dissolved in water. One example of suitable proportions is to mix 110 lbs. of sodium nitrate with 115 lbs. of manganese dihydrogen phosphate, although the proportion of sodium nitrate to the phosphate may be varied widely. About 19 grams of copper carbonate may be added, if desired. From 35 to 50 lbs. of the mixture dissolved in 100 gallons of water produces a solution which coats work introduced therein very quickly and evenly. Although the copper is not necessary, the coating is expedited by the inclusion of the small amount of copper, and it also aids in producing a coating action upon surfaces which are somewhat difficult to attack for any reason.

After a bath has been started in this manner, it may be replenished by adding manganese phosphate, containing copper if desired, and manganese nitrate. One-fourth of a pound of

copper carbonate to 100 lbs. of the manganese phosphate has been employed with success in replenishing a bath of the kind described. Any less amount of copper may be employed, and some more might be used, but too much copper produces an undesirable coat. The manganese nitrate and manganese dihydrogen phosphate should not be mixed and allowed to stand before being introduced into the bath, as there is reaction between the nitrate and dihydrogen phosphate which rapidly reduces the efficiency of the powder.

Manganese nitrate readily absorbs moisture from the air and is difficult to handle for that reason. By adding normal manganese phosphate or mono-hydrogen manganese phosphate to the manganese nitrate, the difficulty in this respect is largely avoided, and at the same time the manganese content of the bath increased, and no undesirable material is introduced into the bath. No injurious reaction takes place between the normal or mono-hydrogen manganese phosphate and the manganese nitrate.

The normal or mono-hydrogen manganese phosphate may be added to the nitrate in widely varying proportions but two parts of the phosphate to three of the nitrate have been found to work very well. When the phosphate and nitrate are mixed in this proportion, the powder keeps and may be transported and handled with fair facility. Replenishing the bath with equal parts of this mixture and manganese dihydrogen phosphate maintains a bath which operates quite satisfactorily, some copper being usually included with the phosphate.

Where the bath is started with manganese dihydrogen phosphate and manganese nitrate, without the use of any sodium nitrate, and is replenished with the same materials, the new bath operates satisfactorily at first, but quickly deteriorates so that it is unsatisfactory, although the presence of copper mitigates the difficulty. Where the bath is started with a mixture of sodium nitrate and manganese dihydrogen phosphate and is replenished with the same mixture, the initial operation is satisfactory and the work continues to be satisfactory for a considerable time, but the sodium gradually builds up in the bath and the manganese phosphates and iron phosphates are reduced in quantity until the bath becomes ineffective. By starting the bath with the mixture of manganese dihydrogen phosphate and sodium nitrate and maintaining the bath by the addition of manganese phosphates and manganese nitrate, as described, the bath is

maintained at high efficiency, but in all cases some copper increases the efficiency.

By proceeding in the described manner, the phosphates of iron and manganese are not displaced by sodium phosphate to an injurious extent, nor do they become undesirably high in proportion to the other ingredients of the bath, and the solution is maintained in proper balance so that a good paint-holding coat high in manganese phosphate is produced very quickly.

While manganese nitrate is preferred in the replenishment of the bath, for reasons given above, it will be evident that some use is possible of nitrates of metals such as magnesium, calcium, barium, strontium, zinc, cadmium and iron, which enter into the coating as phosphates.

Various changes may be made within the scope of the appended claims.

What we claim is:—

1. A process of coating iron or steel which consists in forming a solution containing acid phosphates and a nitrate of an alkali metal, immersing in the solution articles having surfaces of iron or steel, and maintaining the strength of the solution by adding thereto acid phosphates and a nitrate of an element of the class that consists of magnesium, calcium, barium, strontium, manganese, zinc, cadmium and iron, which enter into the coating as bases of phosphates.

2. A process in accordance with claim 1, and in which a copper compound is dissolved in the solution.

3. A process of coating iron or steel which consists in forming a solution by dissolving in water acid phosphates and sodium nitrate, heating the solution and immersing therein articles having surfaces of iron or steel, and replenishing the solution by adding thereto acid phosphates and nitrate of manganese.

4. A process in accordance with claim 3, and in which a compound of copper is dissolved in the solution.

5. A process in accordance with claim 3, and in which the acid phosphate is essentially manganese dihydrogen phosphate.

6. In coating surfaces of iron or steel, the method which consists in replenishing a phosphate coating bath by the addition of materials including manganese nitrate and manganese dihydrogen phosphate.

7. In coating surfaces of iron or steel, the method which consists in replenishing a phosphate coating bath by the addition of materials including dihydrogen phosphate of manganese, manganese nitrate, and phosphate of manganese less acid than the dihydrogen phosphate.

8. In coating surfaces of iron or steel, the method which consists in replenishing a phosphate coating bath by the addition thereto of one mixture consisting chiefly of phosphate of manganese, less acid than is manganese dihydrogen phosphate, and nitrate of manganese, and another material consisting essentially of manganese dihydrogen phosphate.

9. A method in accordance with claim 8, and in which a compound of copper is included in one of the mixtures.

10. A method in accordance with claim 8, and in which the proportions of the three named chemicals is approximately 2, 3 and 5 respectively.

11. A material, for use in replenishing a phosphate bath, consisting essentially of manganese nitrate and material of the class consisting of manganese mono-hydrogen phosphate and normal manganese phosphate.

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