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# UNITED STATES PATENT OFFICE

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## PROOFING OF METAL AGAINST CORROSION AND PARTICULARLY OF IRON AND STEEL AGAINST RUST

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This invention relates to proofing metal, against corrosion and particularly of iron and steel against rust.

It is the object of this invention to proof metals, especially iron and steel, against rust or corrosion.

It is a further object to provide a highly rust- or corrosion-resisting surface upon all parts of the metal without disturbing the physical characteristics as to shape, quality, temper or other conditions of the piece so treated.

In my Letters Patent No. 1,719,464, I describe a process for rust-proofing, in which aluminium, zinc, iron and chromium are dissolved in phosphoric acid of concentration 45° Bé., diluted with water to 22° Bé., the final solution being of concentration 36° Bé.

I have now discovered that markedly improved results and complete security against any preliminary corrosion of the articles subjected to the rust-proofing treatment, prior to the beginning of the deposition of the protecting layer of proofing composition, are obtained by dissolving the metals in phosphoric acid of lesser concentration, namely, in a solution diluted to a concentration of 12° Bé.

In order to carry out the process of my invention, I first dissolve separately to saturation the following metals: iron, zinc, aluminium and chromium into an aqueous solution of phosphoric acid of concentration 12° Baumé.

When I refer to saturation, I mean such a solution of phosphoric acid in which has been dissolved all of the metal that can be dissolved and there is still remaining undissolved metal. I recommend for ease in effecting such a dissolution of these metals that aluminium, zinc and iron powders be utilized and that a chromium oxide powder be used in the case of chromium.

I further prefer the dissolution be effected at room temperature, but the application of heat may be utilized if desired to hasten the reaction. If heat is applied, it should be below 90° C. and preferably about 60° to 70° C.

Upon accomplishing a saturated solution of each of the foregoing metals, I mix them in the following proportions by volume: 5 parts iron solution; 5 parts zinc solution; 1 part aluminium solution; and ½ part chromium solution.

The above are the proportions which I have found to give the best result; it will be understood that the rust-proofing properties of the coating depends on the proportions of the different constituent metals in it, which proportions in their turn depend on the proportion of each solution constituting the proofing mixture. It will be therefore conceived that some departures may be made from these proportions without failure to obtain a protective coating according to this invention. The protective properties of the coating obtained by carrying out the process as set forth results from the nature of the metals used and the manner in which they are brought in combination, in the presence of agents which enhance the cementation, the affinity, the cohesion, the homogeneity of the coating, as explained in the specification, and, again, it is evident that some departures from the proportions of these agents stated in the specification may be introduced without failure to obtain a useful result according to the invention, the proportions stated being those which were experimentally found to give the best result. It is estimated that a departure of ten per cent in any of the quantities given would still enable a coating to be obtained which would be useful and afford better protection against rust than the other processes hitherto used.

As a matter of convenience, I find the following quantities of the above metal powders can be approximately used in each litre of 12° Baumé phosphoric acid solution; 50 grammes iron; 60 grammes zinc; 10 grammes aluminium; and 10 grammes chromium,

To each litre of this phosphoric acid metallic solution is then added 4 cc. of the following solution as an accelerator: in ½ litre of water, preferably distilled, I introduce 25 grammes of bichromate of potassium, 70 grammes of neutral chromate of potassium, 25 grammes of monobasic phosphate of ammonium and 5 grammes of naphthalene.

This resulting solution is hereinafter termed the "stock liquor."

The stock liquor may be evaporated down to substantial dryness for ease in handling or transportation. In the event such an evaporation is practised, the heat of the evaporation should never exceed 90° C. and constant stirring should be practised during the evaporation over a hot sand bath or hot plate, or other equivalent means.

In the process of proofing of the metal, I prefer to dilute the stock liquor to 3° Baumé. If the evaporation has been practised the dry product is ready for application after mixing water with it to bring it to 3° Baumé.

In the foregoing combination I employ bichromate of potassium because of its cementation effect on the combined precipitated mass when it attacks the iron or steel surfaces. The neutral chromate of potassium creates a special affinity between the metals after they have been dissolved. It facilitates the cohesion between the chromium and the other metals. The monobasic phosphate of ammonium holds for an instant the final combination of the precipitates until all of the metals have been thrown down. The naphthalene aids in the union of the combined precipitates onto the surface of the article treated.

Substantially the proportions and temperatures mentioned above bring about a greatly improved result over what I have been able heretofore to accomplish in certain kind of proofing, and the temperature as well as the amount of acid for performing the saturated solutions is essential.

It will be understood that I desire to comprehend within my invention such modifications as may be clearly embraced within the scope of my claims and invention.

What I claim and desire to secure by Letters Patent is:—

1. A composition for proofing metals against corrosion, consisting of a metallic stock solution which is a mixture of saturated solutions of iron, zinc, aluminum and chromium in an aqueous solution of phosphoric acid of concentration 12° Baumé, in the proportion of 5 parts of iron solution, 5 parts of zinc solution, 1 part of aluminium solution and ½ part chromium solution, to which metallic stock solution is added, in the proportion of 4 cc. to each litre of the former solution, an accelerator stock solution which is an aqueous solution of bichromate of potassium (5 per cent) neutral chromate of potassium (14 per cent), mono-basic phosphate of ammonium (5 per cent) and naphthalene (1 per cent), whereby a non-corrosive smooth surface is produced on a metal article being immersed in the composition.

2. A composition for proofing metals against corrosion, consisting of a metallic stock solution which is a mixture of saturated solutions of iron, zinc, aluminium and chromium in an aqueous solution of phosphoric acid of concentration 12° Baumé, in the proportion of 5 parts of iron solution, 5 parts of zinc solution, 1 part of aluminium solution and ½ part chromium solution, to which metallic stock solution is added a small quantity of an accelerator stock solution which is an aqueous solution of bichromate of potassium (5 per cent) neutral chromate of potassium (14 per cent), mono-basic phosphate of ammonium (5 per cent) and naphthalene (1 per cent), whereby a non-corrosive smooth surface is produced on a metal article being immersed in the composition.

3. A composition for proofing metals against corrosion, consisting of a metallic stock solution which is a mixture of saturated solutions of iron, zinc, aluminium and chromium in an aqueous solution of phosphoric acid of concentration 12° Baumé, in the proportion of 5 parts of iron solution, 5 parts of zinc solution, 1 part of aluminium solution and ½ part chromium solution.

In testimony whereof, I affix my signature.

WILLIAM HOWARD COLE.