

UNITED STATES PATENT OFFICE

2,265,467

CONTROL OF NICKEL-DIP SOLUTIONS

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No Drawing. Application February 23, 1939,
Serial No. 257,969

1 Claim. (Cl. 91—68.3)

This invention relates to chemistry and more particularly to the control of the deposit of nickel or nickel compounds upon metal, such as enameling iron and steel sheets.

It has been found desirable to provide a thin uniform coating of nickel or nickel compound upon the surfaces of enameling iron or steel sheets prior to the application of the porcelain enamel thereto. It has been found that the use of an electrolytic process is not satisfactory for this purpose because with such a process the coating of nickel is often thicker at the edges than at the center of the surfaces and/or is usually unnecessarily heavy. The immersion process for the deposit of nickel has been found to be satisfactory from this and other standpoints and is simpler and less expensive than the electrolytic process. It has been found, however, when the immersion process is controlled in the customary manner that the amount of deposit varies somewhat irregularly according to the amount of use of the immersion bath.

In preparing the enameling iron or steel sheets for this deposit the iron or steel sheets are ordinarily first subjected to several cleaning baths followed by rinses after which they are treated with an acid bath, preferably for ten minutes at 140° to 160° F. having a concentration of from 6% to 8% sulfuric acid by weight. This treatment, however, is not essential to the deposit of nickel. The metal may be clean enough as received from the mill or may be cleaned by other means and methods. Preferably the iron or steel sheets are then subjected to two rinses and then they are ready for the deposit of nickel.

For the deposit of nickel it has been customary to immerse the iron or steel sheets for about five minutes in a bath of a single nickel salt. It has been found that as this solution is used it is necessary to add some substance for maintaining the hydrogen ion concentration within certain limits. In order to do this it has been customary to add ammonium hydroxide or ammonium carbonate in amounts necessary to maintain the hydrogen ion concentration within prescribed limits. This has been found unsatisfactory because it appears that the ammonia compounds formed as a result of this addition causes a variation in the amount of coating deposited at various times throughout the life of the bath. For example, the amount of coating rises rapidly when the bath is first used and reaches a maximum of about 500% of the initial coating or deposit. Thereafter the amount of deposit declines rapidly until it reaches an amount of about

one-third to one-half the maximum deposit, after which the amount of deposit is comparatively uniform.

We have discovered that if a strongly alkaline compound of lithium, sodium, or potassium, such as sodium hydroxide or carbonate is used to maintain the desired hydrogen ion concentration, the amount of coating is substantially uniform throughout the life of the bath. With the use of sodium hydroxide, the amount of deposit does not vary over 25%.

As one specific example of our invention, in the immersion bath we use from two to four ounces per gallon of a single nickel salt, such as nickel sulphate and one-fourth ounce per gallon of boric acid and maintain the pH value of the solution by the addition of sodium hydroxide to raise the pH value of the solution. When necessary sulfuric acid may be used to lower the pH value of the solution, but we find that normally small amounts of sulfuric acid are carried into the immersion bath from the acid bath or the pH becomes lower for other reasons, such as the precipitation of iron as the hydroxide. For these reasons it is usually unnecessary to add sulfuric acid to the immersion bath. Preferably, the enameling iron or steel sheets are kept in the immersion bath for about five minutes and the bath is maintained at a temperature of about 160° or 170° F. Following the immersion bath the enameling iron or steel sheets are given a rinse for 1½ minutes in a bath containing 0.05% to 0.1% sulfuric acid by weight. After this the enameling iron or steel sheets are immersed for three minutes in a neutralizing bath.

If desired slightly wider limits of hydrogen ion concentration may be maintained such as a pH value to 5.2 to 6.4. The time, temperature and nickel salt content may vary over a considerable range. For example the temperature may vary from room temperature to boiling. Instead of employing nickel sulphate in the nickel treatment bath other nickel salts, such as nickel chloride or nickel nitrate may be used. In this case it is sometimes desirable that the acid bath contain the acid of the nickel salt which is used in the immersion bath and that such acid be used if necessary to lower the pH value of the solution.

Instead of employing sodium hydroxide to raise the pH value of the solution, potassium hydroxide or even lithium hydroxide may be used. Even the strongly alkaline weak acid salts of sodium, potassium and lithium such as the carbonates and phosphates may be used. Instead of boric

acid, other buffer salts may be used to stabilize the pH value of the immersion. The use of a buffer is not necessary but preferable.

We find that this process provides a uniform coating of nickel or nickel compound over the surface of the enameling iron and steel sheets, and this amount of coating is substantially uniform over the entire life of the bath.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claim which follows.

What is claimed is as follows:

A process for the immersion deposit of nickel on iron which comprises immersing the iron in a solution selected from the group consisting of nickel sulphate, nickel chloride, and nickel nitrate, and reducing the acidity of the solution by the addition of a compound selected the group consisting of lithium, sodium and potassium hydroxide.

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