Patented June 18, 1929. 1,717,468

UNITED STATES PATENT OFFICE.

LOUIS SCHULTE, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO ALLEGHENY STEEL COMPANY, OF BRACKENRIDGE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTROPLATING PROCESS.

No Drawing. Application filed May 29, 1926. Serial No. 112,687.

This invention relates to electro-plating and more particularly to the production of a dense, hard, bright, silver-like plating for iron and steel which will prevent the same from rusting.

Chromium plate having a hard, bright, silver-like surface has been deposited on iron and steel and while it has been claimed that this plate prevented the iron and steel from rusting, my experience has been that where the chromium metal is deposited directly on the iron or steel the plated metal will invariably rust if given a severe test.

Other experimenters having found, as I have, that chromium will not protect iron or steel from rusting when plated on it directly, have thought that if an underlying metal such as nickel, copper or cadmium were first plated on the steel, it might be possible to prevent it from rusting and at the same time obtain the advantageous properties of the chromium plating. None of the methods to this end which might be termed duplex methods, have so far as I am aware, been entirely satisfactory. In those cases where the duplex plating apparently protects against rusting, either the chromium plate or both the chromium and the underlying plate are liable to peel away from the steel or iron and so far as I know, no one has heretofore obtained a hard, bright, silver-like plating which would satisfactorily adhere to an iron or steel base and which would prevent the same from rusting, if subjected to a severe test.

An object of this invention is to provide a method whereby a hard, bright, silver-like coating may be deposited or electroplated onto steel or iron and which will tenaciously adhere thereto and prevent the same from rusting, even when subjected to severe tests.

In a broad way, the invention consists in first electroplating the iron or steel with a thin coating of cobalt and then with a coat of chromium on top of the cobalt coating.

The chromium coating is so extremely hard that it is difficult to buff the same and I, therefore, prefer to obtain a somewhat softer plating and to that end I deposit the cobalt and chromium simultaneously or as an alloy of the two metals.

An alloy of cobalt and chromium where the chromium predominates, when deposited onto iron or steel, presents a relatively hard, bright, silver-like surface which adheres so tenaciously to the base that the same can be bent and otherwise manipulated without causing the coating to peel. The coating being relatively softer than pure chromium can be more readily buffed and polished.

In cases where it is desirable to have a high mirror surface, on the finished articles, it is preferable to buff the articles prior to plating. I find that if this is done, the plating produced from my solution will have a high mirror finish without further buffing.

In case it is not desirable to deposit the chromium and cobalt as an alloy, or simultaneously, I find that the iron or steel articles plated with cobalt first followed by a chromium plating will not rust even though subjected to extremely severe tests.

In order to obtain a satisfactory cobalt coating, I use a cobalt solution made up of the following and in substantially the proportions given:—

50–75 grams of cobalt sulphate.

20–40 grams sodium sulphate.

5–15 c. c. of hydrofluoric or hydrofluosilicic acid in about 250 c. c. of water.

The formula which I find satisfactory for obtaining the chromium plating is substantially as follows:—

75 grams chromic acid.

3 grams caustic potash.

10 c. c. commercial hydrofluosilicic acid in about 250 c. c. of water.

I have found that a satisfactory cobalt deposit can be obtained in from five to ten minutes and that if this is followed by a chromium deposit of about one hour, the results will be satisfactory for most purposes. In producing the cobalt deposit a current of about 20 amperes per square foot or more is preferred and resembles those of high speed nickel deposition. I have been able by such current density to obtain in thousandth of an inch per hour deposit of cobalt which is smooth, dense and adheres tightly to the iron or steel.

In order to obtain satisfactory chromium plating, the current should be from 30 to 200 amperes per square foot. Ordinarily about 80% of the current utilized is wasted in the formation of hydrogen due to the chromic acid in the solution. I have discovered, however, that the hydrogen formation can be considerably reduced and the cathode efficiency thereby increased by the addition of the caustic potash (KOH).

By weakening the chromic acid with caustic potash and then reacidifying slightly with hydrofluosilicic acid I am able to obtain a bright chromium plating which is adherent and less porous than any other chromium platings known to me.

In order to plate the cobalt and chromium simultaneously or as an alloy of these two metals I mix a certain amount of the cobalt solution above mentioned with the chromium solution above mentioned. Since the cobalt plates more rapidly than the chromium this will have to be taken into consideration and the proportions will have to be regulated in accordance with the proportions of the two metals desired in the alloy. Since the current density is a factor in obtaining alloys through electrodeposition, the plater is in position to obtain the desired proportions of the metals forming the alloy. In other words, by adding a relatively small amount of cobalt salt preferably of the sulphate form to the chromium solution above specified an alloy consisting of 50% chromium and 50% cobalt can be obtained by using a high current density, and if a relatively large amount of cobalt salt is used in the chromium solution with a low current density the same result will be obtained.

It is preferable, however, to add but a relatively small amount of cobalt to the chromium solution and to use a high current density as the plating will be more satisfactory.

It will be found that the addition of the cobalt salt to the chromium solution reduces the formation of hydrogen and thereby increases the cathode efficiency in the same way that the addition of potash increases the cathode efficiency and the conductivity of the electrolyte.

Having thus described my invention, what I claim is:—

The method of obtaining deposits of cobalt chromium alloys on a ferrous base, which consists in passing an electric current through a bath in which the articles to be coated are immersed, said bath containing a mixture of the following solutions in which mixture the chromium solution predominates; one of said solutions being made up in substantially the following proportions:—50–75 grams cobalt sulphate, 20–40 grams sodium sulphate, 5–15 c. c. of hydrofluoric acid in about 250 c. c. of water; the other solution being in substantially the following proportions:—75 grams chromic acid, 3 grams caustic potash 10 c. c. of commercial hydrofluosilicic acid in about 250 c. c. of water.

In testimony whereof, I have hereunto subscribed my name this 26th day of May, 1926.

LOUIS SCHULTE.