

UNITED STATES PATENT OFFICE

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PLATING PROCESS

No Drawing.

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This invention relates to plating processes; and it comprises a process of electroplating iron and steel objects with other metals wherein the object is made an anode in a solution of chromic acid and a flow of current maintained until a brownish film coating forms and is then plated with a metal other than chromium, such as nickel, the brown film being sometimes removed before plating and sometimes not; all as more fully hereinafter set forth and as claimed.

As is well known, it is difficult by the ordinary plating processes to deposit various metals, such as nickel, as coatings of any substantial thickness with sufficient cohesion to the base to permit much, if any, stamping or punching of the coated base. The reason for this behavior is variously explained as being hydrogen adsorption, internal strains in the coating, etc. Whatever the reason, the peeling of nickel and other coatings is notoriously a difficulty in the art.

In a prior patent to one Pierce 1,645,927, there is described and claimed a method of fixing chromium to iron and steel wherein the iron or steel is made an anode in a solution of CrO_3 , or the ordinary chromium plating bath, prior to depositing the chromium coating. The anodic treatment of the object is quite brief and is not sufficiently long to produce any visible change in the iron surface. Chromium plating baths have extremely poor throwing power and the advantage of this Pierce process is apparently that it oxidizes the whole surface sufficiently to obviate local electrochemical differences; local couples. So to speak, the whole surface is made equally difficult to plate.

This Pierce process is applicable only to chromium plating; but I have discovered that I can use a like process in plating iron or steel with other metals than chromium with advantageous results. The most commercially advantageous results are in nickel plating but the advantage exists in the case of many other metals.

In this modification of the Pierce process under the present invention the suitably cleaned metal article, which is usually iron or steel is made an anode in a solution of chromic

acid (CrO_3) and operation is continued under current until a distinct brown film forms. A chromic acid bath of about 21°Bé . and containing 240 grams per liter of CrO_3 with about 2.5 grams of SO_4 per liter and 5 grams Cr_2O_3 per liter serves well for my purposes. Other CrO_3 baths may be used but one of the stated concentrations and proportions I regard as advantageous. Concentrations of SO_4 ranging between zero and 50 grams per liter have been used; but it has been noted that the presence of high proportions of sulfates causes considerable etching. Sometimes this is desirable but commonly it is not. Concentrations of CrO_3 as low as 100 grams per liter have been used but higher concentrations are in general more desirable. Saturated solutions have been used with satisfactory results. In the present operation chromate and bichromate solutions may be used although I regard CrO_3 as much more satisfactory. The current conditions should be such as to give free gassing. A temperature of 25°C . and a current density of 1 or 2 amperes per square inch of metal surface serves well. The time required to produce a good brown film varies with the particular steel or iron treated but is usually from 5 to 25 minutes.

After this treatment the object can be rinsed and transferred directly to a plating bath and plated in the usual way. Or, the film may first be removed either mechanically as by scrubbing the object with the aid of fine pumice-stone, or chemically by means of dips of concentrated sulfuric or nitric acids. I ordinarily remove the film.

The nature of the brown film is not known. Rinsing the filmed object will remove a portion of the film but to remove all requires either the use of a brush or a swab with considerable scrubbing or immersion in concentrated nitric or sulfuric acid. Even after scrubbing enough to polish the metal there is a slight brownish cast left on the treated surface.

By utilizing the present invention, nickel coatings can be made, if desired, much thicker than in ordinary ways of nickel plating without danger of lifting and peeling. Whatever its thickness, the coherence of the nickel

coating to the underlying steel is sufficient to permit a large amount of mechanical work on the coated metal; stamping and punching of the sheet for example.

5 The reason for the advantageous results secured in a plating operation following this anodic treatment of iron and steel in CrO_3 is not known. It may, or may not, be due to equalization of carbon content over the treated
10 surface or to the removal of undesirable impurities from the surface layer. As is well known, the carbon in iron and steel objects is not in homogeneous distribution and also rolling scale, molding sand or even dissolved
15 gases are often present on or near the surface.

The present process is particularly applicable in the production of nickel or other metal coatings on objects which are to be subsequently chromium plated; for instance,
20 steel or iron objects carrying a layer of chromium with an intermediate linking layer of nickel. The nickel plated object may be chromium plated in any of the usual ways.

25 Steel objects coated with nickel, or with nickel and chromium, according to the present process may be twisted to the breaking point, punched, ground, hammered, etc. without lifting or peeling the coating.
30 Boiler tubes coated with chromium with an intermediate coating of nickel have been flanged into headers without destroying or cracking the coating.

The present process may be applied in the
35 direct plating of iron and steel with chromium; the iron or steel being made an anode in a chromic acid solution until a brown film forms and then plated with chromium in the usual chromic acid bath. But I regard the
40 invention as more particularly advantageous in the production of coherent coatings of nickel and metals other than chromium.

What I claim is:—

1. In electroplating iron and steel articles
45 with other metals, the process which comprises making the articles an anode in a CrO_3 bath sufficiently long to produce a brown film coating and then plating a metal thereon.

2. In electroplating iron and steel surfaces
50 with other metals, the process which comprises making the article an anode in a CrO_3 bath sufficiently long to produce a brown film coating and then plating the nickel.

3. In electroplating iron and steel articles
55 with other metals, the process which comprises making the article an anode in a CrO_3 bath sufficiently long to produce a brown film coating, then plating with nickel and finally
60 plating with chromium.

4. In electroplating iron and steel objects,
the process which comprises making the article an anode in a CrO_3 bath sufficiently long to produce a brown film coating, removing
65 a major portion of this film and then making

the object a cathode in a plating bath to plate a metal thereon.

In testimony whereof, I have hereunto affixed my signature.

BATIST R. HAUEISEN.

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