Patented Oct. 13, 1942

2,299,054

UNITED STATES PATENT OFFICE

2,299,054

ELECTROPLATING

William J. Harshaw, Shaker Heights, and Kenneth E. Long, South Euclid, Ohio, assignors to The Harshaw Chemical Company, Elyria, Ohio, a corporation of Ohio

No Drawing. Application June 20, 1939, Serial No. 280,142

12 Claims. (Cl. 204—32)

This invention relates to the preparation of electrodeposits for chromium plating.

In our application, Serial No. 106,816, filed October 21, 1936, now patent No. 2,125,229, issued July 26, 1938, we described the production of bright deposits of nickel by the use in the regular or gray nickel bath of certain addition agents, namely, a brightening agent, a ductilizing agent and an agent for prevention of pitting. The addition agents used for brightening were described as selenium and tellurium compounds. The ductilizing agents were aromatic sulfonates such as naphthalene mono- and di-sulfonates. Aliphatic sulphates such as sodium lauryl sulfate; sodium octyl sulfate and the like were described for use for prevention of pitting.

In nickel plating according to the process described in our said patent, a difficulty, related to the use of selenium and tellurium compounds, apparently due to the presence of selenium or tellurium on the surface of the plate, was encountered when nickel plate produced as described was to be electroplated with chromium. A film forms on the surface of the nickel deposit and special cleaning or "activation" is necessary in order to prevent imperfections when the chromium deposit is applied to the nickel deposit.

We have tried a number of conventional cleaning methods but have not found any of them fully satisfactory.

For example, cathodic cleaning in a regular cleaning solution containing borax is effective in some cases, especially if a small amount of glucose or sugar be added, but not infrequently the film condition appears to be of such a thickness that cleaning in this manner cannot be effected in any reasonable length of time.

We also have tried adding copper cyanide to the cleaner, depositing a film of copper and removing such film with chromic acid either in the chromic acid bath or by a pretreatment, as well as plating on a film of zinc and stripping this with hydrochloric acid. Here again the cleaning is ineffective if the film condition is bad.

We have found, however, that by the following procedure the nickel plate can be quickly and effectively put in condition for the superposed chromium plate, viz., by placing the nickel plated article in an aqueous solution of sodium cyanide, and then using the metal plated article as an anode, passing an electric current therethrough at a voltage of from 2 to 10 volts for a period of about 1 second; we then reverse the current making the piece cathode for a few seconds, preferably not less than 5, up to several minutes. There is no definite time limit for such last mentioned step (cathodic treatment), but ordinarily 15 to 30 seconds will be quite sufficient. A suitable sodium cyanide solution will contain from 1 or 2 to 18, suitably 8 ounces per gallon and the solution may be used at room temperature or warm, as desired.

We find that by making the piece anode in a sodium cyanide solution, the objectionable film effect is removed, but apparently the nickel surface is left passive. However, by making the piece first anode and then cathode, the surface film is quickly stripped off during the anodic treatment and the surface of the metal then reactivated by the cathodic treatment. Where the shapes are very complicated, it may be necessary to continue the anodic treatment for as long as 5 or even 10 seconds before reversing the current and subjecting to the cathodic treatment. Fairly good results can be had, in some cases but not in all cases, without making the work anode at all.

In place of using a cleaning solution containing simply sodium cyanide, as specified above, we may substitute soda ash in part for such sodium cyanide and seemingly obtain results that are just about as good. An example of such modified solution would comprise approximately 4 ounces of sodium cyanide and 4 ounces of soda ash to a gallon of water. We have also found that sodium formate can be substituted in large part for the sodium cyanide and that a good cleaning bath can be had using only 1 or 2 ounces of sodium cyanide to 6 or 7 ounces of sodium formate per gallon of water. In the case of each of the named ingredients, or combination of ingredients, for the cleaning solution, it may be desirable to increase the conductivity of the latter by the addition of conducting salts. This would be more especially the case where the nickel plated article to be cleaned is of complicated shape, such as a radiator shell or the like.

We have also found that in place of subjecting the article first to anodic and then to cathodic treatment, satisfactory results can also be obtained by using an alternating current superimposed upon a direct current so as to obtain a cathode effect in excess of the anode effect. This, however, requires a somewhat more elaborate electrical set-up than simple current reversal, which we regard as providing the more practical procedure.

By following the above described procedure, it has been found commercially practicable to produce excellent deposits of chromium over bright

nickel produced from a selenium containing bath as described in our said patent.

This application is a continuation in part of our copending application Serial No. 221,012, filed July 23, 1938, which was a continuation in part of our application Serial No. 106,816, filed October 21, 1936, now Patent No. 2,125,229, issued July 26, 1938.

Having thus described our invention, what we claim is:

1. In an electroplating process, the steps of producing a bright electrodeposit of nickel containing a minor amount of a codeposited element of the class consisting of selenium and tellurium and preparing the said deposit for plating with another metal by a process including the step of making said deposit cathode in an aqueous bath essentially consisting of an aqueous solution of sodium cyanide.

2. An electroplating process including the steps of electrodepositing nickel from a nickel plating bath containing, in addition to water and a soluble nickel salt, a minor amount of a substance of the class consisting of compounds of selenium and tellurium and preparing such deposit for chromium plating by making the same anode and then cathode in a bath essentially consisting of an aqueous solution of sodium cyanide.

3. A process of preparing a selenium containing nickel electrodeposit for chromium plating including the steps of making the same anode and then cathode in an aqueous solution of sodium cyanide.

4. A process of preparing a selenium containing nickel electrodeposit for chromium plating including the steps of making the same anode and then cathode in a bath essentially consisting of an aqueous solution of sodium cyanide, the concentration of sodium cyanide being from 1 to 18 ounces per gallon.

5. A process of preparing a selenium containing nickel electrodeposit for chromium plating including the steps of making the same anode for a time not exceeding 10 seconds and cathode for a time not less than 5 seconds in a bath essentially consisting of an aqueous solution of sodium cyanide with a member of the group consisting of sodium carbonate and sodium formate, sodium cyanide being present to the extent of at least one ounce per gallon.

6. A process of activating a selenium containing nickel electrodeposit preparatory to chromium plating comprising making the same cathode in a bath essentially consisting of an aqueous solution of sodium cyanide in concentration from 2 to 18 ounces per gallon and for a period of time not less than 10 seconds.

7. A process of activating a selenium containing nickel electrodeposit preparatory to chromium plating comprising making the same alternately anode and cathode in an aqueous solution of sodium cyanide, sodium cyanide being present in said solution in concentration of at least one ounce per gollon.

8. A process of activating a nickel deposit containing a substance of the class consisting of selenium and tellurium preparatory to plating with another metal comprising making the same an electrode in an aqueous solution of sodium cyanide, the current employed being an alternating current superimposed upon a direct current, the deposit to be activated being made the cathode with respect to the direct current component of the electrolyzing current.

9. A process of preparing a selenium containing nickel electrodeposit for chromium plating including making the same alternately anode and cathode in an aqueous solution consisting essentially of sodium cyanide and a compound of the group consisting of sodium carbonate and sodium formate.

10. A process of preparing a selenium containing nickel electrodeposit for chromium plating including the step of making the same cathode for a period not substantially less than one second in an aqueous solution consisting essentially of sodium cyanide.

11. A process comprising preparing a selenium containing nickel electro-deposit for chromium plating by making the same cathode in a bath consisting essentially of an aqueous solution of sodium cyanide and a member of the group consisting of sodium carbonate and sodium formate, said solution containing at least one ounce of sodium cyanide per gallon of solution.

12. A process comprising preparing a selenium containing nickel electro-deposit for chromium plating by making the same anode and then cathode in a bath consisting essentially of an aqueous solution of sodium cyanide and a member of the group consisting of sodium carbonate and sodium formate, said solution containing at least one ounce of sodium cyanide per gallon of solution.

WILLIAM J. HARSHAW.
KENNETH E. LONG.