

# UNITED STATES PATENT OFFICE

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## METAL CLEANING AND PLATING PROCESS

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1

The present invention relates to a process of cleaning and plating metal parts. It is particularly concerned with a method for reworking or replating nickel plated parts.

In the electroplating of metal articles, it frequently becomes necessary to replate a certain number of the parts due to surface imperfections such as nicks, poor polish, etc. Generally, it is impossible in the case of nickel or nickel and chromium plated parts to carry out the replating process employing the standard electroplating processes used on new work. For example, when the part has been provided with a chromium layer over the nickel layer, it has ordinarily been found necessary to strip the article of the previously applied chromium plate and thereafter subject it to replating, employing a process differing in one or more respects from that originally employed to plate the article originally. It is therefore an object of the present invention to provide a process which can be employed either for plating new work or for reworking or replating old work. Another object of the invention is to provide a relatively inexpensive process for replating defective nickel plated parts including nickel plated parts which have also been provided with a layer of chromium. A more specific object of the invention is to provide a standard cleaning and plating process which can be employed either for the nickel or nickel and chromium plating of iron parts or for the replating of such plated parts.

One standard method for plating articles of iron or steel comprises anodically cleaning the part in an alkaline solution, dipping the cleaned part in a hydrochloric acid solution, copper flashing the acid-treated part, dipping the flashed part in sulphuric acid and thereafter applying a bright nickel plate which may or may not be followed by the application of a wear-resistant or decorative chrome plate. While this process is satisfactory for the plating of new work, it has not been found satisfactory for the repair or replating of worn or defective nickel or chromium plated articles due to the fact that the copper and nickel layers applied during reworking tend to blister and peel. In addition, in order to rework a chromium plated part, it is first necessary to include the additional steps of stripping the chromium plate from the nickel, for example, by a hydrochloric acid soak, after which the article is cleaned with a suitable lye solution. While it has been found that such parts can be satisfactorily replated by a process differing from the above described standard

2

process, for example by the steps of scrubbing of the stripped article with pumice sand, and the omission of the anodic alkaline cleaning step or steps and the substitution therefor of a simple alkaline wash without the application of any electric current, this practice has the obvious disadvantage of necessitating the complete segregation of reworked from new parts, and the separate processing thereof.

The present invention is based on the discovery that either new work or nickel or chromium plated articles can be satisfactorily plated or replated by a process which differs from the above described standard process for plating new work by the replacement of the hydrochloric acid dip by a cathodic etch in a strong hydrochloric acid bath. Briefly, the process of the present invention comprises anodic cleaning of the old or new work in a hot alkaline bath, and thereafter making the article the cathode in a solution of hydrochloric acid after which it is given a copper flash coating over which the nickel or nickel and chromium plates can then be applied. While the acid concentration of the hydrochloric acid bath is not critical and may range for example from 10 per cent to 100 per cent by volume of 21° Bé. acid, it has been found that the subject process is not effective for the replating of old work unless the work is made the cathode during the acid treatment.

A particularly useful process comprises making the part or parts the anode in an alkaline bath comprising an aqueous solution of about 12 ozs. sodium silicate (40–41° Bé.), 8 ozs. caustic soda and 2 ozs. tri-sodium phosphate per gallon of bath, and while holding the bath at a boiling temperature passing a current through the article as the anode employing a current density of 75 to 150 amperes per square foot of work surface at applied voltage of about 6 volts. During the anodic cleaning step any grease or dirt is removed from the surface of new work being processed and any chromium plate which may be present on old work is dissolved down to the underlying nickel surface. This anodic cleaning step, which may be repeated if necessary, is followed by a cold water rinse before introducing the part into a relatively strong or concentrated (e. g. 1:1) aqueous solution of hydrochloric acid. In the hydrochloric acid bath the part is made the cathode, and current densities and potential the same as those employed in the anodic alkaline cleaning bath can be employed. This step is essential in order to obtain satisfactory plating results particularly in the case of reworked parts.

3

One minute is usually sufficient to obtain the results desired, that is, the complete neutralization of the surface and the preparation thereof for the subsequently applied flash copper coating. After rinsing the part with water to remove excess acid, a flash copper coating is applied to the article in the usual manner, for example, by making the article a cathode in a solution of copper and sodium cyanides containing some soda ash and caustic soda. Ordinarily, the flash coating of copper is then subjected to a sulphuric acid dip (40% by weight of sulphuric acid) followed by the usual washing steps prior to the application of any of the standard nickel or bright nickel plates. The nickel plated part may or may not thereafter be given a chrome plate.

It is to be understood of course that in the re-working of plated parts in accordance with the present invention, the surface imperfections such as nicks, and polish or plate imperfections are removed, for example by means of a polishing wheel before subjecting the article to the above sequence of steps beginning with the anodic alkaline cleaning step.

The above described process is particularly adapted for the nickel or nickel and chromium replating of parts and can be carried out automatically or semiautomatically. It will be seen that the present invention has the advantage that the various steps previously employed for re-working parts such as the preliminary stripping of the chromium by soaking in acid and lye and scrubbing, etc., which were special steps outside of the regular plating process, have been eliminated. As the process is applicable, without modification, to both new and old, i. e. previously plated, work, a considerable saving in time, plating equipment, and materials is realized over the prior practices which included the separate handling of the two types of work.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of replating a nickel plated article from which a chromium plate has been stripped by anodic treatment in a caustic alkali solution for replating, which method comprises

4

immersing the nickel plated article in a strong hydrochloric acid solution and passing a current through said article as the cathode for about one minute at a current density of from 75 to 100 amperes per square foot, applying a flash coating of copper onto said article and nickel plating the copper flashed article.

2. The method of replating a plated article having thereon a layer of nickel and an outer layer of chromium on said nickel layer, which process comprising immersing the article in a boiling alkaline bath essentially containing sodium silicate, caustic soda and trisodium phosphate, passing a current through said article as the anode at a current density of 75-150 amperes per square foot of anode surface to strip the chromium layer and expose the nickel layer, thereafter immersing said article in a hydrochloric acid bath having a concentration of from 10 to 100 percent by volume of 21° Bé. acid, passing a current through said acid bath with the article as the cathode at a current density of from 75-150 amperes per square foot of cathode surface, and replating the article by applying thereto a flash copper coating, a nickel plating over the flash copper coating and a chromium plate over the nickel plate.

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