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PROCESS FOR CHROMIUM PLATING

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This invention relates to chromium plating of metallic articles and more particularly to the preparation of the surface to be plated in order to produce consistently thereon a uniformly lustrous deposit of chromium.

In the production of ornamental rust- and abrasion-resistant surfaces on metallic articles it has been found that a deposit of chromium gives a surface which is superior to nickel or copper in its rust- and abrasion-resistant qualities and which, if properly applied, gives a lustrous non-tarnishable surface without buffing.

The chromium may be plated directly upon steel or other suitable base metal but since a pound of chromium may not be as cheaply deposited as a pound of nickel or copper and, inasmuch as chromium does not seem to be superior to these metals in its rust prevention qualities, the base metal would ordinarily first be plated with nickel or copper or some combination of these metals and would merely be given a final coating of chromium.

One characteristic of all chromium plating solutions which are known today is that they do not plate well in the recessed portions of the object to be plated and so may leave exposed portions. Consequently it is desirable that the top coat upon which the chromium is deposited be nickel, as the color of nickel does not strongly contrast with the color of chromium. Therefore, if we are to produce an article of lustrous finish and with a top coat of chromium we prefer to apply a thin plate of nickel, then a plate of copper, then a plate of nickel. The nickel surface is then buffed, polished, prepared for chromium plating and plated in the usual chromium plating bath.

In processes which have been used heretofore to produce a chromium surface on a polished nickel article it has been the customary practice, in order to produce a uniformly lustrous surface, to dry the article before placing it in the chromium plating bath and to place the article in the bath with the current turned on.

It is the object of our invention to so prepare the polished nickel surface for plating that a bright deposit of chromium free from areas of inferior lustre may be consistently obtained. It is a further object of our invention to produce such a deposit without the necessity of drying the article before inserting it in the chromium plating bath.

We obtain the foregoing advantages, as well as others which will be apparent from the description and claims, by the use of the process to be described, the preferred operation being as follows:

The polished nickeled article is made the cathode in an alkaline cleaning solution, which may be a solution of caustic soda and sodium silicate, and is subsequently rinsed in water and dipped for a short time in a solution of hydrochloric acid. The article is again rinsed in water and is placed immediately in the chromium plating bath. After remaining in the chromium plating bath for at least two seconds the current is turned on and the article, as the cathode, is left in the plating bath until the desired thickness of deposit is obtained.

It is our theory that the success of this sequence of operations is due to the elimination of the metallic oxide which may form upon metal surfaces that have been exposed to air, and the maintaining of the article in that condition until the plating operation is completed. This is done by a cathodic reduction at the metal surface, followed by an acid treatment and the subsequent protection of the surface from further oxidation by maintaining it wet until the article is immersed in the chromium plating bath. The water film is then removed from the metal surface by diffusion and convection, so that chromium plating solution of substantially full strength is in contact with the metal surface before the current is turned on. We have found that this time interval of at least two seconds is essential to the substantially complete diffusion and convection of the water film into the chromium plating solution, but that the article may be left in the bath for a longer period without detrimental results. In the operation of a commercial process, however, it would be desirable that

this time should not greatly exceed the minmum stated.

We have found that other basic cleaning solutions may be substituted for the caustic soda and sodium silicate and also that other acids, such as sulphuric, chromic or nitric acid, may be substituted for the hydrochloric acid solution. It is obvious that if chromic acid is used for the acid dip the rinsing of the article before immersion in the chromium plating solution may be omitted and the wet articles may be passed directly to the plating tank.

The chromium plating bath we prefer to use is a solution containing 200 grams of chromic oxide, 1 gram of chromium sulphate and 7 grams of chromium carbonate per liter of solution, such a solution having a gravity of about 16° Baumé, but the process is equally applicable to operation in conjunction with all chromium plating solutions containing a large percentage of chromic acid and in which plating is done under such conditions that a uniformly lustrous deposit would be produced on an article prepared for chromium plating by the methods used heretofore. It is therefore obvious that our process is applicable to chromium plating baths containing various proportions of chromic acid, chromium sulphate and chromium carbonate, and also to baths which may consist of chromic acid and other compounds of chromium or other suitable substances.

It is also obvious to one skilled in the art that our invention may be applied to chromium plating operation in which any suitable anode is used, although we prefer to use an insoluble anode.

We have also found that successful results can be obtained by operating at a cathodic current density of 100 to 150 amperes per square foot of article to be plated and at a bath temperature of from 100° F. to 140° F. but we prefer to use a current density of about 100 amperes per square foot and a bath temperature of about 100° F.

We have explained our process as applicable to depositing chromium upon a nickel surface but it is apparent that such a series of steps may be advantageously used in the deposition of a superior deposit of chromium upon metallic surfaces other than nickel.

It is further apparent that any of the rinsing steps may be omitted where the mechanical transfer of liquid from one tank to the other is not objectionable. Also, it is apparent that the article might be placed in the chromic acid chromium plating bath immediately after the first rinse and allowed to remain there a somewhat longer period before turning on the current, so utilizing the acid of the bath for the acid dip.

Having thus described our invention, what we claim is:—

1. In a process for chromium plating, the succession of steps comprising cleaning the article as a cathode in an alkaline bath, dipping in an acid bath, rinsing, placing immediately in a chromium plating solution and turning on the current when the article has been in the solution about five seconds.

2. In a process for chromium plating an article having a nickel surface which has been exposed to the air, the following sequence of steps: electrolytically cleaning the nickel surface as the cathode in an alkaline cleaning solution, dipping the article in an acid bath, rinsing, dipping the wet article into a chromium plating bath and turning on the current after at least two but not more than five seconds have elapsed.

3. In a process for chromium plating an article having a nickel surface, the succession of steps comprising, cleaning the article as a cathode in an alkaline bath, dipping in an acid bath, placing while wet in a chromium plating solution, and turning on the current when the article has been in the solution about five seconds.

4. In a process for chromium plating, the succession of steps comprising, electrically cleaning the article as a cathode in an alkaline bath, dipping the same in an acid bath, dipping the wet article in a chromium plating bath containing a high percentage of chromic acid, allowing the same to remain in that solution at least two seconds before turning on the current but turning on the current before the article has been rendered passive by the solution.

In testimony whereof, we hereunto affix our signatures.

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