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PROCESS OF PRODUCING CHROMIUM PLATED ARTICLES WITH MIRROR LIKE SCRATCH FINISH OR THE LIKE SURFACES

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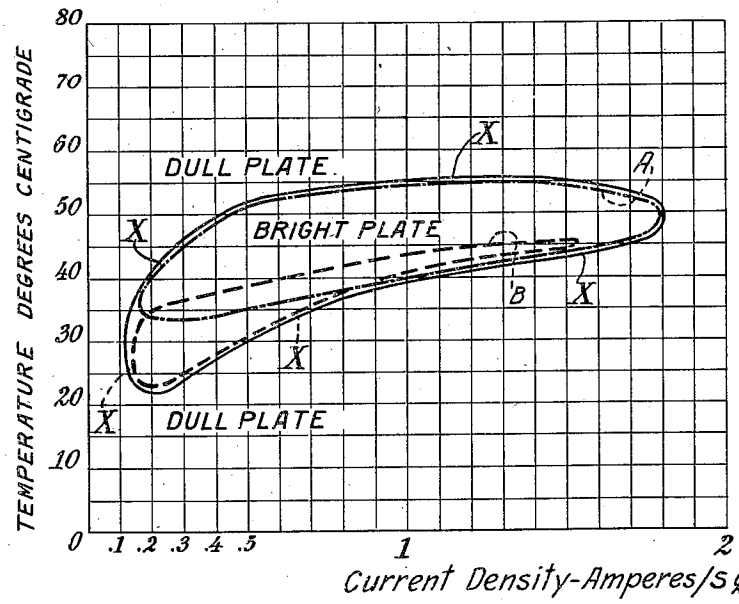

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UNITED STATES PATENT OFFICE

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PROCESS OF PRODUCING CHROMIUM-PLATED ARTICLES WITH MIRRORLIKE, SCRATCH-FINISH, OR THE LIKE SURFACES

Application filed September 19, 1925. Serial No. 57,290.

This invention relates to chromium-plated articles having mirror-like image-reflecting surfaces, scratch finish surfaces and the like, and to processes of producing the same, and aims to provide improvements therein.

Chromium plate being very hard, it is not possible to produce mirror-like and scratch finish surfaces on articles plated with chromium with anything like the same facility that such surfaces are produced on silver- and nickel-plated articles, by methods analogous to that practiced in producing such surfaces on such silver- and nickel-plated articles.

Nickel-plated and silver-plated articles, with a mirror-like or scratch finish surface, are usually produced by plating the surface with nickel or silver, and then polishing the surface on a buffing wheel, or scratching the surface with a brush.

The present invention provides a novel chromium-plated article and a process whereby mirror-like image-reflecting surfaces may be produced on chromium-plated articles especially such articles having a thin plate thereon (one thousandth inch for example), in a manner which is more simple and easy and less costly than polishing the hard chromium surface.

According to the present invention, the article to be plated is first polished on a buffing or polishing wheel or the like, to produce a smooth bright polished image-reflecting surface, or scratch finished by the use of a scratch brush or the like, as it has been found that an adherent plate of chromium may be plated on such a prepared surface, in a thin plate, and under certain conditions of plating, to faithfully represent the underlying surface as to scratch finish and polished or mirror-like appearance.

By scratching methods or manipulations, various so-called "soft" finishes may be obtained, as for example various kinds of "satin" finishes.

The prepared article (polished or scratch finished) is thereupon put into a chromium plating bath, and chromium plated on the article under those conditions which produce the bright mirror-like surface.

For a chromic acid plating bath, containing a suitable addition of catalytic agent or radical (such as a bath containing 2–8 grams per litre sulphuric acid, or equivalent sulphate, or fluorid—optimum 5 grams per litre,—to 500 grams per litre of chromic acid) the conditions of obtaining a mirror-like deposit are to maintain temperatures between 24° to 45° inclusive, in the bath, and to maintain current densities approximately between ⅛ to 1.5 ampere per square inch inclusive. These conditions are best shown on the accompanying graph, on which the ordinates indicate temperatures (centigrade) and the abscissas indicate current densities in amperes per square inch. The dot and dash line A circumscribes the area on the graph for reliable plating conditions using a solution containing 250 grams per litre of chromic acid and 2.5 grams per litre of sulphuric acid, and the dotted line B circumscribes the corresponding area for a solution of double the concentration of chromic and sulphuric acids. The line X (composed in part of the line A and in part by the line B) circumscribes the area on the graph wherein reliable mirror-plate may be obtained.

The conditions for carrying on the plating which appear to give best results and to be most satisfactory, all things considered, and the one used in practice, is to use a bath containing 500 grams chromic acid, 5 grams sulphuric acid (as a catalytic agent), and current densities from .5 ampere to .75 ampere per square inch, and to maintain the temperature at approximately 40° C.

It is pointed out that the area circumscribed by the line X is approximate, as mirror-like plate may be obtained outside of the area circumscribed, but not reliably, the plate being liable to be spotted with dull spots, especially at corners and near edges. At the right side of the graph, mirror-like plate may be obtained at temperatures and current densities greater than those circumscribed, but the uncertainty here is the appearance of nodules. Moreover, the amount of the catalytic agent present has an effect on the area circumscribed by the line X, and with a lower ratio of

chromic acid to catalytic agent than 500 to 5 given herein, the area will be less and with a greater ratio, the area will be slightly greater. Furthermore, the concentration of the chromic acid also has an effect on the circumscribed area, reduction of the concentration enlarging this area, as may be seen by a comparison of the area included within the dot and dash line A with the area within the dotted line B.

A rational use of the data given herein and shown by the annexed graph indicates the desirability, when plating articles, of operating at the higher temperatures and current densities within the bright plate range of the bath, as the current density range at the higher temperatures is wider than at the lower temperatures.

A plate of desired thickness (a thickness of ½ to 1 mil—five ten-thousandths to one-thousandth of an inch—is usually sufficient for most purposes) may be obtained in from one and a half to three hours, depending principally upon the temperature and current density of the bath.

No polishing or scratching of the plate after removal from the bath is required, as the plate faithfully represents the polish or scratch finish of the underlying surface. In nickel and silver plating the polishing and scratching is effected after plating, first of all because the plate as it comes from the bath is dull, and secondly because these metals are relatively soft and "flow" well under the buffing wheel, and are readily scratched for scratch finish. Chromium is too hard to "flow" and is not easily scratched by the usual scratch brushes, so polishing would involve a considerable abrasion of the surface, and this would in turn require thicker initial deposits than in the case where the polishing and scratch finishing is produced on the underlying metal. This would require that the article remain in the bath a longer time, which is an objection of considerable importance.

Where the underlying or foundation metal is hard (steel for example) the polishing and scratching may be simplified by first coating the steel with a softer metal—copper, for example—and polishing or scratching this softer metal to produce the character of surface desired in the finished surface. The plating baths described herein may be prepared and maintained according to my Patent 1,581,188, dated April 20, 1926.

What is claimed is:

1. The process of producing a chromium plate surface of a desired ornamental appearance upon an article having a metal or alloy surface which does not have formed thereon an insoluble precipitate when in contact with a chromic acid plating bath, said process comprising preparing said metal or alloy surface, prior to chromium plating, so that it has the ornamental appearance desired for the finished surface, then electroplating the same with chromium in a bath prepared and maintained in the proportion of 500 grams of chromic acid (CrO_3) per liter and from 2 to 8 grams of sulphate (SO_4) per liter or an amount of other acid radical equivalent in effect (the optimum being 5 grams of sulphate (SO_4) per liter for a bath containing 500 grams of chromic acid (CrO_3) per liter) and a proportionately lower or higher sulphate (SO_4) content for a lower or higher chromic acid (CrO_3) content, while substantially maintaining for a given temperature the cathode current density range delineated by the line X on the accompanying graph.

2. The process of producing a bright, image-reflecting chromium plate surface upon an article having a metal or alloy surface which does not have formed thereon an insoluble precipitate when in contact with a chromic acid plating bath, said process comprising preparing said metal or alloy surface, prior to chromium plating, so that it is smooth, bright and image-reflecting, then electroplating the same with chromium in a bath prepared and maintained in the proportion of 500 grams of chromic acid (CrO_3) per liter and from 2 to 8 grams of sulphate (SO_4) per liter or an amount of other acid radical equivalent in effect (the optimum being 5 grams of sulphate (SO_4) per liter for a bath containing 500 grams of chromic acid (CrO_3) per liter) and a proportionately lower or higher sulphate (SO_4) content for a lower or higher chromic acid (CrO_3) content, while substantially maintaining for a given temperature the cathode current density range delineated by the line X on the accompanying graph.

3. The process of producing a scratch (butler, sand-blasted, etc.) finish chromium plate surface upon an article having a metal or alloy surface which does not have formed thereon an insoluble precipitate when in contact with a chromic acid plating bath, said process comprising preparing said metal or alloy surface, prior to chromium plating, so that it has a scratch (butler, sand-blasted, etc.) finish of the ornamental appearance desired for the finished surface, then electroplating the same with chromium in a bath prepared and maintained in the proportion of 500 grams of chromic acid (CrO_3) per liter and from 2 to 8 grams of sulphate (SO_4) per liter, or an amount of other acid radical equivalent in effect (the optimum being 5 grams of sulphate (SO_4) per liter for a bath containing 500 grams of chromic acid (CrO_3) per liter) and a proportionately lower or higher sulphate (SO_4) content for a lower or higher chromic acid (CrO_3) content, while substantially maintaining for a given temperature the cathode current density range

delineated by the line X on the accompanying graph.

4. The process of producing a chromium plate surface of a desired ornamental appearance upon an article having a metal or alloy surface which does not have formed thereon an insoluble precipitate when in contact with a chromic acid plating bath, which consists in the following five steps in combination: (*a*) preparing said metal or alloy surface so that it has the ornamental appearance desired for the finished surface; (*b*) employing a bath prepared in the proportion of 500 grams of chromic acid (CrO_3) per liter and from 2 to 8 grams of sulphate (SO_4) per liter or an amount of other acid radical equivalent in effect (the optimum being 5 grams of sulphate (SO_4) per liter for a bath containing 500 grams of chromic acid (CrO_3) per liter) and a proportionately lower or higher sulphate (SO_4) content for a lower or higher chromic acid (CrO_3) content; (*c*) selecting a temperature approximately 25° C. to 55° C., as indicated by the line X on the graph as about the bright plate range; (*d*) determining by reference to the accompanying graph the optimum current density to employ with the three conditions already selected in order to faithfully reproduce the ornamental appearance of the prepared surface; (*e*) electrolyzing while maintaining these conditions of composition, temperature and current density.

In witness whereof, I have hereunto signed my name.

COLIN G. FINK.