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COATING WITH CHROMIUM

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One of the objects of my invention is the deposition of chromium for the covering or plating of a non-metallic surface, said surface being rigid as of glass, porcelain, china or stoneware; or the non-metallic article may be covered with a layer, skin, pellicle or coating containing chromium on the exterior when of flexible material, such as leather, celluloid, paper, rubber, textiles or similar foundation or base intended to be metallized, by application thereto or thereon of a coating the exterior or visible portion of which is chromium.

I have found, by operating according to my invention as herein described, that it is possible and commercially feasible to attach an exterior layer or deposition of chromium to a non-metallic surface irrespective of whether that surface is rigid or flexible, and thereby prepare flexible or non-flexible coated articles with chromium thereon as by proceeding in the following manner, the two examples given herewith being for illustrative purposes only, and it is to be understood may be varied within wide limits and still be within the limits of my invention.

1. Chromium plating a rigid non-metallic article. A glass or porcelain container as bottle or salt cellar is taken, and the surface thereof preferably roughened either mechanically or chemically for more uniform and better adhesion. It is immaterial as to the size, shape, configuration or pattern previously inlaid or impressed thereon. The surface may be roughened mechanically as by submission of the article to the action of a sand blast, or may be roughened chemically by treatment of the surface with a solvent therefor, such as hydrofluoric acid. If a preliminary abrasion treatment has been applied, it is advisable to thoroughly remove mechanically any detached particles and to cleanse the surface thoroughly, as by an air blast. If a solvent of silica has been applied, it is desirable that the surface afterwards be rendered neutral by washing. While it is not always necessary to submit the surface to an abrasive treatment as above indicated, it is usually advantageous in that the adhesion of the deposited portion is more tenacious, hence liability of scaling, chipping or peeling correspondingly minimized.

The cleaned article is then immersed in an aqueous solution of tin sulfate of 5° Baumé strength for less than five minutes, removed, partially or superficially rinsed with water, and without previous drying, treated simultaneously by pouring over the article, a solution comprising 1 oz. silver nitrate and 1 oz. 28% aqua ammonia in

one qt. water, and also an aqueous solution of 1 cc. 40% formaldehyde solution per quart of water. The surface of the article being treated takes on a yellowish, milky appearance.

The coated article is next plunged into water to rinse off the silver and formaldehyde solutions, and then submerged in a solution prepared by dissolving copper sulfate in water to a density of about 25° Bé. at room temperature. A current of 5 to 15 amperes is then applied, the article being left in this solution for about 5 to 15 minutes. The strength of current and length of immersion will be governed somewhat by the ratio of copper sulfate solution to bulk of material being treated at one time.

The article after removal from the copper solution is then rinsed in cold water, followed by immersion in an aqueous nickel sulfate solution of about 25° Bé. strength for about 2 hours, the current beginning at 15 amperes and gradually rising to 25 amperes toward the close of the operation. The article is then taken out of the solution and dried after washing. Before attachment of the chromium constituting the outer layer, I have found it beneficial to polish the surface by means of a rag wheel with some relative soft abrasive thereon as chalk, and at the close of this step, the article is plunged into cold or warm alkali solution, such as 5% sodium hydroxide solution, to remove any fatty or waxy component that may have been acquired in the polishing operation.

The article is then immersed in a chromic acid solution in water of 25°–40° Bé. strength, preferably somewhat warm, at 100–200 amperes for 3 to 10 minutes, usually 5 minutes after which the article is withdrawn, rinsed in water and dried.

In my experience it is advisable to introduce the step of immersion of the article to be coated in a tin salt solution, as it appears to increase the adhesion of the silver in the succeeding step. Likewise I have found that the interposition between the copper and chromium of a thin film of nickel is advantageous on account of resulting in the formation of a more compact, less porous and spongy surface for the deposition of metallic chromium.

2. Chromium plating a flexible non-metallic surface. In the plating of surfaces such as leather, celluloid, rubber or paper, according to my invention, the method above outlined is used, except the abrasive or hydrofluoric acid solvent step is omitted, and with the exception that I have found it usually advisable to prepare the surface with a filler or coating composition suit-

able for the purpose and not incompatible with the succeeding steps of treatment, such as the application as a unitary or plurality of coats of a shellac solution in a volatile solvent or of a varnish or enamel. Upon this surface, after evaporation of volatile solvent, the operations and steps above indicated are applied.

To one skilled in the art to which this invention appertains, it is obvious that concentrations, time factors and current strengths may be varied in order to produce varying effects and amounts of metal deposited, and still conserve the essence of my invention which is the formation of a chromium covering upon a non-metallic article or base, whether that base be primarily of inorganic material such as a silica-containing body, or organic material as paper, leather, rubber or celluloid, and irrespective of the absence of flexibility or its presence in the base to be covered.

By proceeding according to the steps, and under the range of conditions above stated, I am able to obtain a uniform deposition of chromium of high gloss upon flexible and rigid non-metallic articles.

What I claim is:

1. A process for coating a non-metallic rigid article with a chromium compound comprising immersing in an aqueous solution of tin sulfate of about 5° Bé. strength washing superficially, then simultaneously pouring over the article a solution comprising one ounce silver nitrate and one ounce 28 per cent aqueous ammonia in one quart water together with a solution of formaldehyde, rinsing in water, then submerging in a copper sulfate solution of about 25° Bé. strength to which an electric current of 5 to 15 amperes is applied, rinsing in water, immersing in aqueous nickel sulfate solution of about 25° Bé. strength, then washing, drying, polishing, washing in alkali solution, and immersing in a chromic acid solution of 25-40° Bé. strength for 3 to 10 minutes at 100

to 200 amperes, finally rinsing the article in water and drying.

2. A process for coating a non-metallic article of organic composition with a chromium compound comprising immersing in an aqueous solution of tin sulfate, washing superficially, then simultaneously pouring over the article a solution comprising one ounce silver nitrate and one ounce 28 per cent aqueous ammonia in one quart water together with an aldehyde solution, rinsing in water, then submerging in a copper sulfate solution of about 25° Bé. strength to which an electric current is applied rinsing in water, immersing in aqueous nickel sulfate solution of about 25° Bé. strength for about two hours at 15 to 25 amperes, then washing, drying, polishing, washing in alkali solution, and immersing in a chromic acid solution of 25-40° Bé. strength for 3-10 minutes at 100 to 200 amperes finally rinsing the article in water and drying.

3. A process for coating a non-metallic article of organic composition with a chromium compound comprising immersing in an aqueous solution of tin sulfate of about 5° Bé. strength washing superficially, then simultaneously pouring over the article a solution comprising one ounce silver nitrate and one ounce 28 per cent aqueous ammonia in one quart water together with a solution of formaldehyde, rinsing in water, then submerging in a copper sulfate solution of about 25° Bé. strength to which an electric current of 5 to 15 amperes is applied rinsing in water, immersing in aqueous nickel sulfate solution of about 25° Bé. strength for about two hours at 15 to 25 amperes then washing, drying, polishing, washing in alkali solution, and immersing in a chromic acid solution of 25-40° Bé. strength for 3-10 minutes at 100 to 200 amperes, finally rinsing the article in water and drying.

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