

## UNITED STATES PATENT OFFICE

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## ART OF GOLD PLATING

Joseph E. Underwood, Camden, N. J., assignor to  
C. Howard Hunt Pen Company, Camden, N. J.,  
a corporation of New Jersey

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This invention relates to the electrodeposition of gold on the surface of an article formed from a chromium alloy steel such, for example, as so-called "stainless steel".

5 The invention, moreover, is especially useful in the manufacture of pen points, it being a major object of the invention to provide a method for gold plating "stainless steel" whereby to make possible production of a pen point which is characterized by three important qualities, to wit:

10 (a) A high resistance to corrosion and acid attack;

(b) Gold surface and appearance; and

(c) Low cost in manufacture.

15 It has been common practice to employ solid gold pen points in fountain pens, and such pen points, of course, have a high degree of corrosion resistance and, naturally, the desired gold surface and appearance. However, the cost of these pen points is obviously high, and the invention is concerned with a relatively simple process especially suitable in producing such an inexpensive article of this type.

In prior application Serial No. 707,502, filed 25 January 20, 1934, issued May 5, 1936, as Patent No. 2,039,326, of Hiram S. Lukens, assignor to the assignee of this application, there is disclosed a pen point of the general type to which the present invention relates, and also a method for producing such an article, on which method the present invention is an improvement.

30 Briefly stated, in accordance with said prior application, a pen point was produced by first forming the pen from a chromium alloy steel containing, for example, 18% chromium, 8% nickel and the balance iron. While it is not essential, I preferably add about 2½% molybdenum or some other similarly acting ingredient serving to increase the resistance of the alloy to attack by 35 certain acids, particularly hydrochloric which, from time to time, is found in small percentages in commercial inks.

The base or body of the pen, therefore, is highly resistant to attack by acids and also to corrosive influences of various different types usually encountered in use of the pen.

45 Following formation of the pen from an alloy of this nature, in accordance with said prior application, the pen is subjected to treatment in a concentrated hydrochloric acid bath. Thereafter the article, in accordance with the prior application, was rinsed in a dilute hydrochloric acid bath and then immersed in a gold plating bath containing the following:

55 1 gallon water  
½ oz. sodium gold cyanide  
8 ozs. sodium cyanide  
1 pt. hydrochloric acid

60 After an initial deposit of gold from this plat-

ing bath, an additional gold film was applied from a gold plating solution of the alkaline type.

In the prior process referred to above the gold plating bath, because of the presence of the cyanide and the hydrochloric acid, also contained 5 hydrocyanic acid which, as is well known, is a highly poisonous substance.

In accordance with the present invention I am enabled to eliminate the presence of hydrocyanic acid in any of the baths and also to simplify the 10 process. When proceeding in accordance with my preferred process, I first form the pens from a chromium alloy steel as hereinbefore described, and then subject the pens to a thorough cleaning action, preferably in an alkaline (for example, 15 potash) cleaning solution in which an electric current is caused to flow to and from the cleaning solution and the pens. The pens are then placed in an acid pickle containing, for example, from about 10% to about 50% hydrochloric acid, 20 and an electric current is passed between the acid solution and the pens. The action of this bath apparently is to remove the oxide film normally present on the pens.

Thereafter, I plate the pens in an alkaline type 25 of gold plating solution which I have found may contain the following ingredients in about the proportions indicated:

1 gallon water  
½ oz. sodium gold cyanide 30  
2½ ozs. sodium cyanide

While the gold content of a plating bath of this nature may be permitted to drop very considerably when plating other metals, I have found 35 that the content should preferably be at least sufficient to give about .35 grams of metallic gold per liter of solution. Preferably the content should be a little higher, as is the case with a solution prepared in accordance with the above 40 formula.

While it is not essential, I also prefer to complete the cathode connection to the pens prior to immersion into this bath, this being especially true in instances where the cyanide content is 45 relatively high. This is desirable apparently for the reason that the cyanide content, particularly in the upper ranges, has a tendency to promote the redevelopment of the oxide film. It therefore is of importance to secure at least some gold 50 deposit directly on the base metal before any appreciable oxide film reforms.

Following the initial plating bath in accordance with this invention, the pens may be given a second coating if it is so desired, although this 55 is not of the same importance as when practicing the prior methods, for the reason that the initial bath in accordance with this invention is of the alkaline type and provides a good surface texture and gold color, whereas a gold deposit from an 60

acid bath, though adherent, is not of the best characteristics in other respects.

The present invention therefore eliminates the necessity for using hydrocyanic acid in any of the baths and also materially simplifies the entire process.

I claim:—

1. A method for gold plating a chromium alloy steel article which method includes treating the surface of the metal by immersing the article in a bath essentially consisting of an aqueous solution of hydrochloric acid, passing an electric current between the article and the bath to dissolve the oxide film normally present on the surface of a chromium alloy steel, and thereafter electrodepositing a layer of gold on the surface of the article treated as above from an aqueous alkaline cyanide plating bath containing a gold salt in quantity sufficient to provide at least .35 grams of metallic gold per liter, the plating being initiated substantially simultaneously with immersion of the article into the plating bath

so as to secure bonding of the gold to the article prior to appreciable reformation of the oxide film thereon.

2. A method for gold plating a chromium alloy steel article which method includes treating the surface of the metal by immersing the article in a bath essentially consisting of an aqueous solution of hydrochloric acid, passing an electric current between the article and the bath to dissolve the oxide film normally present on the surface of a chromium alloy steel, and thereafter electrodepositing a layer of gold on the surface of the article treated as above from an aqueous alkaline cyanide plating bath containing about  $\frac{1}{2}$  ounce sodium gold cyanide and about  $2\frac{1}{2}$  ounces sodium cyanide per gallon, the plating being initiated substantially simultaneously with immersion of the article into the plating bath so as to secure bonding of the gold to the article prior to appreciable reformation of the oxide film thereon.

JOSEPH E. UNDERWOOD.