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PROCESS FOR METALIZING NONMETALLIC ARTICLES

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This invention relates to a process for the metalization of plastics and other non-metallic substances, such as paper, Celluloid, sheet cork, ivory, bone, hard rubber, wood, leather, cloth, horn, pressed woods, imitation leather, glass, porcelain products and plastic materials which are not reactive to alcohols, ketones and esters, and the products resulting therefrom.

It has heretofore been proposed to coat non-metallic substances with metal, such as silver or copper, but these processes have not been entirely satisfactory due to cost, time consumed in treating the substance to be metalized, and lack of durability.

An object of the present invention is to provide a simple and novel process for metalizing non-metallic substances which can be carried out by an unskilled worker and one which requires very little time and wherein the resulting product is durable and relatively inexpensive.

The new process includes the steps of subjecting the non-metallic substance, or article to be metalized, to three baths to be specified hereinafter, and then a plating operation of any well-known type now in use. As one example of carrying out the novel process, the same will be described, merely for the purpose of illustration, in connection with the metalization of plastics cellulose nitrates, and cellulose acetates and plastics which do not react to alcohols, ketones and esters.

A plain, clean sheet of cellulose nitrate plastic is first subjected to a bath of acetone, denatured alcohol and silver nitrate. This bath or solution is formed by dissolving silver nitrate crystals in denatured alcohol at a temperature of approximately 15° C., or slightly higher, and this mixture is added to acetone. Preferably the bath comprises 50 parts by volume of denatured ethyl alcohol, 50 parts by volume of acetone and silver nitrate crystals of from 5 to 10 parts of the mixture of acetone and alcohol. Nothing is gained by adding more than 10 parts by volume of silver nitrate although if an alcohol of a higher specific gravity is used a greater amount of silver nitrate crystals will be dissolved. The best results have been obtained by using ethyl alcohol in the bath where methyl alcohol or acetone is used as the denaturant. The plastic sheet is dipped into the bath at room temperature, i. e., approximately 65° F., for thirty seconds and after this dip the article is dried, preferably in a stream of warm air.

After the initial silver dip, the plastic sheet is

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dipped in the following solution to oxidize the silver deposited on the sheet in the first dip:

To equal parts of water and denatured ethyl alcohol by volume add 5 or 10% of a light metal hydroxide, such as sodium hydroxide or potassium hydroxide. The denatured alcohol content of this solution should not drop below 50%. When the hydroxide is added, the solution will turn an amber color. The solution should be allowed to age for at least 24 hours before using. The treated sheet of plastic is now given a thirty second dip in this oxidizing solution at room temperature whereupon the solution oxidizes the silver on the sheet converting it to either silver hydroxide or silver oxide. If a heavier coating is desired the sheet may be left in the solution for 40 or 50 seconds. It is then dried and is ready for a reducing bath.

In order to prepare the reducing bath a selected quantity of water is saturated with sulfur-dioxide gas to obtain sulphurous acid,

$$H_2O+SO_2=H_2SO_3$$

Sodium sulphite is now added to the sulphurous acid until the reaction of the acid ceases. There is thus obtained a saturate solution of sodium bisulphite which has good keeping qualities and which is used as a stock solution. A 12 to 15% water solution of the sodium bisulphite is now placed in a suitable container, such as a bottle, and powdered zinc is added. For example, to 60 c. c. of the stock solution of sodium bisulphite is added 500 c. c. of water and into this is poured powdered zinc to obtain the following reaction:

$$4NaHSO_3+Zn=ZnSO_3+Na_2SO_3+2H_2O+Na_2S_2O_4$$

This mixture is kept cool as by means of ice or cold water until the reaction between the zinc and the acid of the bisulphite has been completed. A portion of the zinc sulphite is converted into a basic salt and SO_2, thus set free, is then reduced in turn by the excessive zinc present. A reducing bath thus formed gives fair results if used within a few hours after it is first made but better results are obtained if the bath is aged for 24 hours or more. It should be kept corked in a cool place. The plastic coated strip from the oxidized bath is now dipped into the reducing bath for from 1 to 2 minutes, or the reducing bath can be wiped on with a piece of cotton, whereupon the oxidized silver on the strip is converted into metallic silver which closely adheres to the plastic surface. The strip is now rinsed in water and dried and a slight burnishing with cotton will bring out the

silver finish. The strip can then be plated with any suitable material, such as copper, where the required temperature of the plating bath is below the danger point of deterioration of the plastic base.

The reducing bath slowly oxidizes and hence must be kept in a closed container. It has been found that if a small amount of sugar, honey, or glycerine is added, the oxidation will be slowed and the keeping properties improved. It is noted that meta bisulphite should not be used in making the reducing bath because if used sulphides will be formed and the results will be unsatisfactory.

When metalizing the other non-metallic substances referred to above, such as rubber, for example, it is preferred to make a solution of a cellulose nitrate plastic and acetone to the consistency of light cream. The rubber, or other article, is dipped into this cream, then dried and processed in accordance with the procedure outlined above for the cellulose nitrates strip.

There is thus provided a novel and simple method for metalizing non-metallic substances and one which can be quickly and inexpensively carried out. The product obtained is durable and has a wide variety of uses as will be apparent to those skilled in the art.

What is claimed is:

1. A process for metalizing non-metallic articles of the class described which includes the steps of subjecting the article to a bath of denatured alcohol, acetone and silver nitrate, drying and subjecting the article to a bath of water, denatured alcohol and an alkali metal hydroxide, and drying and subjecting the article to a reducing bath of sodium bisulphite and zinc.

2. A process for metalizing non-metallic articles of the class described which includes the steps of treating the article with a silver nitrate solution, subjecting the treated article to alcohol, metal hydroxide oxidation of the silver deposited thereon from the first solution, and subjecting the article to a solution containing zinc sulphite to convert the oxidized silver to metallic silver.

3. A process for metalizing non-metallic articles of the class described which consists in subjecting the article to a silver nitrate-denatured alcohol-acetone bath, drying the article, subjecting the dried article to a bath of water, denatured alcohol and an alkali metal hydroxide, drying the article, dipping the dried article in a bath of sodium bisulphite and zinc, and washing and drying the article.

4. A process for metalizing non-metallic articles of the class described which includes the steps of subjecting the article to a silver nitrate-denatured alcohol-acetone bath, drying the article and subjecting it to an oxidizing bath of denatured alcohol, water and sodium hydroxide, drying the article and subjecting it to a bath formed by introducing powdered zinc into sodium bisulphite.

5. A process for metalizing a plastic article which consists in dipping the plastic article in a silver nitrate-denatured ethyl alcohol-acetone bath, drying the article, subjecting the dried article to a bath of water, denatured ethyl alcohol and sodium hydroxide, drying the article, dipping the dried article in a bath of sodium bisulphite and zinc, and washing and drying the article.

6. A process for metalizing a non-metallic article of the class described which includes the steps of subjecting the article to a silver nitrate bath for approximately thirty seconds at room temperature, drying and subjecting the article to an oxidizing bath of water, denatured ethyl alcohol and sodium hydroxide at room temperature for approximately thirty seconds, drying the article and subjecting the same to a bath containing zinc sulphite for approximately two minutes at room temperature.

7. A process for metalizing a non-metallic article of the class described which includes the step of subjecting the article to a solution of cellulose nitrate and acetone having a consistency of light cream, drying the article, subjecting the article to a bath of denatured alcohol, acetone and silver nitrate, drying and subjecting the article to an oxidizing bath of water, denatured alcohol and an alkali metal hydroxide and drying and subjecting the article to a reducing bath of zinc and sodium bisulphite.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
906,229	Von Hoessle	Dec. 8, 1908
1,452,281	Marino	Apr. 17, 1923
1,744,281	Pfiffner	Jan. 21, 1930
1,941,438	Kiefer	Dec. 26, 1933
2,351,940	Dupuis	June 20, 1944
2,355,933	Weiss	Aug. 15, 1944

FOREIGN PATENTS

Number	Country	Date
2,698	Great Britain	1915
644,429	France	June 5, 1928