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METAL COATED PLASTIC MATERIAL AND
METHOD OF PRODUCING THE SAMEBernard F. Walker, Cedarhurst, N. Y., assignor
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corporation of New YorkNo Drawing. Application May 3 1939,
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4 Claims. (Cl. 204—38)

This invention relates to a process for metallizing plastic materials, such as hard rubber, phenol condensation products, urea resins, synthetic resins, cellulosic plastic materials or materials coated therewith and has for an object to provide a convenient, dependable and comparatively inexpensive process for the above purpose.

This application is a continuation-in-part of my application Ser. No. 209,525, filed May 23, 1938, Patent 2,214,646 for Metal coated plastic material and method of producing the same.

Another object of the invention is to provide a novel and improved process for treating the surface of a plastic material of the above type so that an adherent metal coating may be applied thereto.

Another object is to provide a novel and improved process for applying to the surface of a plastic material a conductive layer having characteristics suitable for subsequent electroplating.

A further object is to provide a process of the above type which is adapted to apply the metallized or coated layer in the form of a design.

A further object is to provide a process for stenciling a metallized coating on a plastic material.

A still further object is to provide a plastic material having a coating of the above type.

Another object is to provide a process of the above type which is particularly suitable for metallizing the surface of cellulose acetate products.

Another object is to provide treating compositions suitable for use in the above process.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Although the novel features which are characteristic of this invention are pointed out more particularly in the claims appended hereto, the invention itself may be better understood by referring to the following description in which certain specific embodiments thereof are set forth for purposes of illustration.

Certain specific terms are used herein to refer to various details of the invention. It is to be understood, however, that these terms are to be given as broad an interpretation as the state of the art will permit.

The present process comprises in general so treating the surface of a plastic material that an adherent metallized layer may be applied thereto. This layer may be used for the subsequent electroplating or, in certain instances, may be polished or otherwise treated to provide the finished surface.

It has been found that plastic materials of the type above referred to, and particularly the synthetic plastics, require certain pretreatment before the metallizing operation can be efficiently

carried out. This pretreatment may produce a physical or chemical change in the surface itself or may result in the provision of a film of highly reactive material on the surface, although I am not limiting myself to either of these explanations. Whatever the action of the pretreating material, the step has been found to be essential in order to obtain the subsequent deposition of an adherent metallized layer.

More specifically, the material may first be depolished and cleaned. It is then given the pretreatment hereinafter referred to to condition the same for the metallizing operation. Thereafter, the surface is washed and a suitable silver solution is supplied to deposit silver on the surface as a metallized coating. This coating is sufficiently adherent to be polished and used as such or may be used as a vehicle for the subsequent electroplating of the metallized portion.

As a specific example of one method of carrying out this process, the material, such as a phenol condensation product or other synthetic resin, may first be depolished, either by chemical means, such as by the use of a reagent having the property of depolishing the surface, or by mechanical means, such as by sand blasting. For cellulose acetate products, the depolishing may be replaced by the use of a solution of sodium hydroxide, preferably a normal solution. This solution, which I term a priming solution, has the property of cleaning or conditioning the surface to receive the subsequent treatment.

After the priming or sand blasting, above described, the material is cleaned of all foreign substances by the use of a suitable solvent or washing liquid, such as gasoline or water. The material is then subjected to the pretreating solution. This solution may comprise a water solution of stannous chloride, which may be of a concentration such that a milk-like consistency is obtained. I have found, however, that the addition of hydrochloric acid to the solution greatly decreases the time required for the pretreatment. The hydrochloric acid is used in a quantity such that the solution becomes clear and remains clear under the conditions of use. The solution may have the following composition:

Stannous chloride	grams	360
Hydrochloric acid	cc.	216
Water	cc.	4000

This solution remains permanently clear and is capable of effecting the desired pretreatment in an extremely short time. The material may, for example, be dipped in this solution or the solution may be applied to the surface for a period of from forty-five seconds to one minute. It is to be understood, of course, that the exact time and concentrations may be varied and that a longer time will be required with a less concen-

trated solution. Furthermore, it has been found, in general, that a substantially longer time is required when the quantity of hydrochloric acid is reduced.

After the surface has been properly pretreated, as above described, the pretreating solution is removed and the surface is thoroughly washed so as to remove the pretreating solution as completely as possible. The surface is then ready for the metallizing operation. This operation consists in subjecting the surface to a silver bath to precipitate the silver thereon. The silver bath may comprise a water solution of sodium potassium tartrate and silver nitrate or a water solution of formaldehyde, which is combined with a solution of silver nitrate and ammonia under conditions such that the silver is precipitated from the silver nitrate solution onto the surface of the article. The formaldehyde solution may, for example, comprise 22 cc. of 40% formaldehyde in 16,000 cc. of water. A small quantity of silver nitrate may or may not be incorporated therewith. The silver nitrate and ammonia solution may be of about the following composition:

Silver nitrate	-----	33.3 grams
Ammonia (28%)	-----	About 28 cc. (or enough to clear up the solution)
Water	-----	16,000 cc.

These solutions are preferably prepared separately and are mixed only when the metallizing operation is to be carried out. The formaldehyde or sodium potassium tartrate serves to reduce the silver and cause the same to be deposited on the surface. The solution should be agitated throughout the metallizing operation.

The thickness of the layer of silver thus precipitated will depend, in general, upon the length of time that the silver nitrate solution is in contact with the surface and the concentration of silver in the solution. Preferably, the solution is constantly agitated or caused to flow over the surface so that a fresh part of the solution is always in contact therewith. If, after one treatment of this type, the object is not uniformly coated, the operation may be repeated until a coating of the desired consistency and thickness is built up on the treated surface. The metallized surface may now be polished and it may be suitable for certain ornamental purposes. If desired, however, the metallized surface may be used as a conductor for the electroplating of any desired metal thereon.

For this purpose, the object is placed in the usual electrolyte having a composition depending upon the metal to be deposited and the metallized coating may be used as a cathode onto which the metal is applied in the usual manner. The metal coating thus applied will adhere sufficiently to permit buffing and polishing and to produce a finish resembling a metal article.

In the above process, it is to be understood that certain of the steps may be omitted in various instances, depending upon the condition of the material and the type of coating required. For example, if the metallized coating is to comprise the finished surface, particularly in the case of cast resins and thermoplastic materials, the preliminary depolishing may be omitted. It may also be omitted if only a thin plating is to be added which does not have sufficient tensile strength to be peeled from the surface, or if an extremely heavy plating is to be applied which would have sufficient strength in itself to resist the tendency to peel. For coatings having an intermediate thick-

ness, however, which are sufficiently strong to be peeled from the surface, but are not sufficiently rigid to resist such action, the depolishing has been found to be advantageous.

This process is particularly adapted to ornamentation of plastic materials of the type above referred to inasmuch as it may be applied by means of a stencil. If, for example, the surface is covered by a suitable stencil the steps of pretreating and cleaning the surface, treating with stannous chloride and depositing the silver thereon from the silver nitrate solution may all be carried out in the presence of the stencil and will deposit the metal in the form of a stenciled design. Thereafter, if a subsequent electroplating is required, the metallized coating will serve to form the base for the electroplating and cause the latter to also assume the predetermined design.

Objects treated in this manner present the appearance of metal, but have a weight corresponding to that of the plastic and also have the advantage that they may be formed or molded in any desired shape much more readily and inexpensively than a metal article could be so formed and that, when coated, they serve as a substitute for the metal article.

The process is particularly adaptable for novelties, such as costume jewelry, ash trays, ornamental figures or the like.

Although a specific embodiment has been shown for purposes of illustration, it is to be understood that the invention is capable of various uses as will be readily apparent to a person skilled in the art. The invention is only to be limited in accordance with the following claims when interpreted in view of the prior art.

What is claimed is:

1. The method of metallizing the surface of an organic plastic material which comprises treating the surface with a solution of stannous chloride and hydrochloric acid to cause the same to have characteristics suitable for metallizing, washing the surface to remove said solution and applying to said surface a solution of silver nitrate, ammonia and a reducing agent under conditions to precipitate the silver thereon to form a metallized layer, and electrodepositing metal on said layer.

2. The method of metallizing the surface of an organic plastic material which comprises treating the surface with a solution having about the following composition:

Stannous chloride	-----	grams	360
Hydrochloric acid	-----	cc	216
Water	-----	cc	4000

washing the surface to remove said solution and treating the same with a mixture of the following solutions in about the proportions specified:

Silver nitrate	-----	grams	33.3
Ammonia	-----	cc	28
Water	-----	cc	16,000
Formaldehyde	-----	cc	22
Water	-----	cc	16,000

3. The method of metallizing the surface of a cellulose acetate product which comprises treating said surface with a sodium hydroxide solution to depolish the same, then treating the depolished surface with a solution of stannous chloride and hydrochloric acid to cause the same to have characteristics suitable for metallizing, washing the surface to remove said solution and applying to said surface a solution of silver nitrate, ammonia and a reducing agent under conditions to

precipitate the silver thereon to form a metallized layer, and electrodepositing metal on said layer.

4. An organic plastic treating solution for pre-treating the surface of an organic plastic material selected from the group consisting of hard rubber, synthetic resins and cellulosic plastic materials preparatory to metallizing said surface,

said solution comprising the following ingredients in about the proportions specified:

Stannous chloride	grams	360
Hydrochloric acid	cc	216
5 Water	cc	4000

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