

June 16, 1953

J. GAROFANO

2,642,390

PROCESS OF ORNAMENTATION OF ARTICLES MADE OF PLASTICS

Filed Sept. 11, 1950

2 Sheets-Sheet 1

Fig. 1

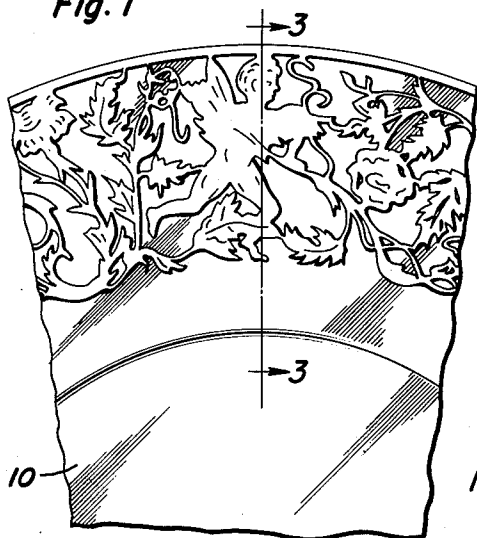


Fig. 2

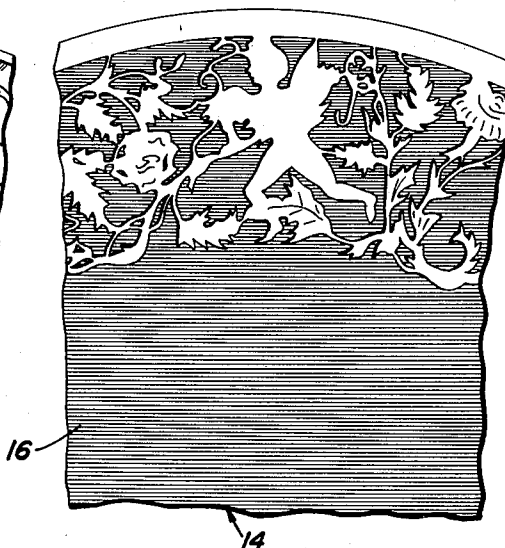


Fig. 3

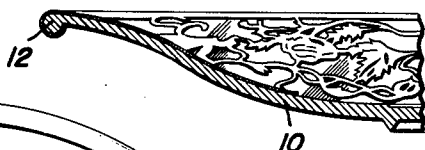


Fig. 4

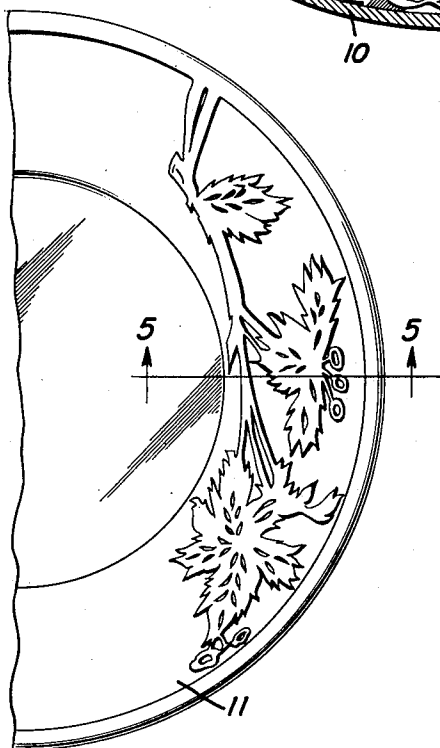
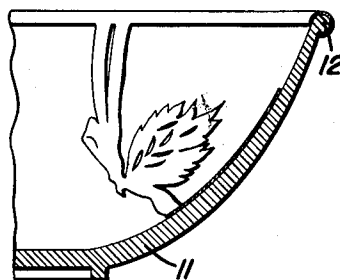


Fig. 5



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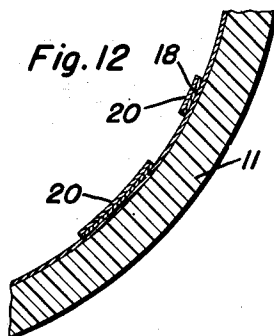
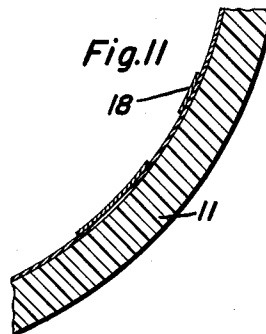
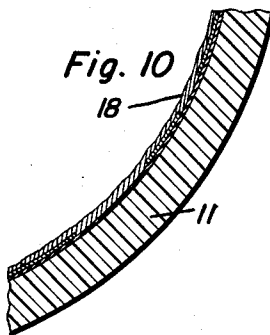
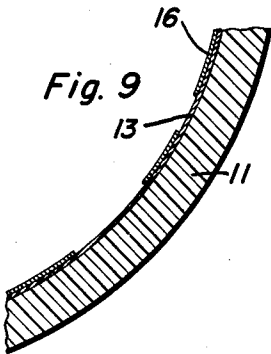
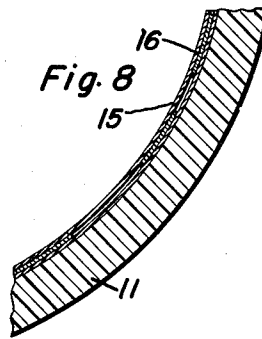
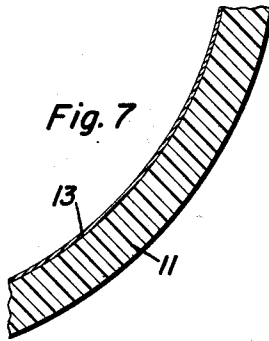
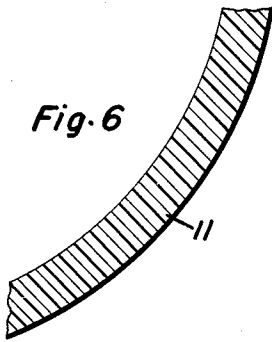
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UNITED STATES PATENT OFFICE

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PROCESS OF ORNAMENTATION OF ARTICLES MADE OF PLASTICS

Joseph Garofano, Hartsdale, N. Y.

Application September 11, 1950, Serial No. 184,302

4 Claims. (Cl. 204—18)

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This is a continuation in part of prior application, Serial No. 650,324, February 26, 1946, now abandoned.

This invention relates to the process of ornamenting surfaces of articles made of organic resinous plastics of all types and it has for its main object to provide a dependable and comparatively inexpensive process for metallizing or depositing permanent and durable metal coatings on parts of a surface of the article, which metal coatings preferably form an elaborate artistic design either of a negative or of a positive character with the metallized or non-metallized portions forming the design, the metal coating being so completely united with the decorated surface that for all practical purposes it forms part of it and will neither peel off nor wear off during use.

A further object of the invention consists in a process for depositing a permanent highly polished or matted ornamental metal coating of any desirable design on the surface of an article made of organic resinous plastics, which coating is so completely united with the surface on which it is deposited that it may be considered as part of the surface, the depositing process comprising steps permitting the deposition of coatings in extremely fine lines delineating or shading objects or the deposition of metallic coatings with fine delineating or shading lines left uncoated, through which the background consisting of the plastic is seen, thus producing an ornamentation which has the quality of a pen or pencil drawing.

A further object of the invention consists in providing a metallizing process suitable for the fine ornamentation of articles with surfaces of any configuration, including surfaces which are convex or concave and surfaces of a double or multiple curvature or with an irregular curvature changing from positive to negative curvature, and also including surfaces provided with sharp edges formed by projecting portions or by indentations located adjacent to surfaces of a small curvature radius, such as stepped portions or fluted portions or the like. Likewise, it is an object of the invention to provide an ornamentation process which is suitable for the ornamentation of surfaces of articles in which the ornament to be metallized is in relief.

The process according to the invention therefore permits to obtain a new type of product. It is a well known fact that metals do not adhere to surfaces of resinous organic plastics and can be made to adhere only to a very limited extent, unless an extensive preparation takes place. Preparatory steps have therefore to be under-

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taken which usually consists either in a chemical preparation, such as depolymerization, or in a mechanical preparation of the surface such as roughening, both process being usually only suitable for the preparation of articles the entire surface of which has to be metallized. Other industrial metallization processes consist in covering the surface with a bonding agent. Also these processes are mostly suitable for industrial products where large surfaces or at least large fractions of a surface have to be metallized.

As will, however, be clear from the above statement of the objects of the invention, the process according to the invention results in a complete adhesion of the metal on certain portions of the surface of a resinous organic plastic, producing an ornamental decoration of the same and in fact a completely unitary, combined surface is obtained in which the metal permanently adheres to certain portions of the surface not only in the case of large surfaces, but also in the case of linear ornaments where the metal has to adhere in the form of fine lines which may be likened to pen or pencil lines drawn on the surface. This result has not been obtainable with the preparatory steps hitherto recommended for securing adherence of metal to plastic surfaces.

The process according to the invention is described in one modification only. However, it will be clear that this modification which provides an example described in specific terms cannot be regarded as the sole way of carrying the invention into effect. Modifications of the process or a departure from the example given does therefore not necessarily constitute a departure from the principle of the invention.

The process according to the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of a fragment of a plastic dish with double curvature which is provided with an ornamentation according to the invention on the curved edge;

Figure 2 is a plan view of the mask which is used during the process, the view being fragmentary;

Figure 3 is a cross sectional elevational fragmentary view of the same dish showing the mask applied to the marginal portion to be ornamented, the section being taken along the line 3—3 of Figure 1;

Figure 4 is a fragmentary plan view of a bowl the interior of which is to be decorated;

Figure 5 is an elevational sectional view of said bowl the section being taken along line 5—5 of Figure 4; and

Figures 6 to 12 are sectional fragmentary views through a portion of an article to be decorated illustrating diagrammatically the successive stages of the process.

The process according to the invention may be carried out with molded or manufactured articles, sheets, plates and other objects consisting of any type of organic plastic hereinafter termed organic resinous plastics, or coated with any type of such plastics, certain small modifications and simplifications of the process, hereinafter specifically mentioned, being possible when using certain types of organic resinous plastics. These organic plastics used may be colored, transparent or translucent.

The above mentioned process may be carried out with articles of any shape. An article in the form of a decorative dish 10 having a marginal portion of double curvature is shown in Figures 1 and 3. The decoration may be an elaborate one and it may cover either the inner marginal portion alone or it may extend to the edge or over the edge and to a portion of the outer surface. It will be noted that, with the object shown in Figures 1 and 3, one part of the ornamented portion is convex while the other is concave. Ornamentation of objects of this type is usually extremely difficult.

Likewise, the object 11 shown in Figures 4 and 5 shows an ornamentation on the inside. Such an ornamentation on the concave inside by means of a metal coating firmly and permanently adhering to the surface is usually regarded as a problem presenting great difficulties. The object shown in Figures 4 and 5 is a bowl or cup and the ornamentation, as seen, extends from the edge over the inner surface of the bowl or cup.

Organic resinous plastics with a cellulose base, such as those enumerated in Modern Plastics Encyclopedia, 1947, page 63 (for instance cellulose acetate, cellulose acetate butyrate, cellulose propionate, ethyl cellulose, etc.), resinous plastics derived from styrene (styrene polymers and copolymers, polystyrene) and allyl types of polyester resins need no preparatory treatment. However, it is to be understood that the application of a cellulose lacquer, while unnecessary, does not affect the process to be described.

All other organic resinous plastics (see enumeration in Modern Plastics Encyclopedia, 1947, pages 62 and 63) receive a preliminary treatment which consists in providing the surface to be treated with a coating of cellulose lacquer. Cellulose lacquers (cf. Kirk-Othmer, Encyclopedia of Chemical Technology, volume 3, article: Cellulose Derivatives; Thorpe's Dictionary of Applied Chemistry, 4th ed. vol. II, p. 468) of all types are usable, the cellulose lacquer most frequently used by applicant being the lacquer known in the trade under the name "Zapon-Lacquer" (for composition see Ullmann's Encyclopedie der Technischen Chemie, volume VII, 467-469, volume III, 140). Alternatively, the following cellulose lacquer is usable:

	Parts by weight
Clear Celluloid shavings	5
Amyl acetate	16
Acetone	16
Sulph. ether	16

The cellulose lacquer coating is indicated at 13 in Figure 7.

Now a mask 14 is prepared and applied (Figures 2 and 5) which contains the design to be applied as a negative, the latter expression indicat-

ing that the parts to be covered by silver or other metals are not covered by the layer on the mask. The mask consists of a thin paper sheet 15 covered with a mixture of rosin, wax, some fatty material and dye such as is used in printing processes.

A suitable mixture was prepared from the following ingredients:

	Per cent
Rosin	24
Venetian turpentine oil	1
Stearine	25
Carbon black	50

The ornamental design is printed on the mask in a well known manner using the above named mixture.

This mask is then applied on the plastic base 11 (Fig. 5) care being taken that it lies perfectly smooth and flat on the base 11 with the coating 16 turned towards the plastic material. The paper of the mask is preferably larger than the printed portion so that it may be drawn around the edges 12 of the plastic base sheet 10 or 11 as shown in Figs. 3 and 5, in order to secure adhesion of the mask along the rounded portions near the edges.

When the mask has been pressed against the base 11 and has been smoothed out its rosin and wax coating 16 will adhere to the base 11 as shown in Figure 8.

The paper 15 can now be removed. This may be done by soaking the paper in water. When thoroughly wet the paper 15 can be peeled off, leaving the layer 16 of wax and rosin on the base. This stage is illustrated in Figure 9.

The ornamental design is now delineated on the base sheet in such a way that those parts of the base which are to be coated are uncovered while those parts which are not to be coated are covered with the layer of wax and rosin. The design may be quite an elaborate one and may contain fine lines for delineating objects or ornaments within the layer. It is a main advantage of the process that it is capable of bringing out a very elaborate design to full advantage, on any kind of surface, whatever its curvature. Grooves, stepped or fluted portions, and indentations may be covered with the ornament, the sole condition being that the thin paper 15 of the mask 14 must be capable of covering the said surface smoothly.

A suspension of very finely powdered metal, for instance silver in acetone, to which liquid a so-called "thinner" may be added, is now applied on the surface of the base 10 by means of a spray gun. The metal such as silver, as shown in Figure 10, forms a uniform layer 18 covering the layer of wax and rosin and penetrating into it where the ornamental design interrupts the layer.

A solvent for the mixture of rosin and wax, such as carbon tetrachloride or gasoline is now applied to remove the latter. When the rosin and wax mixture has been removed and the coated object has been dried it is then treated with a soft brass wire brush. The metal is removed from all places which have been covered by the wax-rosin mixture together with said mixture by the application of the solvent. Where the base plate has not been coated with the wax-rosin mixture, however, the metal layer 18 will adhere firmly to the base 11, this stage being shown in Figure 11. The result will therefore be a reproduction of the ornamental design whose negative had been printed on the mask.

The brushing may be continued and polishing

or burnishing may take place if desired, for the result may already be used as a finished product, although this product is not of the same quality as that which can be obtained when the process is continued.

For better quality products the base sheet with the ornamental metal coating is further treated by making an electrolytic deposition of metal on the metal layer which is adherent to the base. This process may be carried out in the customary way as the metal deposit on the base provides a suitable conductive electrode for electrolytic metal deposits while the non-conducting base sheet will not be affected by the electrolytic process.

The electrolytic process may be stopped when a layer of sufficient thickness for polishing has been deposited or the electrolytic process may be continued until a layer 20, of a material thickness has been formed as shown in Figure 12.

The ornamental design which essentially is a metal covered surface with a suitable contour, with fine lines delineating the object represented on the ornament, will either make the impression of an inlaid metal or of an engraving, if the layer of the metal deposit has a thickness which is visible, as the ornamental lines piercing the metal layer and encircling the background make the impression of having been cut by a needle or a similar engraver's instrument.

The article is now polished with a buff and the customary polishing means, and is then washed and covered with a clear cellulose lacquer.

It will be clear from the above that the process is a simple and inexpensive one, which, however, is capable of producing a highly decorative product. The effect is especially pleasing with polished silver on a completely transparent plastic material, such as methyl-methacrylate, or any other transparent plastic or with a colored plastic the color of which is suitably chosen so that the colors of the base plate contrast with the metal.

It is, of course, obvious that the steps with which the process may be carried out may vary and that especially since the substances mentioned may be replaced by others known in the art. For instance all cellulose lacquers so far tested have been found to be suitable. Any known solvent for rosin and wax may be used. The invention mainly resides in the process which permits to deposit a metal layer in the shape of an elaborate ornamental design on a plastic material in such a way that this layer will form a complete unit with its base whereby the expensive methods such as inlaying or the like are avoided. It will also be clear that in order to produce a preformed ornamental design special means such as the paper mask on which the design may be printed are used and a main feature of the invention therefore consists in providing means for producing said design by print on a paper sheet and for transferring it to the surface of the plastic in such a way that on this surface the metal deposit is governed by the said design.

It will also be clear to the expert that other metals which are susceptible of being suspended in a liquid in a finely divided form may be used with a similar effect.

Having described the invention, what is claimed as new is:

1. A process for producing a metallic ornamentation on the surface of objects made of organic resinous plastics selected from the group consisting of cellulose base resin plastics, of plas-

tics derived from styrene and of plastics of the allyl type of polyester resins comprising coating the surface of the resinous plastic to be ornamented with a design carrying soluble adhering layer, consisting substantially of a mixture of rosin, wax and an essential oil, said layer showing the ornamental design to be applied to the surface of the objects to be ornamented in the shape of open and blocking solid portions, the former covering the portions of the surface to be ornamented which are to be covered with metal and the latter covering the portions of the surface to be ornamented to be kept free of metal deposits, spraying a suspension of finely powdered particles of metal in acetone onto the surface covered by the aforesaid soluble layer carrying the ornamental design, and applying, after evaporation of the acetone, a solvent for the soluble layer in order to remove the layer together with the metal which has been sprayed onto said layer from the surface to be decorated.

2. A process for producing a metallic ornamentation on the surface of objects made of organic resinous plastics which consists in applying a cellulose lacquer to the surface to be ornamented, in coating the surface to be ornamented with a design carrying soluble adhering layer, consisting substantially of a mixture of rosin, wax and an essential oil, said layer showing the ornamental design to be applied to the surface of the objects to be ornamented in the shape of open and blocking solid portions, the former covering the portions of the surface to be ornamented which are to be covered with metal and the latter covering the portions of the surface to be ornamented to be kept free of metal deposits, spraying a suspension of finely powdered particles of metal in acetone onto the surface covered by the aforesaid soluble layer carrying the ornamental design, and applying, after evaporation of the acetone, a solvent for the soluble layer in order to remove the layer together with the metal which has been sprayed onto said layer from the surface to be decorated.

3. A process for producing a metallic ornamentation on the surface of objects made of organic resinous plastics selected from the group consisting of cellulose base resin plastics, plastics derived from styrene and plastics of the allyl type of polyester resins, which consists in applying a mask, including a carrier sheet consisting of paper covered by a design carrying soluble layer on which the design to be produced is imprinted and on which those portions which are to be covered with metal on the surface of the object to be decorated are open, while the solid portions of the layer block the deposit of metal in accordance with the selected design, said layer consisting substantially of rosin, wax and an essential oil, in covering the surface to be ornamented completely by the said mask, with the soluble layer of the mask turned towards and adhering to the surface to be ornamented, in removing the carrier sheet of the mask consisting of paper, leaving the design carrying soluble layer as a coating on the surface to be ornamented, in spraying a suspension of finely powdered metal in acetone onto the surface of the object to be ornamented which is covered by the aforesaid coating and in applying to the surface, after evaporation of the acetone, a solvent for the aforesaid mixture forming the soluble design carrying layer in order to remove said layer, together with the metal deposited on top of the same from those portions of the surface to be ornamented which

are to be free of metal, and in brushing the surface of the ornamented object to effect complete removal of the soluble layer, and all non-adhering metal parts.

4. A process for producing a metallic ornamentation on the surface of objects made of organic resinous plastics, which consists in applying a cellulose lacquer to the surface to be ornamented, in applying a mask, including a carrier sheet of paper covered by a design carrying soluble layer on which the design to be applied to the surface of the object to be ornamented has been produced by imprinting the design, the solid portions of the soluble layer blocking out those lines and those portions of the surface to be ornamented which are to be free of metal and the open portions of the layer corresponding to those portions of the surface on which metal is deposited, said soluble layer consisting substantially of rosin, wax and an essential oil, said mask covering the surface to be ornamented completely, with the soluble layer turned towards and adhering to the surface of the object to be ornamented, in removing the carrier sheet of the mask, leaving the design carrying soluble layer undisturbed on the surface to be ornamented, so that the layer alone adheres to and coats the surface to be ornamented, in spraying a suspension of finely powdered metal in acetone onto the surface of the object covered by the adhering

soluble design carrying layer, in applying to the surface, after evaporation of the acetone, a solvent for the soluble layer in order to remove the portion of said soluble layer which has been covered with metal during spraying from the surface to be ornamented, in brushing the surface to be ornamented so as to remove all traces of the non-adhering metal, and in electrolytically reinforcing the metal deposit on the surface to be ornamented in order to remove the ornamental appearance.

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