Feb. 21, 1933. A. P. SCHULZ 1,898,500

ENAMEL DECORATING PROCESS

Filed May 19, 1930

Fig. 1.

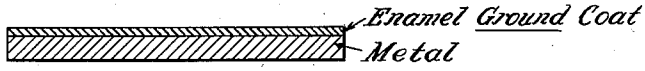


Fig. 2.

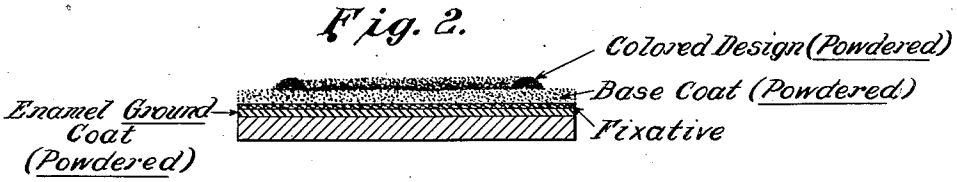


Fig. 3.

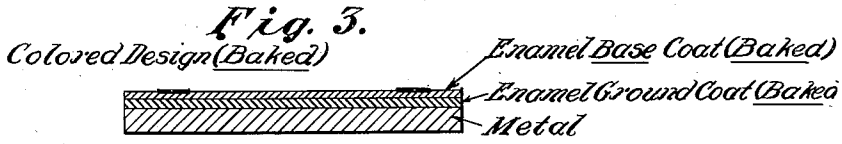
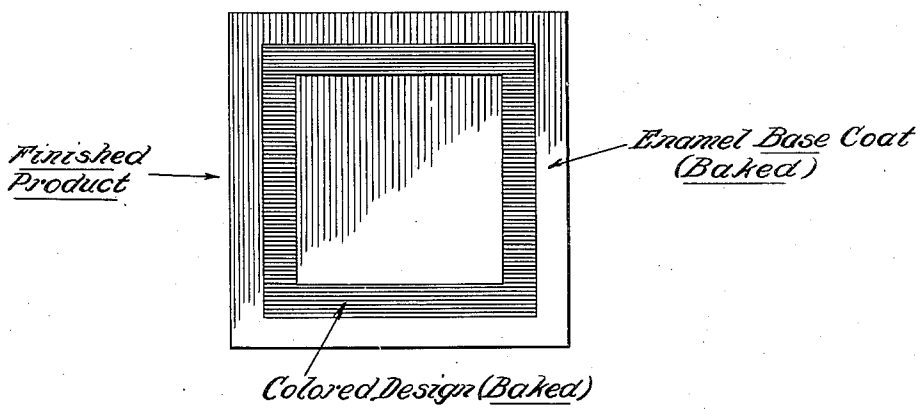


Fig. 4.



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Patented Feb. 21, 1933 1,898,500

UNITED STATES PATENT OFFICE

ARTHUR P. SCHULZ, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO TELLER STOVE DESIGNING CORPORATION, A CORPORATION OF NEW YORK

ENAMEL DECORATING PROCESS

Application filed May 19, 1930. Serial No. 453,871.

My invention relates to enamel decoration and covers a simplified and more economical process for applying colors to be fused into an enamel coating to produce a highly decorative and ornamental effect and finish.

The invention is particularly useful and effective in the application of color designs and decorations on vitreous enamel products as for example, enameled sheet metal plates or panels.

So far as I am aware, in all processes heretofore practiced in the decoration of enameled surfaces the procedure is to apply colors in a wet state, that is, a color is mixed in a liquid vehicle and applied in that state to the fired enameled surface. After application of a color it must be dried, and under certain conditions, fired before another color can be applied thereover. If a certain shade of color is desired one or more colors are mixed wet and applied in the wet state. Thus where a number of colors are used many drying steps and firing steps are necessary involving considerable time and expense.

In the prior processes, the colors as applied, are opaque so that after the application of one color and drying and firing, another color applied over the first color will entirely cover the first color so that it will not shine through. It is therefore impossible in such processes to obtain blending of colors when applied to the surface to be decorated.

Take for example in the enameling of a panel of sheet metal, in accordance with the old processes, the panel is first coated with black enamel ground coat which is fired on. Then a white or other light color enamel base coat is applied and fired. On this fired light enamel base coat the colors are applied in the wet state, and after each application of color the panel will have to be dried and fired before another color can be superposed. In other words, the number of colors applied substantially governs the number of drying and firing operations necessary for a completed piece of work. Usually the vehicle used for the wet colors contains foreign matter which might cause discoloration.

The main object of my invention is to provide a process by which colors in a dry state or powdered form are directly applied, preferably by means of stencils and suitable brushes on an unfired base coat or layer of enamel, which base coat, after application thereto of all the colors for the design or ornamental illustration desired, is then fired, so that one firing only is necessary for all the colors. The dry color adheres to the unfired enamel coating in sufficient quantity to make the desired tint in the enamel when it is fired, and the fired color is practically the same as the natural color.

The application of the dry color in powdered form makes it possible to superpose several colors on the unfired enamel base coat and as the layers of colors adhering to the base coat are comparatively thin, the color layers will be transparent so that superimposed colors will combine to form a derivative or complementary color. Thus, with my process, only the primary colors need be used and can be applied directly to the unfired base coating of enamel and by superposition any desired complementary or derivative color can be accurately obtained. Premixing of colors to get the desired tint is therefore eliminated.

To illustrate an embodiment of my invention I will now describe the various steps of procedure in decorating, for example, a sheet metal plate or panel.

Figure 1 is a sectional view through a plate to be decorated, and showing the plate with the enamel ground coat;

Figure 2 is a similar view and showing the powdered base coat with the colored design;

Figure 3 is a similar view, showing the enamel ground coat, enamel base coat and colored design after having been baked, and

Figure 4 is a plan view of the baked and finished decorated plate.

In the customary manner the plate or panel may be given a ground coat of black vitreous enamel and this coat is fired. Over this ground coat is applied a base coat of white or other light colored vitreous enamel, but, contrary to the usual procedure heretofore, this base enamel coat is not immediately fired, but, in accordance with my process, it

will first receive the dry colors for forming the desired design.

The colors used are the usual oxides in powdered form, and by means of a brush or other suitable device or material the colors are applied either directly to the unfired base coat, or by means of stencils. The adhesion of the color powder to the unfired porcelain is a natural result due to the porous structure of the unfired enamel and the color powder will enter the pores of the unfired enamel to a considerable depth. Usually a separate stencil is used for the application of each color, and after all the colors have been applied, the plate or panel is put into a furnace and is fired.

Where the color has been applied lightly the frit content of the unfired enamel base coat will be sufficient to glaze over the color to give a glossy surface. To increase the glossiness the oxide colors may first be mixed with a certain percentage of powdered enamel or other vitreous material to add frit element to the base coat enamel while it is being fired.

With a light layer of dry color on the unfired enamel coat the color will be correspondingly light after firing. If a heavier or deeper shade of the color is desired the unfired enamel coat may be suitably treated so that more of the powdered color will adhere thereto. For example the base coat could be sprayed with a fixative such as a thin solution of gum arabic just before the color is to be applied and more color will then of course adhere. I have found that a water solution containing about five per cent of gum arabic will serve the purpose. The fixative solution may be sprayed or otherwise applied to the unfired enamel coating and when the coating is fired after application of the colors this fixative will not cause discoloration nor interfere with the proper fusing of the colors into the enamel.

The amount of powdered enamel or other gloss producing ingredient will depend upon the finish desired. I have found the proportion of 1/3 color powder to 2/3 powdered white enamel to be very efficient. The color and glazing element should of course be thoroughly mixed and this can be accomplished in the usual manner by wet mixing in a mill. However, after such wet mixing the mixture is poured into molds and dried to form cakes from which the mixture may be readily rubbed in powdered form by means of a brush or other suitable material or device and then applied to the surfaces on the enamel coating to be decorated.

The application of the colors in dry form to leave comparatively thin color layers on the unfired enamel coat leaves the color layers more or less transparent and a color layer first applied will be visible through a color layer applied thereover so that with my improved process superposing of colors is possible to produce complementary or derivative colors and many tints and hues not obtainable heretofore. Only the primary color oxides, blue, red and yellow, and perhaps black, need be employed and by proper superposition any desired color, shade, tint or hue may be produced directly on the unfired enamel coating without first having to premix the colors as is necessary in prior processes.

Of course, where colors are to be superposed the ceramic or glazing element content of the colors will be in proper proportion so that the proper glazing or gloss effect will be obtained when the enamel base coat, on which the colors have been superposed, is fired.

Also, when superposing colors, more or less application of a fixative may be necessary in order to get the adhesion of the required amount of colors. A single application of fixative on the unfired enamel coat may be sufficient, or after the application of each color more fixative may be applied before the next color is superposed. Then with the proper amount of color held to the coat by the fixative, and the proper supply of glazing element in the colors, firing of the colored base coat will produce decorated areas which will have the desired glazed, glossy or enamel surface.

After all the colors have been applied to the unfired base coat rubbing or brushing may be resorted to for producing high lights. This is preferably accomplished by means of a stencil having openings where high lights are wanted, and the degree of brushing or rubbing off some of the color will determine the nature of the highlight. Also, after the colors have all been applied, the uncolored enamel base coating may be entirely brushed out preferably by using a stencil, so that the exposed black ground coat will form a background for the colored areas or designs. After such treatment for producing highlights or back ground, the panel is placed in a furnace for the final firing operation during which the colors will be merged into the fusing enamel of the base coat, the superposed colors merging to produce the desired complementary colors or derivatives.

Where part of the enamel base coat, before firing, is brushed out to form a background, the decorated areas will be raised to give the effect of enameled embossing. If a background is desired of a color different from the ordinary black, the procedure would be to cover the black ground coat with an enamel coating of the color desired for the background, and to fire this coating and then apply thereover an enamel base coating which remains unfired until the colors have been applied thereto. Then after application of the colors this base coating will be

brushed out at the desired places down to the underlying fired back-ground coating. After producing the background the colored base coating is fired to produce the finished work.

My improved process differs from all prior processes in that no liquid binder is necessary for the colors for their application to the surface to be decorated. In prior processes the color with the liquid binder is applied to a fired enamel surface and, particularly where stencils are used, after application of one color, the work must be put into an oven for drying before the next color can be applied, and if the work involves any brushing out, application of one color and drying must be followed by a firing operation before the next color can be applied. These prior processes therefore involve many drying and firing steps substantially governed by the number of colors applied. With my process the enamel base coat is left unfired and for ordinary color application the mere porous condition of the enamel surface serves as the adhesive agent until the enamel is fired to make the design fuse into an integral mass. Where heavier and deeper coloring is desired a suitable fixative is applied, particularly when colors are superposed. However, the fixative is not wholly necessary except when it is necessary for more color to adhere to the unfired coating to produce the desired heavier or more brilliant tones.

In prior processes, color oxides and powdered white enamel or other suitable glazing material are mixed with a vehicle or binder and this mixture, of paint consistency, is applied on the fired enamel coat to be decorated. Such vehicle or binder very often causes discoloration of the enamel and destroys the life of the colors. Furthermore, where colors are applied over each other the enamel, after firing, is so thick that it may readily chip off.

With my process the color oxides in the form of dry fine powder are applied directly to the unfired enamel coating or mixtures of oxides and glazing materials are applied. The mixture of the oxide with the white enamel powder or other glazing element is with water, and the mixture is then dried in molds to form cakes from which the material can be rubbed in powdered form to be applied to the enamel coat to be decorated. The coloring matter thus has nothing in it which could cause discoloration or destroy the natural tones of the colors. Furthermore, the powder layer is so thin, even with superposition of many color layers, that piling will not result but the finished work will be of substantially uniform depth and will not chip.

My improved process is very economical as it entirely eliminates intermediate dryings and firings during the application of colors and requires only one final firing for all the colors. No special, expensive and rare color oxides are required, and from the ordinary primary color oxides the production of any desired derivative colors is possible by superposition and blending while the colors are being applied to the ground coating. Furthermore, on account of the light application of the colors in powdered form, the volume of color used is very small as compared with the quantity necessary with prior processes.

It is evident that my improved process may be employed for the decoration of many surfaces and objects capable of having enamel fired thereon.

Having described my invention, I claim as follows:

1. The process of applying a decorated enamel finish to a surface which consists in first applying a base coating of enamel to the surface, drying said enamel and then before firing this coating applying the coloring material thereto in dry form, fixing said dry coloring material, and then firing the coating to infuse the coloring material with said base coating.

2. The process of producing a decorated enamel finish upon a surface which consists in first applying a ground coat of enamel to the article to be treated; firing said ground coat; applying a base coat in dry form to said fired ground coat; fixing said base coat; producing a design on said base coat, imposing coloring material in dry form upon said base coat and said design; and then firing said base coat and coloring material whereby to cause said coloring material to fuse with said base coat.

3. The process of producing a decorated enamel finish upon a surface which consists in first applying a ground coat of enamel to the article to be treated; firing said ground coat; permitting said ground coat to cool; applying a base coat in dry form to said fired ground coat; fixing said base coat; removing portions of said base coat to form a design; imposing coloring material in dry form upon said base coat and design, and then simultaneously firing said base coat and coloring material whereby to cause said coloring material to fuse with said base coat.

4. The process of producing a decorated enamel finish upon a surface which consists in first applying a ground coat of enamel to the article to be treated; firing said ground coat; permitting said ground coat to cool; applying a base coat in dry form to said fired ground coat; fixing said base coat with an adhesive agent; imposing coloring material in dry form upon said base coat and design, and then simultaneously firing said base coat and coloring material whereby to cause said coloring material to fuse with said base coat.

5. The process of producing a decorated

enamel finish upon a surface which consists in first applying a ground coat of enamel to the article to be treated; firing said ground coat; permitting said ground coat to cool; applying a base coat in dry form to said fired ground coat; fixing said base coat with a liquid adhesive agent, forming a design on said base coat; imposing coloring material in dry form upon said base coat, and then simultaneously firing said base coat and coloring material whereby to cause said coloring material to fuse with said base coat.

6. The process of producing a decorated enamel finish upon a surface which consists in first applying a ground coat of enamel to the article to be treated; firing said ground coat; permitting said ground coat to cool; applying a base coat in dry form to said fired ground coat; fixing said base coat with a liquid adhesive agent, removing portions of said base coat, when dry, to expose parts of said ground coat to form a design; imposing coloring material in dry form upon said base coat, and then simultaneously firing said base coat and coloring material whereby to cause said coloring material to fuse with said base coat.

7. The process of producing a decorated enamel finish upon a surface which consists in first applying a ground coat of enamel to the article to be treated; firing said ground coat; permitting said ground coat to cool; applying a base coat in dry powdered form to said fired ground coat; fixing said base coat with a solution of gum arabic; forming by means of stencils a design on said base coat; imposing oxide colors in dry powdered form upon said base coat, and then simultaneously firing said base coat and oxide colors to cause said colors to fuse with said base.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook County, Illinois.

ARTHUR P. SCHULZ.