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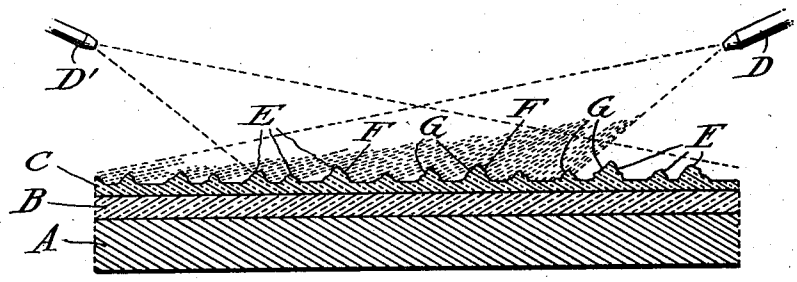


Fig.1.

Inventor,
Richard H. Türk.
By Ivan P. Tarkoff,
Attorney

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PRODUCTION OF PORCELAIN ENAMELED ARTICLES OF CHANGEABLE COLOR

Richard H. Türk, Baltimore, Md., assignor to The Porcelain Enamel and Manufacturing Company of Baltimore, Baltimore, Md., a corporation of Maryland

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The present invention relates to the production of porcelain enamel articles which appear of different colors when viewed in different directions.

In accordance with the present invention, the articles have a rough finish, and contrasting portions of matt finish and gloss finish enamels whereby very artistic effects may be obtained.

Several examples will be given illustrating the present invention, but it is to be understood they are merely illustrative and the invention is not limited thereto.

A base material is cleaned and thereafter there is applied a moist enamel coating. In some cases, it is desirable to use a ground coating, and this is first applied and thereafter the enamel coating. While the enamel coating is still wet and before it has dried to any substantial degree, coarse particles of enamel frit are dusted on to the moist enamel coating. The article is thereafter dried and fired in a suitable furnace, and withdrawn therefrom, preferably before the coarse particles of enamel frit have fused to a smooth surface. Very beautiful effects may be obtained, depending upon the color of the enamel frit that is dusted on to the first enamel coating. A light dusting of another enamel may be sprayed on the coarse particles before burning. Exceptionally novel results may be obtained by applying in one direction against the facelets of the enamel particles an enamel of one color, and thereafter applying in the reverse direction against the reverse facelets of the enamel particles an enamel of another color, both coatings of enamel being applied preferably by spraying the coarse enamel particles so that when the article is viewed from different opposing directions it appears differently colored in accordance with the colors of the enamels used. In order to obtain the best results, the different colored enamels are preferably applied at a sharp angle to the facelets of the enameled particles. It is desired to point out that the application of the coloring enamels at a sharp angle is merely the preferred form of carrying out the invention, and that the angle may be varied. The application of different colored enamel coatings will be clear from the figure, wherein A is the base, B is a ground or preparatory coat, C is a matt or rough enamel coating, and D is a spraying device. The coarse enamel particles are indicated at E. When the spraying device D is in the position indicated in the drawing, the facelets F of the coarse enamel particles receive a dusting of enamel of one color, for example red. When the spraying device is positioned as shown at D', the opposing facelets G of the enamel particles receive a coating of one color, for example green. When the sprayer is in the position shown at D, it is of course obvious that the intervening portions between the particles F receive a very slight coating of the color applied, for example red, and that when the sprayer is positioned as shown at D', the intervening portions between the particles F will receive a very light coating of the color applied, for example green. However, the finished article, when viewed in one direction is predominantly red, and when viewed in the opposing direction is predominantly green. The procedure set forth admits of various modifications to vary the changeable color of the enameled article. For example, while as shown different colors are applied from the spraying apparatus at approximately the same angles to the horizontal, one of the colors may be applied at a greater or less angle and this will result in a modification of the changeable color of the finished article. The amounts of enamel of each color applied may be varied and this will have some influence on the changeable color of the finished article. It is obvious that the different colors may be sprayed so that more of the green shows when viewed in one direction than the other, or that more of the red shows when viewed in one direction than the other.

When two different colors are used, one applied in one direction and the other from the directly opposing direction, very beautiful effects may be obtained and the ware may have a decided predominance of color according to the position of the observer in relation to the direction in which the enamels were originally applied or sprayed.

The procedure offers several advantages. In the first place, it is possible to produce a finished product with only one firing. Secondly, as the enamel frit which is used to produce the coarse surface is preferably of the same nature as the material which binds it to the base, much higher strength in the entire cover is obtained and the coarse particles of enamel frit do not loosen and come away from the surface of the ware.

Any suitable enamel frit may be used for dusting. However, it is preferred that the enamel frit should be of the same character as the enamel coating underlying the frit, and the latter should have about the same firing temperature as enamel upon which it is dusted. The enamel frit should preferably be sized to remove the very coarse particles and the excess of fines.

As illustrative of the size of the enamel particles, very satisfactory results have been obtained by using an enamel which will pass through a 20 mesh sieve and on to a 40 mesh sieve. However, it is desired to point out that this example is merely illustrative of suitable mesh size for the enamel particles, and that these limits may be greatly varied depending upon the effect desired. In other words, coarser or finer particles may be used, depending upon the degree of roughness which it is desired that the finishing surface should have. The enamel particles preferably have a fair degree of uniformity of size.

Heretofore, it has been the practice to dust sand or other coarse material which is fusible at the firing temperature of the enamel on to a wet enamel surface. After the ware was fired, it was presumed that the inert material was held tightly by the enamel. However, in time the inert particles became loosened from the enamel surface and fell therefrom, making the article unsatisfactory for further use. It has been attempted to eliminate this difficulty by applying over the inert particles of sand or the like a light dusting of enamel. However, this has not been entirely satisfactory.

It may be pointed out that where materials such as sand and the like have been applied to enameled surfaces there is quite a tendency for the enamel to weaken where the particles are embedded therein. This is not the case when enamel frit is used for roughening purposes, as herein described. It may be further pointed out that in using enamel frit, the final surface after firing, while a rough one, is comparatively easy to clean, as the particles of enamel of the roughened surface are smooth. It does not hold dirt, as is true when other materials are used, and particularly so when such materials as sand or the like have not been covered with a light dusting of enamel and then fired. When this last step is omitted, a surface is presented which very readily catches dirt and dust and in a short time the article is unsatisfactory. In accordance with thte present invention, even when the final dusting of enamel is omitted the enamel particles forming the rough surface are themselves relatively smooth thereby eliminating the objections above referred to. In the above form of the invention fired enameled articles having a rough surface are formed by applying to a base a coating of porcelain enamel. Then enamel frit particles are applied to the enamel coating. A color stable at the firing temperature is then applied in one direction against the facelets of the enamel particles, and thereafter a different color is applied against the reverse facelets of the enamel particles. There is then applied a light dusting of another enamel, and the article is fired so that it retains its rough surface.

In the example above referred to, the ware has a rough finish, being taken from the furnace before the coarse particle of enamel frit had fused to a smooth surface.

By combining gloss and dull enamels, very artistic effects may be obtained. For example, there may be produced a finish that closely simulates the crystalline lacquer finishes. For example, after the base is prepared to take a dull enamel coating, and the dull enamel is fired, a gloss enamel, for example green, is sprayed on to the dull enamel at a very sharp angle of 30° or less with the face being sprayed. Preferably, only a very light dusting is applied to the ware. The article is then turned about, and from approximately the same angle at dusting of enamel of another color is sprayed thereon. The article may then again be fired to simulate a crystalline lacquer finish. An article produced as set forth and viewed at about the same angle from which the green enamel is sprayed, appears very definitely green, while when viewed from the angle from which the red enamel is sprayed, it appears very definitely red. Instead of applying a vitreous dull or matt enamel to the article base, there may be first applied gloss enamel particles and then a vitreous matt enamel of one color may be applied in one direction and a vitreous matt enamel of another color applied in a reverse direction so that the article when viewed in one direction appears predominantly of one color, and when viewed in a different direction the article appears predominantly of another color. Thereafter the article is fired at fusion temperature, and withdrawn from the furnace before the particles of gloss enamel have fused to a smooth surface. In other words, the article retains its rough finish.

In accordance with the present invention, a variety of novel effects may be obtained, depending upon the kind of frit that is used. Frits of a number of different colors may be used for this purpose. Any of the enamel frits readily purchased on the open market may be used in carrying out the present invention. While the matt enamel herein referred to may be produced in various ways, it is preferred that it contain a zinc compound in excess. In that form of the invention herein disclosed, employing a matt enamel, it is preferred to use one compounded with a zinc ingredient.

The following are examples of ground coats, matt enamels and gloss enamels which may be used in carrying out the present invention.

An enamel milled by the following formula matures in two and one-half minutes at a temperature of about 1450° F. to a fine smooth glossy finish.

	Parts by weight
Frit	100
Clay	6
Tin oxide	6
Water	40

The frit above set forth was produced from the following mixture:

	Parts by weight
Flint	15.3
Feldspar	27.1
Borax	26.00
Sodium nitrate	6.2
Cryolite	12.5
Fluorspar	5.8
Zinc oxide	1.4
Potassium carbonate	1.0
Sodium antimonate	4.1

This will produce a white, opaque frit.

If the clay is increased to 15 or 20 parts in the first formula the enamel will burn to a dull or matt finish in the same time and temperature.

Similar results may be obtained by adding, in the mill, or substituting for the clay other materials such as flint, feldspar, or in general any ingredient that increases the fusing temperature of the milled enamel. The dull finish of the resulting enamel is due to the fine particles of other refractory material that are dispersed through the enamel and prevent the soft enamel particles from fusing into a smooth glass-like surface.

Dull enamels may also be obtained by under-

firing a very hard enamel. For example, an enamel that normally matures at 1600° F. in 2½ minutes may be fired at 1450° F. for the same time and a matt finish is obtained. Matt finishes may also be obtained by etching the gloss off of crdinary enamel, and the same result may be secured by sand blasting or grinding. Dull or matt finishes may be also produced by adding one of the enamel ingredients in excess in the compounding before smelting.

While various ingredients may be added in excess, zinc compounds have given the most satisfactory results. Therefore, the production of an enamel having a matt finish by allowing one of its ingredients to be present in excess will be illustrated by the preparation of a zinc enamel. What is here termed a zinc enamel frit may be produced by compounding the following ingredients in the proportions specified:

	Parts
Flint	15.0
Feldspar	38.0
Borax	5.0
Sodium nitrate	5.6
Sodium carbonate	6.2
Cryolite	8.7
Antimony oxide	2.1
Zinc oxide	34.7

The materials comprising the enamel mix are carefully weighed, mixed, and smelted together at a temperature of approximately 2000° F. until all bubbling ceases. Thereafter, the molten enamel is poured into water and broken into small particles. It is then milled in a pebble mill with approximately 6% of clay and 45% of water, this clay being added merely for its suspending properties. It is ground down to a thick paint-like consistency. This produces what is known as a liquid enamel.

The following illustrates the preparation of a suitable ground coat for sheet steel:

	Parts
Flint	19.2
Feldspar	30.9
Borax	28.8
Sodium nitrate	4.8
Sodium carbonate	6.1
Fluorspar	6.8
Cobalt oxide (black)	.8
Manganese dioxide	2.6

The above referred to materials are prepared in the same manner to produce a frit as outlined for the preparation of the matt finish enamel. The ground coat is milled to a fairly fine mixture in the following proportions:

	Parts
Ground coat frit	100
Clay	6
Borax	1
Water	45

What I claim is:

1. The process of producing enameled articles comprising applying to a base a matt enamel providing a rough surface, then applying in one direction a coating of a gloss enamel of one color and thereafter applying in the reverse direction a gloss enamel of another color, both coatings of gloss enamel being applied so that when the article is viewed from different opposing directions it appears differently colored in accordance with the colors of the gloss enamels used.

2. A process as set forth in claim 1 wherein the base has first applied thereto a ground coating.

3. The process of producing fired enameled articles simulating a crystalline lacquer finish comprising applying to a base a matt porcelain enamel, firing to a rough surface, applying to the fired matt enamel in one direction a coating of gloss enamel of one color, and thereafter applying in the reverse direction a coating of a gloss enamel of another color, and again firing so as to produce a surface simulating a crystalline lacquer finsh.

4. The process of producing fired enameled articles having a rough finish of changeable color comprising applying to a base a coating of enamel, applying enamel particles thereto to provide a rough surface, applying in one direction against the facelets of the enamel particles an enamel of one color stable at the firing temperature, applying in the reverse direction against the reverse facelets of the enamel particles an enamel of another color stable at the firing temperature, both coatings of enamel being applied to the enamel particles so that when the article is viewed from different opposing directions it appears differently colored in accordance with the colors of the enamels used, and then firing the article so that it retains its rough surface and changeable color.

5. A process as set forth in claim 3 wherein the base has first applied thereto a ground coating.

6. The process of producing rough finish fired enameled articles of changeable color comprising applying to a base a wet coating of enamel, applying enamel frit particles to said wet enamel coating, applying in one direction against the facelets of the enamel particles an enamel of one color stable at the firing temperature applying in a reverse direction against the reverse facelets of the enamel particles an enamel of another color stable at the firing temperature, and then firing the article so that it retains its rough surface and changeable color.

7. The process of producing fired enameled articles having a rough finish comprising applying to a base a coating of enamel, applying enamel frit particles to said enamel coating, applying in one direction against the facelets of the enamel particles an enamel of one color stable at the firing temperature, thereafter applying in a reverse direction against the reverse facelets of the enamel particles an enamel of another color stable at the firing temperature, applying a light dusting of another enamel on the so-treated enamel particles, and then firing the article so that it retains its rough surface and changeable color.

8. The process of producing fired ornamental enameled articles having a rough finish comprising applying to a base a wet porcelain enamel coating, dusting on said coating before it has dried enamel frit of the same general character as the wet enamel coating and having approximately the same firing temperature, and firing at the fusion temperature of the enamel frit to produce a rough finish.

9. The process of producing fired ornamental enameled articles having a rough finish comprising applying to a base a wet porcelain enamel coating, dusting on said coating before it has dried enamel frit, applying thereover a light coating of another enamel, and firing at the fusion temperature of the enamel frit to a rough finish.

10. The herein described process of producing

porcelain enameled ornamental articles having a changeable color comprising forming on an article base a rough surface by applying material fusible at the temperature at which the article is fired, said material in the unfused state being provided with facelets, applying color stable at the firing temperature to said rough surface so that the article after coloring when viewed in one direction appears predominantly of one color, and when viewed in a different direction the article appears predominantly of another color, and then firing the article so that it retains its rough surface and changeable color.

11. The herein described process of producing fired porcelain enameled ornamental articles having a changeable color comprising forming on an article base a roughened surface having present particles of a predetermined color fusible at the temperature at which the article is fired, applying porcelain enamel to said particles contrasting with the predetermined color of said particles so that the article after coloring when viewed in one direction appears predominantly of one color, and when viewed in a different direction the article appears predominantly of another color, and then firing the article so that it retains its rough surface and changeable color.

12. The process of producing fired porcelain enameled articles of rough finish and changeable color comprising forming on an article base a rough surface by the application of a porcelain gloss enamel, applying porcelain matt enamel to said rough surface so that the article after coloring when viewed in one direction appears predominantly of one color, and when viewed in a different direction appears predominantly of another color, and then firing the article so that it retains its rough surface and changeable color.

13. The herein described process of producing porcelain enameled articles of rough finish and changeable color comprising forming on an article base a rough surface provided with facelets by the application of porcelain enamel, applying color stable at the firing temperature to said rough surface so that the article after coloring when viewed in one direction appears predominantly of one color, and when viewed in a different direction appears predominantly of another color, applying a light dusting of enamel to the colored surface, and then firing the article at the fusion temperature so that it retains its rough surface.

14. In the process of producing fired ornamental articles having a rough surface of changeable color, the steps which comprise forming on an article base a rough surface having particles present of a predetermined color, said particles being adapted to at least partially fuse at the temperature at which the article is fired, applying to said particles at an angle color stable at the firing temperature so that the article when viewed in one direction appears predominantly of one color, and when viewed in a different direction the article appears predominantly of another color, and then firing the article so that it retains its rough surface and changeable color.

15. In the process of producing fired ornamental articles having a rough surface of changeable color, the steps which comprise forming on an article base a rough surface having particles of porcelain enamel present of a predetermined color, said particles being adapted to at least partially fuse at the temperature at which the article is fired, applying to said porcelain enamel particles at an angle color stable at the firing temperature so that the article when viewed in one direction appears predominantly of one color and when viewed in a different direction the article appears predominantly of a different color, and then firing the article so that it retains its rough surface and changeable color.

16. In the process of producing fired ornamental articles having a rough surface of changeable color, the steps which consist of depositing on an article base a base coat of vitreous enamel, depositing thereon small masses of similar material of a predetermined color to form a rough surface, said masses being adapted to at least partially fuse at the temperature at which the article is fired, applying to said masses at an angle a contrasting color so that the article when viewed in one direction appears predominantly of one color and when viewed in a different direction the article appears predominantly of another color, and then firing the deposited masses so that the article retains its rough surface and changeable color.

17. In the process of producing fired ornamental articles having a rough surface of changeable color, the steps of applying to an article base a matt porcelain enamel having a zinc component in excess and forming on said base a vitreous coating having present particles of a predetermined color, applying to said particles at an angle a contrasting color stable at the firing temperature so that the article when viewed in one direction appears predominantly of one color and when viewed in a different direction the article appears predominantly of another color, and then firing the article so that it retains its rough surface and changeable color.

18. An ornamental article of manufacture presenting a fired rough vitreous enamel finish comprising an article base having a base coat of vitreous material carrying small masses of similar material having one common side of one color and their opposite common sides of a contrasting color, the masses being fired onto and permanently attached to the base coat, said fired rough vitreous enamel finish when viewed in one direction appearing predominantly of one color and when viewed in a different direction predominantly of another color.

RICHARD H. TÜRK.