Nov. 19, 1935. F. NOWAK 2,021,820

PRODUCTION OF ARTICLES HAVING A MULTICOLOR FINISH

Filed May 6, 1931

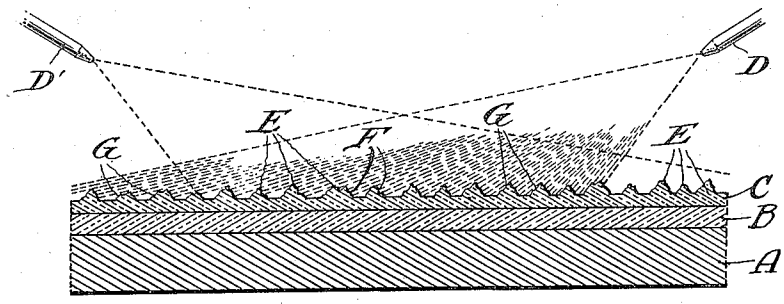

Fig. 1.

Inventor,

Franz Nowak

By Ivan P. Sachof.

Attorney

Patented Nov. 19, 1935 2,021,820

UNITED STATES PATENT OFFICE

2,021,820

PRODUCTION OF ARTICLES HAVING A MULTICOLOR FINISH

Franz Nowak, Baltimore, Md., assignor to The Porcelain Enamel and Manufacturing Company of Baltimore, Baltimore, Md., a corporation of Maryland

Application May 6, 1931, Serial No. 535,548

22 Claims. (Cl. 91—73)

The present invention relates to the production of fired articles presenting a finish having a multi-color effect.

Broadly the present invention is directed to the production of articles having a multi-color finish by applying to the article base granular particles, and then applying against the sides or the faces of these particles a single color or any number of colors from any direction, and thereafter heating the so prepared article at a temperature adapted to fuse the granular particles and their adhering colors to a relatively smooth surface. In one form of the applicant's invention the particles may be applied to the article base with the aid of a binder of any desired character.

The present invention also contemplates the provision of an article having the potential constituents of a multi-color surface, said article comprising an enamel base having superimposed thereon particles having a multiplicity of facelets, the different facelets of said particles being so colored with different colors to produce on fusion and subsequent cooling a surface having a multi-color effect. In the more specific aspect of the invention coarse or granular particles of enamel frit, crushed glass, naturally occurring minerals, or synthetic products are applied to an article base. Thereafter, there is applied to the facelets of the particles in different directions coatings of different colors, the particles being so colored to produce upon fusion and subsequent cooling a substantially smooth surface having a multi-color effect. The coatings of different colors may be applied to the particles so that the article prior to heat treatment adapted to fuse said particles appears, when viewed in one direction, predominantly of one color and when viewed in a different direction predominantly of another color. Upon fusion of the particles and their adhering colored coatings a smooth surface is produced having a multi-color effect. In one aspect of the present invention a rough dull enamel may be applied to the article base, said enamel presenting a rough surface and having a multiplicity of facelets which may be colored and fired as above set forth.

The present invention may be carried out using a ground coat of any character. The article may be fired between the application of any coat such as enamel binder or color, the only limiting factor being that the applied particles should not be fired to a point where they lose their erect form and that the article should not be fired between the application of colors to the respective facelets of the particles.

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

A base material is cleaned by sand blasting or the usual pickling process, and thereafter there is applied thereto a moist enamel coating. In some cases, it is desirable to use a ground coating, and this is first applied and thereafter an 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 multiple color effect of the finished article hereinbefore referred to is obtained by spraying the enamel frit with different colored enamels from a plurality of directions and thereafter firing the entire article so that the portion of the article at and adjacent the surface including the enamel frit fuses to a substantially smooth finish which presents on cooling a multiple color effect. One method of obtaining such a final finish is to apply a light dusting of an enamel of one color in one direction against the facelets of the frit particles, and thereafter apply in the reverse direction against the reverse facelets of the frit particles an enamel of another color. At this stage of the process, the intermediate article before firing, when viewed from different opposing directions, appears differently colored in accordance with the colors of the enamels used. However, after this intermediate article is fired to fuse the portion at and adjacent the surface, the final article simply shows a multiple color effect, depending upon the colors of the enamels used and the direction at which they have been sprayed on to the facelets of the frit particles.

In order to obtain the best results, the different colored enamels are applied at a sharp angle to the facelets of the frit 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 the different colored enamel coatings to produce the intermediate article will be clear from the figure, wherein A is the base, B is a ground or preparatory coat, C is a mat 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 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 portion between the particles F receive a slight coating of the color applied, for example red, and that when the sprayer is positioned at D', the intervening portions between the particles F will receive a very light coating of color, for example green. However, the intermediate article before firing to produce the final enamel article having a smooth surface, is when viewed in one direction predominantly red, and when viewed in the opposing direction predominantly green. When the article is fired, the final fused surface has a multiple color effect produced by diffusion of the colors employed. Stated differently, the colors blend one into another to produce a very pleasing effect.

The procedure set forth is, as stated, merely illustrative, and various changes may be made therein and still come within the scope of the present invention. Instead of using enamel frit any material may be used which is fusible at the final fusing temperature necessary to produce the smooth surface. For example, crushed glass may be substituted for the enamel frit. Further, naturally occurring and synthetic products may be used which will fuse at the final fusion temperature used to produce the smooth surface. This includes various minerals having relatively low fusing points.

It is not necessary that the final finishing coating of enamel be applied to the facelets of the frit particles in substantially reverse directions as set forth. The respective coatings of the final enamel may be applied to the frit particles from a number of directions, the only limiting factor being that the finish of the final article as fused should present a multiple color effect. In the illustrative example shown in the drawing, the different colors are applied from the spraying apparatus at approximately the same angle to the horizontal. However, 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 intermediate article, and a further modification in the color of the final fused article which, as stated, has a multicolor effect. The amounts of enamel of each color applied may vary, and this will have some influence on the multiple color effect of the finished article. In short, it may be stated that the different colors may be so applied to the enamel frit from various directions or from a multiplicity of directions simultaneously so as to produce the desired changeable color in the intermediate article, and a multiple color effect in the final fused article. In other words, the basic idea of the present invention is to apply the different colors in any predetermined fashion upon a granular or roughened surface to produce a predetermined multiple color effect when the surface of the article is finally fired. It is recognized that the color of the enamel frit used will somewhat affect the final multiple color effect of the article, since the enamel frits and the different colored sprayed enamels appearing on the faces of the enamel frit all melt at the fusion temperature and somewhat diffuse. However, in the preferred form of the invention, sufficient amounts of the different colored enamels are sprayed on the facelets of the frit particles so that the final multiple color effect produced on the fused surface of the article is substantially a multi-tone combination of the enamel colors. However, the invention in its broad scope contemplates the selection of a particular colored frit enamel which may in combination with the colored enamels sprayed on the surface of the frit particles produce the ultimate multiple color effect. It is recognized that the color of the frit used will have some effect upon the brilliance of the final color. For instance, white frits will produce much more brillant colors and hues than dark or black colored frits which will tend to reduce the brilliance of the finishing enamel. Therefore, the invention contemplates a control over the brilliance of the finished article by controlling the color of the enamel frit used. Further, instead of spraying the surfaces of the enamel frit with different colors to produce a multiple color effect, the surfaces of the frit may be sprayed with an enamel of only one color, the color thereof contrasting with the color of the frit enamel particles so that upon final fusion the two colors will diffuse to produce a two-tone effect.

The following specific examples will indicate how the color of the frit and the colors of the applied coatings may be so combined as to produce various multiple color effects. To a white enamel frit there may be applied from one direction at a suitable angle a dusting of red enamel. From a slightly different direction, at the same or a different angle, a green enamel may be applied, and from a still different angle or direction, a third or fourth color may be applied. Using a white frit and red and green enamels, as set forth, a finish is produced, the depth of color depending upon the amount of enamel dusted on, that shows well distributed particles of red and green varying in depth from the center of such particles to their edges, there being at the point of contact a slight mixture of color. The color of the white frit has a greater modifying effect upon the particles at this point as they are usually applied thinner. This point of contact in the intermediate article is the apex of the enamel frit particle which as it fuses down causes an intermingling of the colors on its opposite faces. Ordinarily, with the application in equal amounts of the different coloring enamels, there would be no predominance of any color. This may be controlled however by the amount of any one color which is applied. The relation of the intensity of one color to another will depend upon the relative amounts of color applied. It is conceivable however that in a case where there may be a combination of blue, green and yellow that the green might predominate owing to a mixture of the yellow and blue particles which function to strengthen the green color. The combination of blue frit having its faces sprayed with red and green has also been used to produce on fusion a porcelain enamel article having a multiple color effect. In this case, the finish is much the same as in the above illustration, except that the colors are considerably darker. The facelets of a white frit have also been sprayed with red and blue in such a manner as to produce upon fusion a finish which has a purple cast but which, of course, displays a multiple color effect. When using the white frit with red and green, as previously set forth, the article had a brownish cast, or the optical effect, when first viewed, was one producing an impression of weak brown. However, the green and red color was apparent except in those spots where the red and green had combined to produce a brown. It is, of course, obvious that

the color effects produced depend upon the color intensity of the colors used.

It is clear from the above that the cast of the article and the multiple effect of the final fused article may be controlled by controlling the variables involved in the color production. In other words, the color of the frit may be varied with the color of the sprayed enamel remaining constant, and this will result in one multiple color effect. The hue of the color may be changed and the other variables remain constant. In other words, by the use of various combinations of the variables involved, different effects may be produced, as will readily occur to those skilled in the art.

As above set forth, the frit used may be an enamel frit adapted to fuse at the final finishing and fusing temperature, crushed glass or any naturally occurring mineral or synthetic product adapted to fuse at the final finishing temperature. However, where a frit of enamel is applied to an underlying enamel coating, it is desired that the latter and the frit shall have about the same firing temperature. Further, the particles including the enamel frit, whatever their character, should preferably be sized to remove 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. It is desired to point out however that this example is merely illustrative of suitable mesh size for the frit particles, and that these limits may be greatly varied and departed therefrom. In the above example, the enamel particles have a fair degree of uniformity of size. However, the frit particles may be a mixture of varying sizes and when the particles of the frit as applied to the article vary in size, there will be a somewhat different color distribution in the final fused finish. In other words, by applying a mixture of frit particles of different sizes, the color distribution may be controlled to some extent. An ordinary run of frit in the condition in which it is obtained by water-cracking, when used as set forth, gives very satisfactory results.

As previously set forth, the frit particles may be applied to a moist enamel coating and thereafter a multiplicity of colors applied to the facelets of the particles and the article fired. However, if desired, the enamel coating first applied may be fired. In the latter case, it is necessary that means be provided for allowing the frit particles to adhere to the fired enamel coating. The frit particles may be mixed with a suitable adhering agent such as a solution of gum arabic or sodium silicate, and the mixture applied to the fired surface or the fired surface could be sprayed with a suitable adhesive including water and the frit particles thereafter applied. Water has been found to function to cause sufficient adherence of the particles to an underlying medium. In either case, the facelets of the frit particles have a multiplicity of enamel colors applied, as previously set forth, and the final article is then heated to fuse the frit particles and the enamel coating applied on the facelets thereof. This above procedure may be used irrespective of whether a ground coating is used.

The basic idea of the present invention may also be utilized without the employment of any underlying enamel coating. In that case, the metal base is cleaned as usual and there is directly applied upon the base a mixture of the frit material and gum arabic. Thereafter, the enamel coating is applied to the facelets of the frit particles and the article heated to a temperature adapted to fuse the surface layer to produce an article having a multiplicity of color effects. Instead of mixing the gum arabic with the frit particles, the gum arabic may be sprayed directly on the metal base and the frit thereafter applied. In either case, the metal base may be supplied with a ground coating and then a mixture of gum arabic and frit particles may be applied or the gum arabic may be first applied and the frit particles and colors thereafter applied. Proceeding as set forth, the article is thereafter fired at a temperature adapted to fuse the surface layer. The gum arabic, sodium silicate, water, oil or grease or any suitable adhesive serves to securely hold the frit particles on the article to which it is applied until on firing the frit particles and their carrying coats of enamel become sufficiently softened to cause the frit particles to attach themselves to the base. When a ground coat is applied, of course the gum arabic serves to hold the frit particles until, on firing, the ground coat is softened sufficiently to cause the frit particles to attach themselves thereto. The above examples are illustrative of various means of causing the frit particles to be attached to the underlying supporting medium until the article is fired. It is obvious that equivalent methods may be employed and still come within the scope of the present invention, and therefore the above examples are to be taken as illustrative and not as limiting the present invention thereto. Any of the well known adhesives may be used and this aspect of the present invention is not limited to the adhesives set forth.

In all of the above procedures wherein a ground coat and/or a liquid enamel is applied previously to the application of the frit particles, it is of course obvious that these intermediate coats may be fired, and then the frit particles applied. Thereafter, a multiplicity of enamel coatings of different colors may be applied and the article fired to produce a smooth surface also having a multiplicity of color effects. However, it is also to be understood that in the procedures above set forth the article carrying the ground coat and/or intermediate enamel coating may be fired after the application of the frit particles and the adhering coatings of different colored enamels on the frit facelets. In other words, one final firing at the temperature necessary to produce a smooth upper layer having a multiple color effect is sufficient, and this is the preferred method of carrying out the present invention, although as set forth various modifications thereof are permissible.

It is desired to point out that instead of applying a multiplicity of enamel colors to the facelets of the frit particles, under some circumstances raw colors which are stable at the fusion temperature may be applied to the facelets and the article brought to such a temperature as to fuse the surface layer to produce a multiple color effect. Preferably, when using the above procedure, the raw colors are ceramic colors, but this is not absolutely necessary, the limiting factor being that the colors must be stable at the fusion temperature. Under some circumstances, when using raw colors, as set forth, they may be mixed with an adhesive in order to facilitate their adherence to the facelets of the frit particles or the frit particles themselves may be first sprayed with an adhesive. It is obvious that other ex-

pedients may be used in order to facilitate the adherence of the raw colors to the facelets of the frit particles.

In any of the procedures set forth whereby either an enamel or raw color is applied to the facelets of the frit particles, it is within the province of the present invention to apply the frit particles either directly to the article base or on an intermediate coating such as a ground coat or underlying enamel coat, and then heat the article to such a temperature as to cause the frit particles to adhere directly to the article base or to the intermediate coating, but the firing should only be sufficient to cause this adherence and not to cause the frit particles to lose their angularity or, stated differently, to destroy their facelets. Thereafter, coatings of different colored enamels may be applied or the raw colors may be applied as hereinbefore set forth.

It is further desired to state that the color which is applied to the facelets of the enamel particles may be in the form of liquid enamel or dry enamel in dust form, liquid raw colors or dry raw colors. In other words, while the specific precedure herein set forth which is employed to coat the facelets of the frit particles represents the preferred procedure, it is within the province of the present invention to employ equivalent methods for coating the facelets of the frit particles.

It is conceivable that there could be a firing step between the application of any coat, be it enamel, binder or color, the only limiting factor being that in the case of the coarse particle, as stated before, it should not be fired to the point where it loses its erect form, and that in the last step of coloring the facelets a firing between these colors would not be possible.

To better illustrate the working of this invention, a stamped sheet iron stove leg had applied to it by dipping a coating of a standard ground coat enamel. While this was still wet, particles of the frit of which the ground coat was made, and which were sized between 40 and 80 mesh, were dusted on to the wet coating. The leg was then placed in a horizontal position and a light green enamel was sprayed on the facelets of the frit particles at an acute angle to the horizontal measured counterclockwise from the horizontal, as shown in the figure. The stove leg was then reversed in its position and at an almost directly opposite direction a light red enamel was sprayed on the facelets. The stove leg was then put into a drier to drive out all moisture from the enamel, after which the stove leg was placed into a muffle furnace at a temperature of 1550° F. for approximately five minutes, after which it was withdrawn and allowed to cool. The resulting finish gave a multi-tone effect of red and green particles evenly dispersed with a predominance of blue produced by the color of the coarse enamel frit which was of dark blue color. A further example of the present invention is as follows: a cast iron stove leg was given a coating of white liquid enamel. While this was still wet, coarse particles of wet cast iron enamel frit were dusted on and this leg placed in a horizontal position and red and green colors were applied in the same manner as in the above example, and when the enamel was dry the leg was fired at a temperature of 1350° F. for approximately fifteen minutes. In this case, the finish was of a much lighter nature than in the earlier illustration, there being an even distribution of red and green color with a brown cast produced by the admixture of these two colors where they may have made contact.

A further example of the present invention is: a piece of sheet iron had applied to it a standard ground coat enamel. After the ground coat was fired, a light coating of a solution of gum arabic was applied, and while this was still tacky coarse particles of ground coat frit were dusted on. The procedure from there on was the same as that set forth in the first example given. A coat of dull enamel which presents a roughened surface may be substituted for the coarse particles which produce much the same effect but of a much smaller design, the same principle operating as in the former case, except that the particle size is relatively much smaller. In other words, in one of the specific forms of the present invention, it is contemplated to substitute for the frit particles a rough dull enamel. This rough dull enamel may be applied as a coating to a base and the article fired. Since the dull enamel inherently produces a rough surface, there is thereby provided small facelets which may be sprayed, as set forth. For example, a green gloss enamel may be sprayed on the dull enamel at an angle of 30° or less with the face being sprayed. Preferably, only a light dusting of enamel is applied to the ware. The article is then turned about and from approximately the same angle a dusting of enamel of another color, for example red, is sprayed thereon. The article is thereafter fired at a temperature sufficient to fuse the surface layer and thereby produce a multiple color or multiple-tone effect. In the above form of the present invention, it is desired to use a dull enamel having a zinc compound in excess, preferably compounded as set forth in copending application, Ser. No. 511,432, filed Jan. 26, 1931. The latter application also sets forth suitable ground coats and gloss enamels which are eminently suitable for carrying out the present invention.

For example, 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. This formula is:

	Parts
Frit	100
Clay	6
Tin oxide	6
Water	40

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

	Parts
Flint	15.3
Feldspar	27.1
Borax	26.0
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 underfiring a very hard enamel. For example, an enamel that normally matures at 1600° F. in 2½ minutes may be fied 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 ordinary 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
Felspar	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

The above are merely illustrative of suitable frits in enamels which may be used to carry out the present invention. However, it is to be understood that various other frits and enamels well known in the art may be used together with such coloring ingredients as are necessary or desirable, colored enamels also being well known in the art.

It is desired to point out that the claims in the present case are limited to the production of articles preferably having a smooth vitreous or porcelain enamel coating presenting a multi-color effect, although the invention broadly is not limited to the utilization of particles of porcelain enamel frit or adhering coatings of porcelain enamel. If the final step of fusing the particles and adhering coatings of color is modified so that the particles themselves are not fused but are subjected to a temperature insufficient to fuse them, the resulting article has a rough finish and this is claimed in application Serial No. 522,387, filed March 13, 1931. However, it is to be distinctly understood that the various modifications of the basic principle herein set forth may be utilized to produce porcelain articles having a rough finish. In other words, all the steps and the various modifications thereof herein disclosed in producing the present article having a smooth multi-tone effect may be utilized in producing an article having a rough finish, the only modification necessary being that the final firing step should be insufficient to cause the granular or coarse particles or their equivalents to lose their erect form. Stated differently, when the particles are subjected to a firing temperature insufficient to cause their fusion, the changeable color persists, as set forth in the prior application, and when the firing temperature is sufficient to cause the coarse or granular particles to lose their erect form, there is a diffusion of the particles with the applied coatings to produce a substantially smooth surface presenting a multi-color effect.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The herein described process of producing fired vitreous enameled articles having a multi-color effect comprising adherently applying particles to an article base, said particles being fusible at the temperature at which the article is fired and on cooling forming a vitreous coating, applying to said particles in different directions coatings of different colors stable at the temperature of firing, and firing and completely fusing said particles to produce on cooling a surface having a multi-color effect.

2. The herein described process of producing fired vitreous enameled articles having a multi-color effect comprising adherently applying particles to an article base, said particles being fusible at the temperature at which the article is fired and on cooling forming a vitreous coating, applying color stable at the firing temperature to said particles so that when the article after coloring is viewed in one direction it appears predominantly of one color and when viewed in a different direction the article appears predominantly of another color, and then firing the so-treated article to completely fuse the colored particles and produce on cooling a surface having a multi-color effect.

3. The herein described process of producing fired vitreous enameled articles having a multi-color effect comprising producing on an article base a rough enamel surface having constituent particles fusible at the temperature at which the article is fired and forming on cooling a vitreous coating, applying to said particles in different directions coatings of different colors stable at the firing temperature, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

4. The herein described process of producing fired vitreous enameled articles having a multi-

color effect comprising applying to an article base an intermediate coating, adherently applying particles to said coating, said particles being fusible at the temperature at which the article is fired and on cooling forming a vitreous coating, applying to said particles in different directions coatings of different colors stable at the firing temperature, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

5. The herein described process of producing fired vitreous enameled articles comprising applying a ground coat enamel to an article base, applying to said ground coat enamel while it is wet particles of an enamel frit, said particles being fusible at the temperature at which the article is fired and on cooling forming a vitreous coating, applying to said particles in different directions coatings of different colors stable at the firing temperature, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

6. The herein described process of producing fired vitreous enameled articles having a multi-color effect comprising applying to an article base an intermediate coating, firing said intermediate coating, adherently applying to said fired coating particles fusible at the final firing temperature and on cooling forming a vitreous coating, applying to said particles in different directions coatings of different colors stable at the firing temperature, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

7. The herein described process of producing fired vitreous enameled articles having a multi-color effect comprising applying to an article base an intermediate coating, adherently applying particles to said coating, said particles being fusible at the temperature at which the article is finally fired and on cooling forming a vitreous coating, firing said article at a temperature insufficient to cause said particles to lose their erect form, applying to said fired particles in different directions coatings of different colors stable at the firing temperature, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

8. The herein described process of producing fired vitreous enameled articles having a multi-color effect comprising producing on an article base a rough dull vitreous enamel surface provided with facelets, applying to said facelets in different directions coatings of different colors stable at the firing temperature, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

9. The herein described process of producing fired vitreous enameled articles comprising forming on an article base a rough surface adapted to form a vitreous surface on fusion and cooling, said rough surface 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 firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

10. The herein described process of producing fired vitreous enameled articles having a two tone color effect comprising forming on an article base a roughened surface having present particles of a predetermined color provided with facelets and fusible at the temperature at which the article is fired and forming on cooling a vitreous coating, applying color stable at the firing temperature to said particles contrasting with the predetermined color of said particles, 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 firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

11. The herein described process of producing fired porcelain enameled articles having a multi-color effect comprising applying to an article base a coating of a vitreous enamel, adherently applying porcelain enamel particles of a predetermined color thereto to form a rough surface, said particles being 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 when the article after coloring is viewed in one direction it appears predominantly of one color, and when viewed in a different direction the article appears predominantly of another color, and firing and completely fusing said particles to produce on cooling a fused surface having a multi-color effect.

12. In the method of producing a vitreous enamel finish, the steps which consist in depositing a base coat of vitreous enamel material, depositing thereon small masses of similar material, spraying the deposited surfaces at an angle with a different color, and then firing and completely fusing the deposited mass.

13. In the method of producing an article having a vitreous enamel finish, the steps which comprise forming on an article base a rough surface having particles present of a predetermined color fusible at the temperature at which the article is fired and forming on cooling a vitreous coating, applying to said particles at an angle color stable at the firing temperature and contrasting with the predetermined color of the particles, and then firing and completely fusing said surface.

14. In the process of producing an article having a vitreous enamel finish, the steps which comprise applying porcelain enamel particles of a predetermined color to an article base to form a rough surface, applying to said porcelain enamel particles at an angle color stable at the firing temperature and contrasting with the predetermined color of the particles, and then firing and completely fusing said surface to produce a vitreous finish having the visual appearance of depth and roughness.

15. In the method of producing an article having a vitreous enamel finish, the steps which comprise depositing on an article base a cover coat of vitreous enamel material, forming a rough surface on said cover coat by depositing thereon a mixture of particles of vitreous enamel material and a liquid component, applying to said particles at an angle color stable at the firing temperature and contrasting with the predetermined color of the particles, and then firing and completely fusing said surface to a vitreous finish having the visual appearance of depth and roughness.

16. In the method of producing an article having a vitreous enamel finish, the steps which

comprise depositing on an article base a cover coat of vitreous enamel material, drying said cover coat at least to some degree, forming a rough surface on said cover coat by depositing thereon particles of vitreous enamel material, applying to said particles at an angle color stable at the firing temperature and contrasting with the predetermined color of the particles, and then firing and completely fusing said surface to a finish having the visual appearance of depth and roughness.

17. In the method of producing an article having a vitreous enamel finish, the steps which comprise depositing on an article base a cover coat of vitreous enamel material, drying said cover coat at least to some degree, depositing thereon a mixture of particles of vitreous enamel material and a liquid component, applying to said particles at an angle color stable at the firing temperature, and contrasting with the predetermined color of the particles, and then firing and completely fusing said surface to produce a finish having the visual appearance of depth and roughness.

18. In the method of producing an article having a vitreous enamel finish, the steps which comprise applying a wet coat of vitreous enamel material in pebble form to an unfired coat of vitreous enamel material dry at least to some extent, said materials forming on firing at their fusion temperature and subsequent cooling a vitreous coating, applying to the pebble coat of vitreous enamel material at an angle a color coat stable at the temperature of firing so that when the article before firing is viewed in one direction it appears predominantly of one color and when viewed in a different direction the article appears predominantly of another color, and firing and completely fusing the said vitreous enamel and color coat.

19. In the method of producing a vitreous enamel finish, the steps which consist in depositing a base coat of vitreous enamel material, depositing thereon small masses of similar material, treating the deposited surfaces at an angle with a different color stable at the firing temperature, firing the deposited masses at the fusion temperature, said deposited masses forming a completely fused surface and cooling said fused masses.

20. In the process of producing an article having a vitreous enamel finish, the steps which comprise applying small masses of porcelain enamel of a predetermined color to an article base to form a rough surface, applying to said porcelain enamel masses at an angle color stable at the firing temperature and contrasting with the predetermined color of the masses, and then firing the deposited masses at the fusion temperature, said deposited masses forming a completely fused surface which on cooling gives the visual appearance of depth and roughness.

21. An article of manufacture having a vitreous enamel finish produced in accordance with claim 12, said vitreous finish having the visual appearance of depth and roughness.

22. A new article of manufacture having a vitreous enamel finish produced in accordance with claim 17.

FRANZ NOWAK.