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NONOILY VITREOUS ENAMEL

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My invention relates to vitrifiable glass colors or enamels and like compositions for ceramic materials, such as glass, pottery, porcelain, and for metals and other materials adapted to be treated by heat to form a permanent surface thereon and has for its object to provide a new and efficient enamel or vitrifiable glass color which has no oily base or oily ingredients therein.

A further object is to provide a new improved method of decorating glass, porcelain, and like articles, and for metals for applying a plurality of distinct enamels or coatings which may be fired at one time.

This invention is not limited to any one particular form of application, the main function is to provide a carrier or medium having adherent characteristics that the material will be retained as a tough film of color or enamel which may be sprayed, brushed, or screened, onto the surface to be covered, the material to be made in paste, liquid, or semi-liquid form. The material may also be pressed through a mesh fabric, whether of silk, chiffon, organdie, cotton or fine mesh metal, said mesh to carry any desired pattern thereon or therein to form the design desired on the finished article.

A still further object of the invention consists in the composition which is hereinafter described and in the novel features thereof, and providing an improved carrier or medium for vitrifiable colors or enamels producing useful, novel, and improved features in the decorating of glass, pottery, china, or metal, though in the broadest sense of the invention not limited to, the production of designs or ornamentations according to the process of said invention.

The present invention not only is new, novel, and useful by replacing the usual oily carrier or medium but has many advantages such as not requiring any preheating to dry out the oily substance, which eliminates the cost of preheating and the extra handling prior to the final firing of the decorated articles. The composition does not clog or damage the fabrics or metals used whether in paste form for pressing or squeezing through fine mesh, or in liquid form for aerographing or spraying methods. The material dries rapidly, but not too rapid to clog the fine mesh or the delicate parts of a spray gun. After the articles have been decorated they dry perfectly hard in ten to fifteen minutes. This enables the articles to be handled without danger of scratching or blurring the designs prior to firing. The danger of carbonaceous residue is entirely eliminated and it will be noted by those

versed in the art, the ingredients composing the carrier or medium after it has been applied to the articles and allowed to dry is impervious to oil, hence a perfect surface with a high gloss is obtainable.

Another important feature of the present invention is, that the carrier or medium is water-soluble, thereby eliminating all solvents or washes for cleaning the designs or spray guns. It also has the added advantage, that if articles are spoiled by wrong designs or for any other reasons the articles can be washed clean with water at a minimum of cost.

I have also found that after the decorated articles are dried they can be stacked close to each other without injury to the design, and the articles can be stored for an indefinite period without deterioration of the colors or enamels or the softening of same, provided they are kept in a room with an even temperature.

This invention finds particular use in the coating of metal on account of the adherent qualities which the improved enamel or coating has for the metal. The metal surface ordinarily provides no effective bond for a color or enamel but when mixed with the present carrier such a bond is produced also.

For the same reasons the invention particularly lends itself for application to the coating of glass, such as permanent labelling of bottles, jars, and the like, and electric light sign letters, or electric bulbs for indoor or outdoor use. The adherence of the coatings and a higher resistance to weather and wear are important features in this connection. Pottery and glassware for ornamental use may be also readily produced with complex designs in colors and these may be produced by a single firing.

It is not essential according to this invention that each layer or coating should be fired singly or separately, even a ground coat on a plate prepared for a porcelain enamelled sign can be sprayed on the metal and it will dry sufficiently hard to allow the design to be printed over the ground coat on the plate and fired at one operation. Any layer or coating of color or enamel containing the carrier or medium will be practically insulated from an underlying or overlying layer so that superimposing coatings according to this invention may be made prior to firing, whereas under present methods where the old brushing out method is employed, or the colors contain an oily carrier, each color is fired separately.

The use of my liquid quick drying composition

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for applications of the colors or enamels to the articles to be decorated makes the use of spraying through stencils an easily practiced method, for commercial production at small expense of uniform articles such as signs, tile, and the like. By the use of the colors or enamels in paste or semi-paste form they can be pressed or squeezed through fine mesh whether a fabric or metal for applying labels to bottles with a fired design in colors so that the use of such bottles may readily become a commercial practice. Various other uses and advantages of the invention will be apparent to those skilled in the art.

I have also found that my composition when mixed with finely divided particles of oxides, color or enamel, can be pressed or squeezed through a screen or stencil of silk or other meshed material whether a fabric or metal having permeable and impermeable parts on the design formed by opaque fillers, or carbon tissue designs or film treated paper designs without any injury to the designs or the materials used, whether silk, chiffon, organdie, cotton or metal, or other materials for similar purposes, and that it is not necessary or expedient or economical to use an oily medium or carrier.

It is well known to the art, that vitreous colors or enamel compositions containing oily compounds or fats tend to produce a reducing temperature in the furnace or lehr through the retaining of the oils or fats in the vitreous color or enamel, they also leave a carbonaceous residue which prevents the enamel from flowing smoothly, and in many cases, changes the color itself, due to the continued volatilization of the residues as the firing temperature increases, which also results in small blisters or pin-holes and hard, rough surface with a lack of gloss. Orange, red, and yellow being colors of a different nature are not so susceptible to change, but blue colors may show another trouble from carbonaceous residues, as they may become more opaque; that is whitish or chalky, which makes the blue appear lighter in color. By preheating, or as it is sometimes called, decarbonizing, it is possible to dry out the oily medium, but if the furnace or lehr is not sufficiently ventilated to provide an oxidizing atmosphere, the effects of preheating might be completely neutralized. The preheating of the articles decorated with a vitreous color having an oily carrier is far from an economical method and results in the articles having to be handled more often and the cost of fuel in the preheating operation.

In the reissue United States Letters Patent Number 16,048, April 21, 1925, and granted to Herbert Hamilton Scott and George McIntosh Scott, also United States Letters Patent 1,651,474, Dec. 6, 1927, there is described a method of producing such designs utilizing a pasty enamel composition containing a finely ground vitreous enamel and an oily carrier. It is pointed out in said specification that it is important to have the composition in the form of a pasty consistency so that it would be deposited on the enamel surface, after passing through the mesh, in finely divided form, and that it must contain an oily vehicle to lubricate it to enable it to pass through the fine mesh, and that the ingredients mixed with the ground frit or enamel should be of such a character that the composition will not dry too rapidly, and that they may be readily volatilized without damage to the enamel when the latter is fired.

Heretofore the production of decorative de-

signs, lettering or ornamentations on vitreous enamel ware, particularly when multi-colored designs have been desired, has been very different and limited in scope.

Furthermore, it is to be understood, that the invention is not limited to the particular composition and proportions referred to, since the ingredients used and the proportions of same and the method of applying the colors or enamels to various surfaces may be varied according to any particular requirements or materials it is desired to treat and in accordance with any particular practical requirements and conditions it may be desired to fulfil.

The present invention relates to a composition for preparing the vitreous color or enamel with a suitable consistency for applying to a vitreous surface by means of a screen or stencil or spraying, and finally heating the articles so treated to a temperature to cause fusibility of the vitreous color or enamel without any carbonaceous residues. The temperatures used for fusing vitreous color and enamels differ widely, particularly for metals, depending upon the enamel ware. A ground coat is burnt at a higher temperature than a finishing coat, this is not due to the fact that the ground coat necessarily has a higher softening temperature than the finishing coats, but rather that the excellence of the ware is improved, in this respect it has also been found that the enamel prepared with a non-oily carrier has an equalizing softening effect.

I have found that under practical working conditions it is not by any means advisable to use the vitreous color or enamel in paste form when it is to be pressed or squeezed through a fine mesh, whether the mesh is of fabric or metal, with designs formed by permeable or impermeable portions; when said designs are used with mechanical or automatic devices it is necessary to have the vitreous color or enamel in a semi-liquid form to obtain the best results.

I will now describe in detail the composition: I take 20 parts of sodium silicate (36° Bé.) to which I add 40 parts of a starch compound in syrup form, and to the above I add 10 parts of glycerol (30° Bé.) or ethylene glycol. These ingredients are thoroughly mixed until there is no sediment left in the bottom of the container and as these ingredients are soluble one with the other the time of stirring will be only a few minutes after which they will always remain in suspension ready for use. The starch compound used in the above formula is preferably that of the clear variety of syrup commonly known on the market as "Karo".

I now take the powdered coloring matter to which I add a "frit" in the case of metal, and a "flux" in the case of glassware, these are weighed approximately 25% of the "flux" to 100% of the coloring matter. In the case of metal I add from 90 to 95% of the "frit" to from 2% to 5% of the coloring matter. These proportions vary considerably in different factories, they are merely given here as being those which I have had the best results with and are not otherwise vouched for. I take the coloring matter and the "flux" or "frit" as the case may be and grind them in a ball mill or other suitable grinder until the powdered material will pass through a mesh measuring 200 meshes to the square inch.

In preparing the powdered combination of "frit" or "flux" with the coloring matter I add the mixture or composition previously described

- approximately 1 to 2 ounces to one pound of the powdered material. I then mix the powdered material and the mixture or medium thoroughly. It will be found that a dry paste will be formed at first, but after continued grinding the paste will become wet and very pliable, it is advantageous to pass the finished mixture through the ball mill or suitable grinder prior to use. When coloring matter is purchased ready ground it should be stipulated that the material should be ground to pass through 200 mesh, in such a case it is only necessary to mix the coloring matter with the mixture or medium and grind as hereinbefore described.
- 15 The paste like consistency can be regulated by the amount of mixture or medium added to the coloring matter and the above quantities are given as an example. I have found that different materials require different quantities of mixture to apply to different glass and metal articles so that it is in the most pliable form to be pressed or squeezed through the permeable or impermeable portions of the design formed on the meshed fabric or metal. In case of spraying the combined mixture of coloring matter and medium through a spray gun, distilled water can be added until the required consistency to pass through the nozzle of a spray gun has been attained.
- 25 What I claim is:
- 30 1. A vitreous enamel composition comprising

sodium silicate, ethylene glycol, glycerol and corn starch syrups.

2. A vitreous enamel comprising sodium silicate, glycerol, corn starch syrup and suitable coloring.

3. A vitreous enamel comprising sodium silicate 20 parts, ethylene glycol 10 parts, and corn starch syrup 40 parts.

4. A vitreous enamel comprising sodium silicate, 20 parts by weight; glycerol 10 parts by weight; corn starch syrup 40 parts by weight; mixed to a pasty consistency to which suitable coloring material is added.

5. A vitreous composition of a pasty consistency comprising finely ground enamel "frit", a coloring oxide, sodium silicate, ethylene glycol, glycerol, and corn starch syrup.

6. A process for producing a vitreous enamel composition, comprising making a liquid composition of ethylene glycol, corn starch syrup and sodium silicate, and mixing this with ground enamel "frit" and coloring matter.

7. A non-oily vitreous enamel adapted to be passed through a fine mesh fabric by use of a squeegee comprising 20 parts of sodium silicate, 10 parts of glycerol, 40 parts of corn starch syrup, to which a flux is added and the entire mixture thoroughly mixed to a smooth consistency.

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