Sept. 15, 1942. H. J. FRALISH 2,295,945

MANUFACTURE OF VITREOUS ENAMELED ARTICLES

Filed Jan. 24, 1940

FIG. 1

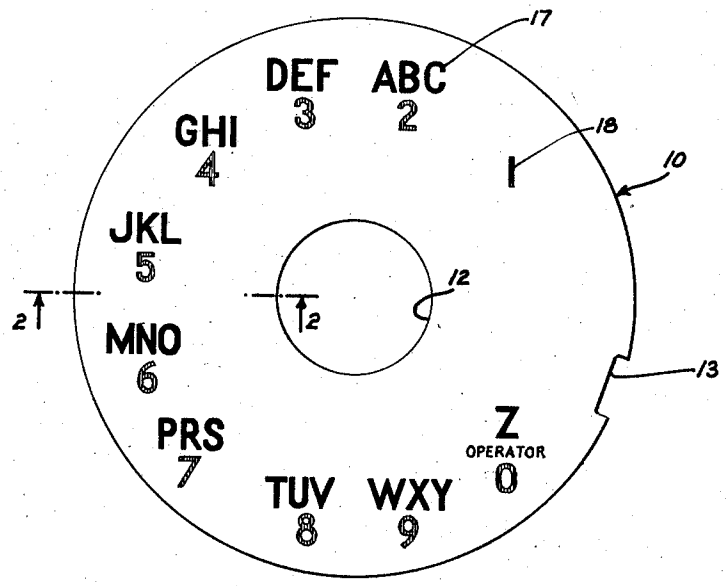
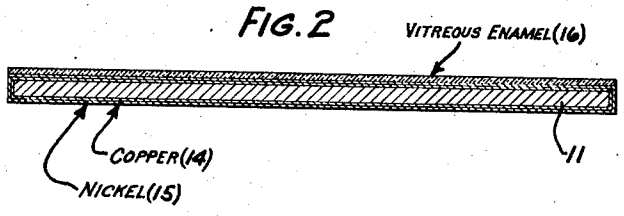


FIG. 2



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MANUFACTURE OF VITREOUS ENAMELED ARTICLES

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6 Claims. (Cl. 117—53)

This invention relates to the manufacture of vitreous enameled articles, and more particularly to methods for applying a coating of vitreous enamel on a portion of an article surface.

It is often desirable to coat part of an article with vitreous enamel and to restrict the coating to definite portions of the article surface. For example, the familiar number plate used in telephone dials is a metal ring having an enamel coating on its top surface or face and characters applied on the coating. The finished number plate is mounted in the dial with its inner and outer peripheral edges closely engaging other dial members. To facilitate assembly of the plate with these members, it is desirable to prevent the formation of any enamel coating on the peripheral edges of the plate. This single requirement can be met readily by applying the enamel frit on the face or top surface of the plate and then firing the plate in the usual manner. Due to the normal tendency of the frit to burn away or pull away from a sharp edge during vitrification, the resultant coating will be spaced from the edges of the plate and the peripheral edge portions of the face will remain uncoated.

However, in the manufacture of telephone dial number plates and similar products, it is also necessary to completely coat the outer peripheral portions of the top surface of the plate with enamel. The inner portion of the ring shaped plate is covered by another dial member but the outer edge fits into a recess with the top portion of the plate exposed and, consequently, the enamel coating must extend uniformly to the outer plate edge. The tendency of vitreous enamel to shrink away from an edge as it fuses is well known and, consequently, when the enamel is applied on the plates by the usual methods, the peripheral portions of the face are often either entirely uncoated or inadequately coated for service and appearance requirements. Usually, the enamel coating on the plates is fused and later refired to mature the character markings and this supplementary firing aggravates any normal deficiency in the enamel coating.

An object of this invention is the provision of improved methods for applying a uniform and durable coating of vitreous enamel accurately on a selected portion of an article surface.

In accordance with one embodiment of this invention, simple and inexpensive methods are provided for coating the face of telephone dial number plates and articles of similar configuration with a vitreous enamel coating that extends uniformly to the outer periphery of the plate. The ring shaped blank or base for the plate is formed of metal and plated first with copper and then with nickel. The edge surface of the plated base is rolled against an absorbent pad saturated with a petroleum distillation product of suitable characteristics to cause its application on the edge surface of the plate and also on a predetermined portion of the face of the plate adjacent to the edge. The edge surface of the plate is then rolled against a clean absorbent pad to remove the petroleum distillation product from the edge surface, but not from the face of the plate. Enamel frit is then dusted on the face of the plate and the plate is fired to vitrify the enamel. Due to the presence of the petroleum distillation product, the enamel fuses uniformly and the resultant coating terminates abruptly at the outer edge of the top surface of the plate.

Following is a more complete description of the invention taken in conjunction with the appended drawing, in which

Fig. 1 is a plan view of a telephone dial number plate made in accordance with one embodiment of the invention, and

Fig. 2 is an enlarged sectional view of Fig. 1 taken on the line 2—2.

In producing a telephone dial number plate 10 in accordance with this invention a ring shaped base 11 or blank is formed of iron or steel. The base is conveniently punched out of sheet material and is provided with a central opening 12 and a shallow notch 13 in its outer periphery for positioning the finished plate in a dial assembly. The blank is usually flat but may be slightly convex.

The formed blank is electroplated first with a layer of copper 14 and then with a layer of nickel 15. These electrodeposited coatings protect the unenameled portions of the base against corrosion and also promote adherence of the subsequently applied enamel, as explained fully in Patent 2,020,477, issued November 12, 1935, to W. J. Scott and S. R. Mason.

In the next operation a localized agent is applied on the face of the base or ring to cause a subsequently applied vitreous enamel to form into a coating having the same thickness and smoothness at the central and at the outer edge portions of the plate surface. To accomplish this result it is necessary for the agent to have definite characteristics and to be accurately

localized on the plate surface. One agent that has been used successfully for this purpose is a petroleum distillation product or refined petroleum oil having a specific gravity between .840 (36.7° Bé.) and .860 (32.8° Bé.) at 60° F., a flash point not lower than 350° F., and a viscosity between 80 and 100 seconds when tested with a standard Saybolt viscosimeter at 100° F.

This material is applied on the plates conveniently by rolling the edge surface of the plate against an absorbent pad, preferably several thicknesses of cotton cloth, that has been saturated with the material. In this operation a number of the plates are mounted on assembled on a rod or mandrel, with the mandrel through the central opening in the plate. The edge surfaces of the blanks are then rolled against the saturated pad with the plates approximately perpendicular to the pad. This coats the edge surface and a definite portion of the plate face with the petroleum derivative. The plates, while still assembled on the mandrel, are then rolled against a clean absorbent pad, made up of several thicknesses of clean cotton cloth. In this operation the edge surfaces of the plates are engaged by the absorbent pad while the plates are substantially perpendicular to the pad, with the result that the petroleum derivative is removed from the edge surface but not from the faces of the plate.

The coating that remains on the plate faces depends largely upon the properties of the petroleum derivative contained in the first pad. These properties are selected to cause the petroleum derivative to travel up the faces of the plate when the edge surface of the plate is engaged by the saturated pad and thus form a deposit extending a predetermined distance from the peripheral edge of the plate. The peripheral notch in the plate is small, being about one-sixteenth inch deep and one-half inch long, and the properties of the petroleum derivative are such that it travels along the plate surfaces around the notch to provide a complete coating on the peripheral portion of the plate face.

The treated face of the plate base is next provided with a coating of white vitreous enamel **16**. For number plates and similar articles a lead boro-silicate enamel opacified with arsenic oxide may be used. The enamel is ground, sized and sifted on the top surface of the plate and the plate is then fired at a temperature around 1600° F. for about six minutes to fuse the enamel particles into a coating. Due to the differential in surface conditions under the enamel, the coating forms in a smooth uniform layer at the extreme outer edge of the plate. The presence of the petroleum derivative at this portion of the plate surface overcomes the normal tendency of the vitreous enamel to shrink away from the edge. By accurately localizing the petroleum coating and providing suitable properties in the coating this normal tendency of the enamel is directly counteracted. The petroleum derivative also serves to hold the enamel particles in position during any handling of the plate before firing, but its principal function is to promote the formation of an enamel coating that is uniform at the outer portions of the plate and terminates abruptly at the plate periphery.

No enamel coating forms on the edge surface of the plate because the petroleum derivative has been removed therefrom, and consequently the accurate dimension necessary to facilitate assembly of the plate with other members in the dial are preserved. The inner edge of the top surface of the plate is covered by another dial member as previously explained, and an incomplete enamel coating at that portion of the plate is therefore not objectionable. The small amount of petroleum derivate remaining on the under face of the plate, where no enamel particles are applied, is either burned out during the firing operation or removed subsequently.

After the white enamel coating is fired, character markings are applied on the plate surface. The characters are formed in ceramic ink, comprising colored metallic oxides or enamel particles mixed to a tacky consistency in a vehicle such as linseed oil. The letters **17**, which are usually black, are printed on the plate surface and the plate is then baked at about 300° F. The numerals **18** are then applied, usually in red, after which the plate is fired at around 1300° F. for approximately 4.5 miutes to mature the inks.

This repeated heating of the plate tends to aggravate any defects in the white enamel coating and, ordinarily, certain defects due to a very thin or a ragged coating at the edge of the plate may not appear until after the final firing operation. The enamel coating produced by the methods described herein has the same thickness at the edge and at the center of the face and the coating terminates abruptly at the edge of the plate. Consequently, the formation of weakened areas in the coating that are subject to damage by repeated firings is avoided.

While the petroleum derivative described herein is preferred, other materials having the same or equivalent properties can be used satisfactorily. Also it will be apparent that these methods can be employed advantageously in the manufacture of certain vitreous enameled articles other than telephone dial number plates. It is, therefore, to be understood that the invention is limited only by the scope of the appended claims.

What is claimed is:

1. In a method of producing a vitreous enamel coating on the face of a substantially flat article, the steps of engaging the edge surface of the article with an absorbent material containing a petroleum oil to apply the petroleum oil on said edge surface and a portion of the article face immediately adjacent to the edge, engaging the edge surface of the article with an absorbent material to remove the petroleum oil from the edge surface, applying particles of vitreous enamel on the face of the article, and firing the article to fuse the vitreous enamel particles and form a coating.

2. In a method of producing a vitreous enamel coating on the face of a substantially flat circular article having a central opening therein, the steps of assembling a plurality of the articles on a mandrel with the mandrel extending through the openings in the articles, rolling the assembled articles over an absorbent pad containing a petroleum oil with the edge surfaces of the articles in contact with the pad, subsequently rolling the edge surfaces of the assembled articles against a clean absorbent pad, applying a vitreous enamel in finely divided form on the face of the article, and firing the article to fuse the enamel into a coating.

3. In a method of producing a vitreous enamel coating on the face of a substantially flat article, the steps of applying a petroleum derivative on an edge surface of the article and the portion of the article face immediately adjacent to the

edge surface by engaging the edge surface with an absorbent material containing the petroleum derivative, said petroleum derivative having a viscosity between 80 and 100 seconds when tested with a Saybolt viscosimeter at 100° F. and a specific gravity between 36.7° Bé. and 32.8° Bé. at 60° F., removing the applied petroleum derivative only from the edge surface by engaging the edge surface of the article with clean absorbent material, applying vitreous enamel particles on the face of the article, and firing the article to fuse the vitreous enamel particles and form a coating.

4. In a method of producing a vitreous enamel coating on the face of a substantially flat circular article having a central opening therein, the steps of assembling a plurality of the articles on a mandrel with the mandrel extending through the openings in the articles, rolling the edge surfaces of the assembled articles against an absorbent pad containing a petroleum derivative having a viscosity between 80 and 100 seconds when tested on a Saybolt viscosimeter at 100° F. and a specific gravity between 36.7° Bé., and 32.8° Bé. at 60° F., subsequently rolling the edge surfaces of the assembled articles against a dry absorbent pad, applying a vitreous enamel in finely divided form on the face of the article, and firing the article to fuse the enamel into coating.

5. In a method of producing a vitreous enamel coating on the face of a substantially flat circular article having a central opening therein, the steps of assembling a plurality of the articles on a mandrel with the mandrel extending through the openings in the articles, rolling the assembled articles over an absorbent pad containing a petroleum derivative with the edges of the articles in contact with the pad and the articles substantially perpendicular to the pad, said petroleum derivative having a viscosity between 80 and 100 seconds when tested on a Saybolt viscosimeter at 100° F. and a specific gravity between 36.7° Bé., and 32.8° Bé. at 60° F., subsequently rolling the edge surfaces of the assembled articles against a dry absorbent pad with the articles substantially perpendicular to the pad, applying a vitreous enamel in finely divided form on the face of the article, and firing the article to fuse the enamel into a coating.

6. In a method of producing a vitreous enamel coating on the face of a substantially flat circular article having a central opening therein, the steps of assembling a plurality of the articles on a mandrel with the mandrel extending through the openings in the articles, rolling the assembled articles over an absorbent pad containing a petroleum derivative with the edge surfaces of the articles in contact with the pad and the articles substantially perpendicular to the pad, said petroleum derivative having a viscosity between 80 and 100 seconds when tested on a Saybolt viscosimeter at 100° F. and a specific gravity between 36.7° Bé., and 32.8° Bé. at 60° F., subsequently rolling the edges of the assembled articles against a second absorbent pad with the articles substantially perpendicular to the pad, applying a lead boro-silicate vitreous enamel in finely divided form on the face of the article, and firing the article at a temperature around 1600° F. to fuse the enamel into a coating.

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