

# UNITED STATES PATENT OFFICE

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## ENAMEL COMPOSITION

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1 Claim. (CL 106—48)

The present invention relates to new and useful improvements in vitreous enamel compositions.

Heretofore it has long been the custom in the production of vitreous enamels to smelt into the enamel certain substances to promote adherence of the enamel to the ferrous base metal when it is applied to the surface and fired. These substances have been cobalt oxide, either alone or in conjunction with nickel oxide and/or manganese oxide. Such a frit produces a dark blue ground coat which is usually covered with other enamels containing opacifiers in order to leave the product with a white or light colored finish. The usual practice is to apply two such coats, as it has been found that one heavy coat is insufficient to completely cover the dark colored ground coat, so that in the production of enamel ware three distinct coats, and thus three distinct heat treatments, are necessary for a finished product of the desired quality.

It has been proposed to smelt about 1.5% molybdenum trioxide ( $\text{MoO}_3$ ) and 7.5% antimony oxide ( $\text{Sb}_2\text{O}_3$ ) with a typical enamel batch from which the dark-color producing substances cobalt oxide, nickel oxide, and manganese oxide have been omitted and thus to produce a light colored ground coat which would have the necessary adherence properties. However, it was found that the results were erratic and satisfactory adherence was frequently not attained, probably due to the volatilization of the added oxides during the smelting of the frit. It has also been proposed to electroplate the ferrous base with  $\text{MoO}_3 \cdot x\text{H}_2\text{O}$  to promote adherence, but this requires accurate control and added equipment, as well as entailing an operation which is foreign to the usual enamelling process.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the steps, instrumentalities and combinations pointed out in the appended claim.

The invention consists in the novel steps, processes, combinations and improvements herein shown and described.

The present invention has for its object the provision of a new vitreous enamel composition which is more adherent to the base metal on which the enamel is applied and fused. The in-

vention also provides a vitreous enamel composition which requires a fewer number of coats, and is of a white or light color. A further object is to provide such a composition which reboils very slightly, which makes possible the use of lower temperatures in the fusion of ground coats for enamel ware, and permits finer adjustment of the ground coat at the mill.

In accordance with the present invention the adherence of the enamel coating may be promoted and the opacity of light colored coats improved by the use of molybdenum salts and compounds in any type of enamel frit or ground coat mixture. The molybdenum is usually employed in connection with antimony oxides and the molybdenum compounds may be added to the smelt when the frit is produced or milled in with the enamel when preparing the slip, depending upon the type of compound used and the results desired. When light colored coats are desired, the usual smelted in cobalt, manganese, and/or nickel oxides may be omitted and the molybdenum and antimony compounds employed, the other ingredients of the usual enamel frit being used in substantially the same proportions. The first coat adheres at least as well as the cobalt-nickel-manganese frit heretofore used, and has the added advantage that due to the light color and opacity only one additional coat is required to completely obscure the base.

It will be understood that the foregoing general description and the following detailed description as well, are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now in detail to several illustrative methods of preparing the compounds and carrying out the processes of the present invention, a molybdenum suboxide, such as molybdenum dioxide ( $\text{MoO}_2$ ) or "molybdenum blue," is milled with antimony trioxide ( $\text{Sb}_2\text{O}_3$ ) in a clear frit, has been found to produce excellent adherence when fused on the ferrous base metal and, probably due to the fact that it is insoluble in the mill liquor, there is no crawling, tearing or peeling of the enamel during the firing process.

Successful results have been obtained throughout a considerable range of variation in the amounts of a lower oxide of molybdenum and antimony trioxide ( $\text{Sb}_2\text{O}_3$ ) used, and the proper amounts will depend on a number of circumstances, such as, for example, the nature of the enamel, the nature of the iron surface, the thick-