

UNITED STATES PATENT OFFICE.

ERNST TRAINER, OF DORTMUND, GERMANY.

ENAMEL.

SPECIFICATION forming part of Letters Patent No. 589,554, dated September 7, 1897.

Application filed April 23, 1895. Serial No. 546,916. (No specimens.)

To all whom it may concern:

Be it known that I, ERNST TRAINER, analytical chemist, residing at Dortmund, in the German Empire, have invented a new and useful Enamel, of which the following is a specification.

Hitherto in manufacturing enamels or glazes it has been usual to add borax or boric acid to the mass under treatment, both with a view to rendering it sufficiently fusible for practical purposes and for imparting to it the gloss or brilliancy upon which its attractive appearance mainly depends. When it is desired in the case of some kinds of enamel to impart to the substances a certain milky whiteness or dullness, there is generally added, in addition to the borax, a certain quantity of cryolite, adapted to act as both a flux and an agent for dulling the color of the enamel or glaze, especially in those cases where the employment of bone-ashes, which are mostly used for dulling, is found inconvenient, which is sometimes the case, because bone-ashes have the property of rendering glass less fusible, and therefore require particularly large quantities of flux. All of these fluxes and dulling agents, however, are attended with the common defect of being comparatively expensive and thereby rendering the employment of enamel altogether impracticable in many cases. In addition to this the fluxes hitherto used, such as borax, must be simply described as necessary evils, inasmuch as the greater the quantity of them used the worse the quality of the glass, glazes, and enamels turns out to be.

Now according to this invention the fluxes named above are either wholly or partly replaced by phosphates of alkali metals. Alkaline earths must invariably be rejected. By such substitution glazes or enamels are obtained which possess all the good qualities which similar substances have exhibited up to the present time. They will, in fact, prove very resistant and elastic, sufficiently fluid and brilliant. At the same time, owing to the employment of a compound of phosphoric acid with alkali metals, the glaze or enamel is dulled when required, and such dulling action becomes particularly intense when some heavy metal is added; but the chief advantage of the improved fluxes over similar

substances heretofore used is that besides their improved quality and reduced cost the enamels thereby produced are fit to be directly applied to almost any conceivable purpose.

It rests, of course, with the manufacturer to effect an entire or only a partial substitution, and the composition of the enamel will necessarily vary accordingly as one or the other course is adopted. In no case, however, should the amount of phosphates of alkali metals be less than five per cent., as otherwise it will not perform the desired combined action of a flux and dulling agent, nor will it materially reduce the cost of the final product if used in an insufficient proportion.

The following is an enamel composition embodying my invention: silica, thirty-three parts; feldspar, twenty parts; phosphate of sodium, twelve parts; calcareous spar, twelve parts; soda, eighteen parts; nitrate of potassium, four parts; fluor-spar, ten parts; clay, two parts; oxid of cobalt, (china-blue,) five thousandths of one part.

The following three known acids and their alkali salts can be used: orthophosphoric acid, (H_3PO_4 ;) metaphosphoric acid, (HPO_3 ;) pyrophosphoric acid, ($H_2P_2O_7$.)

The action of a phosphate of an alkali metal differs considerably from that of a phosphate of an alkaline earth.

The phosphates of the alkaline earths—e. g., phosphate of lime—are only dulling agents; but at the same time they render the glass and enamels stubborn or hard to be melted. In consequence of this large quantities of fluxes, such as borax, must be added. By this large amount of fluxes the good qualities of the glass and of the enamel are destroyed. This disadvantage is prevented by the use of a phosphate of alkali metal. These phosphates likewise are good agents for dulling the glass, and the glasses containing phosphate of alkali metal melt easily. Therefore an addition of the noxious fluxes is no longer necessary and the destruction of the good qualities of the glass is avoided.

Phosphate of lead has been used, but not phosphate of an alkali metal. These two salts cannot be regarded as equivalent substances. The lead phosphate is very expensive. If it is used instead of borax, cryolite, or other

usual fluxes and dulling agents, the enamel cannot be manufactured in a cheap way, as is possible by using alkali phosphates. Furthermore, the enamel containing lead phosphate is not proof against chemical agents, such as acids. By adding alkali phosphate the resistance of the enamel to chemical agents, on the contrary, is increased. Lead is poisonous. The enamels containing it, therefore, cannot be used without danger.

Glass and enamel are equivalent materials with regard to this process. The alkali phosphate produces the same effect or result when added to a composition for producing enamels as when added to a composition for producing glass.

The application of the new process to the production of glass is of great technical importance. By adding alkali phosphates all kinds of dull glasses—such as glazes, alabaster-glasses, and enamels—can be produced.

The following is a good composition for producing glasses: six hundred parts, by

weight, of sand or quartz; one hundred and twenty parts, by weight, of soda, (sodium carbonate;) one hundred parts, by weight, of red lead or minium; fifty parts, by weight, of potash, (potassium carbonate;) ninety-five parts, by weight, of feldspar; one hundred parts, by weight, of fluor-spar; seventy-five parts, by weight, of sodium phosphate, and a very small quantity of manganese.

What I claim, and desire to secure by Letters Patent of the United States, is—

Glazes, glass, or enamels having with silica, an alkali compound and an admixture of a minimum quantity of five per cent. of a phosphate of an alkali metal, such phosphate acting as a flux and a dulling agent, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ERNST TRAINER.

Witnesses:

THEODOR GROLL,
ERNESTINE ANDRÉ.