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W. JANKOWSKY.
ENAMELING METAL WARE.

(Application filed Sept. 9, 1901.)

(No Model.)

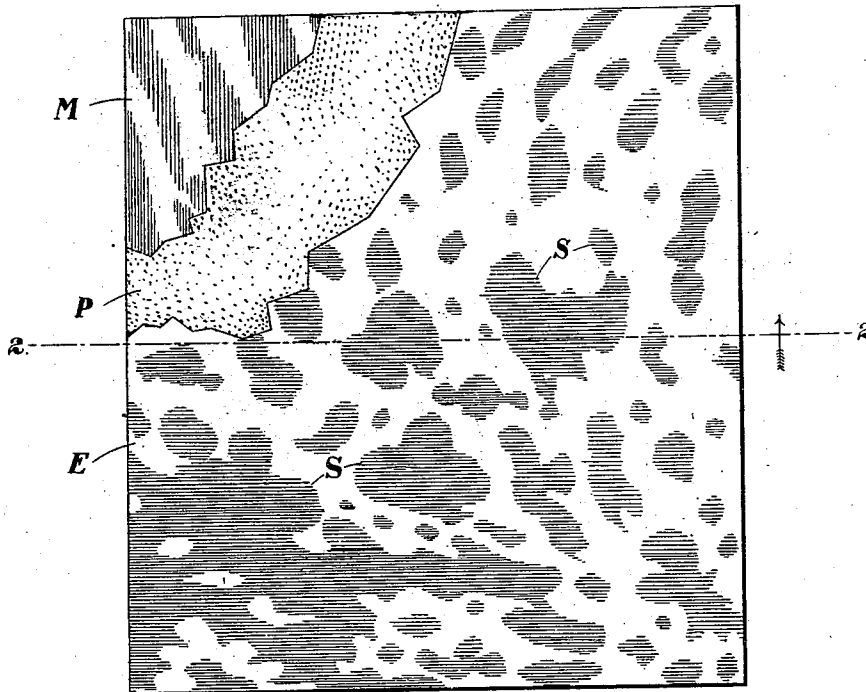


Fig. 1.

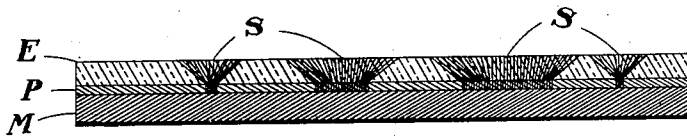


Fig. 2.

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ENAMELING METAL WARE.

SPECIFICATION forming part of Letters Patent No. 691,268, dated January 14, 1902.

Application filed September 9, 1901. Serial No. 74,836. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM JANKOWSKY, a citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Enameling Metal Ware, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in enameling metal ware; and it consists both in the novel process and resulting product, to be subsequently set forth in detail in the description and pointed out in the claims.

In the literature and publications on the art of coating metal with enameled mottled surfaces reference is made to the impracticability of coating certain metallic products with mottled enamel by the use of free acid contained in or applied to the enamel, and to produce a mottled effect in the enamel covering the surfaces of such products (notably the Siemens, Martin, and Thomas steels) resort is made to the use of solutions of copper sulfate to act upon the iron surface, (with which it comes in contact,) converting the latter into ferrous sulfate, which by subsequent conversion into oxid of iron produces the mottled effect in the enamel coating.

The presence of copper, however, in the enamel results in the formation of chemical combinations which are deleterious to health where the ware is used for cooking purposes, and it is my object in the present invention to dispense with the use of copper salts and, in fact, any metallic salts which will tend to exercise any injurious effects on the system or to produce products which will enter into solution with the water employed in the vessels for cooking purposes. With this end in view I employ either free acid to produce the mottled effects referred to or the acid sulfate of one of the alkali metals, preferably potash. My present process has an advantage in that under it the mottled effects in the enamel may be produced on the surface of any character of metallic ware, be the same iron or steel and be the same fibrous or crystalline in texture and be the same homogeneous or heterogeneous in general composition. By my process, too, the "single coat" is elimi-

nated as a distinctive feature of the product, inasmuch as my process contemplates the use of two coats—a priming coat and a final coat—both of which the mottling permeates and both of which are essential to the production of the superior results attained by the present process. In detail the invention may be described as follows:

The enamel employed in my process is prepared substantially as follows: I take by weight twenty-one (21) parts of borax, fifteen (15) parts of quartz, two (2) parts of cryolite, forty-four (44) parts of feldspar, (preferably potash-feldspar,) six (6) parts of soda, (carbonate,) ten (10) parts of potash, (carbonate,) and two (2) parts of saltpeter, (nitrate of sodium.) The foregoing ingredients are thoroughly mixed and fused in a suitable furnace until the mass flows freely, after which it is drawn off into a tank of cold water. The latter has the effect of cooling and disintegrating the same. After this it is removed and thoroughly dried and subsequently crushed to the fineness of granulated sugar. To the crushed powder is added, by weight, about twenty-five (25) parts of crushed crystal glass and twelve (12) parts of fatty clay and ground in water until thoroughly fine, when it assumes a consistency of a thick cream capable of being spread into a thin coherent layer. It is then drawn through a sieve to eliminate any coarse particles, when it is applied to the steel or iron surface to be coated, the metal being preferably dipped into the enameling-bath to receive the coating, the excess of enamel being allowed to drip off from the ware, which for the purpose is held suspended.

It is of course essential that the article to be coated shall be perfectly clean and free from all manner of dirt and grease, and to this end the article is treated as follows: The vessel or metal piece to be coated is first placed into a furnace and heated to a red heat until all oil, grease, and dirt are burned off, after which it is removed from the furnace and allowed to cool. When cool, it is placed in a pickling-vat until all scale, rust, and oxids are removed, when it is sponged thoroughly clean in clear cold water. The ware is then placed into a vat containing clear

cold water, to which has been added a suitable percentage of mixtures of sal-soda and potash, such percentage being determined by the size of the vat and quantity of water therein, but always in sufficient quantities to insure a priming coat of the carbonates of soda and potash upon the surface of the ware after the same has been removed, as presently to be seen. The ware is allowed to remain in this vat for ten or twelve minutes, by which time there has formed on the surface thereof a coat or film of sodium and potassium carbonates. The ware is then introduced into a vat of boiling water, also containing a solution of sal-soda and potash, and boiled for about one minute, after which it is removed and dried on a heated plate until the film (which constitutes the priming coat under my process) becomes dry and hard. The ware with its priming coat of sodium and potassium carbonates is then allowed to cool, after which the enamel is applied in the manner indicated. Upon this enamel-coated surface while still moist a variable percentage of powdered bisulfate of potash may be sprinkled, or a solution of the said bisulfate in water may be applied to the article before the enamel is applied, or the bisulfate solution can be added to and thoroughly mixed with the enamel before the latter is applied. I prefer the latter method, however, as it is the more convenient.

Without attempting to define the precise chemical reactions which take place to produce the mottling effects characterizing my product, the probable reactions under the circumstances may be summarized as follows: The bisulfate of potash (acid sulfate) descends through the enamel coat and in patches encounters the priming coat of alkali carbonate upon the surface of the metal. These patches may or may not be sufficient to neutralize the acid of the bisulfate, and that portion of the bisulfate not then and there neutralized attacks the metallic or iron surface beneath, converting the same into ferrous sulfate, which in turn is reacted upon by unaffected portions of the alkali carbonates and by the salts of the alkali metals of the enamel and converted into unstable ferrous compounds, which by oxidation rapidly become ferric oxid, producing characteristic rust-spots. These rust-spots would gradually grow both in dimension and number, owing to the gradual completion of the reactions between the priming coat and the bisulfate of potash introduced into the enamel; but when the spots have increased to a point where it is desirable that their growth shall be arrested to produce a characteristic mottled surface the vessel or ware is placed in a drying-oven, where the rapid drying of the coatings at once arrests the growth of said spots, so that by my process a fairly uniform product can be turned out. As soon as the growth of the rust-spots has been arrested by the drying process just referred to the articles are

placed into a furnace and heated to a bright-red heat until the enamel is thoroughly fused on the surface of the metal. When cool, the surface of the metal has a light-gray appearance and the rust-spots have been converted into beautiful dark patches so characteristic of this class of ware.

In several particulars my process may be qualified without departing either from the spirit of the invention or producing in any way a different product, advantage being taken of the similarity of action of chemical equivalents. For example, the priming coat while here described as a mixture of the carbonates of soda and potash may in practice be a carbonate of either of said bases. Again, while the reagent employed for the purpose of reacting on the priming coat is here set forth as the primary salt bisulfate of potash (acid sulfate) it has its full equivalent in free sulfuric acid, which, however, is preferably not employed, as it tends to act too rapidly and is not as convenient to handle. Again, I do not wish to be limited to potash-feldspar in the composition of the enamel-bath, as soda-feldspar may be substituted without departing from the spirit of the present invention. The latter contemplates, as will be seen, the novel departure of acting upon the metallic surface through the medium of a priming coat containing salts of alkali metals readily decomposed by either free acid or by the acid sulfate of an alkali metal capable of attacking the iron surface left unprotected by that portion of the film which had combined with such free acid or bisulfate for purposes of its neutralization. Therefore I wish it to be understood that wherever any chemical reagent occurs in the language or expression of any claim such claim is not to be limited in scope to the use of the particular reagent therein expressed, but shall be construed to include any and all chemical equivalents capable of producing equivalent results in the same relation or under similar circumstances. For example, where "carbonate of soda" occurs it is to be understood that carbonate of potash or a mixture of carbonates of potash and soda may be substituted therefor, and, vice versa, where "acid sulfate of potash" occurs sulfuric acid may be substituted, and vice versa, and so on, all as more fully and particularly above pointed out and described in this specification.

To better illustrate the character of the product, reference may be had to the accompanying drawings, in which—

Figure 1 is a plan of a metal sheet having the two coats applied thereto, a section of each coat being removed to show the order in which they occur; and Fig. 2 is a cross-section on line 2 2 of Fig. 1. In said drawing, M represents the metal or ware; P, the priming coat; E, the outer enamel coat, and S the spots which impart the mottled effect to the ware. The section shows such spots permeating both layers as a result of the dif-

fusion of the ferric oxids through said layers and their subsequent chemical combination therewith during the burning process.

Having described my invention, what I claim is—

1. As a new article of manufacture, a steel or iron article having a suitable priming coat, and an enamel coat covering the same and permeated by oxids emanating from the surface of the metal, substantially as set forth.

2. As a new article of manufacture, a steel or iron article having a suitable priming coat, and an enamel coat covering the same, the coats being mottled by oxids emanating from the surface of the metal, substantially as set forth.

3. As a new article of manufacture, a steel or iron article having a priming coat of a salt of exclusively an alkali metal and an enamel coat covering the same, substantially as set forth.

4. As a new article of manufacture, a steel or iron article having two coats mottled throughout their depth by oxids emanating from the surface of the metal, substantially as set forth.

5. As a new article of manufacture, a steel or iron article having a priming coat of a salt of exclusively an alkali metal decomposable by free acid, or by a primary salt containing such acid, and an enamel coat covering said priming coat, substantially as set forth.

6. As a new article of manufacture, a steel or iron article having a priming coat of the carbonate of an alkali metal, and an enamel coat covering the same, said coats being mottled, substantially as set forth.

7. As a new article of manufacture, a steel or iron article having a priming coat of carbonates of sodium and potassium and an enamel covering the same, said coats being mottled, substantially as set forth.

8. As a new article of manufacture, a steel or iron article having two coats of different composition permeated by metallic oxids emanating from the surface of the metal, substantially as set forth.

9. The process of enameling which consists in coating an article with a priming coat of the carbonate of an alkali metal, and applying thereto a coat of enamel containing a suitable percentage of a primary or acid salt capable of decomposing the priming film, substantially as set forth.

10. The process of enameling which consists in coating an article with a film of the carbonate of an alkali metal, and applying thereto a coating of enamel containing a solution of a primary salt combined with an acid capable of decomposing the film, substantially as set forth.

11. The process of enameling which consists in coating an article with a film of the carbonate of an alkali metal, and applying there-

to a coating of enamel containing a solution of acid sulfate of an alkali metal, substantially as set forth.

12. The process of enameling which consists in coating an article with a priming coat of the carbonate of an alkali metal, and applying thereto a coat of enamel containing a suitable percentage of the acid sulfate of an alkali metal, substantially as set forth.

13. The process of enameling which consists in coating an article with a priming film, applying a coating of enamel thereto, and impregnating the latter with a primary or acid salt capable of decomposing the film, substantially as set forth.

14. The process of enameling which consists in coating an article with a priming coat of the carbonate of an alkali metal, and applying thereto a coat of enamel containing a suitable percentage of the acid sulfate of potash, substantially as set forth.

15. The process of enameling which consists in coating an article with a priming film, then applying thereto a coat of enamel containing a reagent capable of decomposing the priming film and attacking the metal surface of said article, substantially as set forth.

16. The process of enameling which consists in coating an article with a priming film, then applying thereto a coat of enamel containing a reagent capable of decomposing the priming film and forming metallic oxids with the metal surface of the article, which oxids serve to permeate both coats and mottle the surface of the enameled article, substantially as set forth.

17. As an article of manufacture, a steel or iron article having a priming coat of a salt of an alkali metal decomposable by free acid or a primary salt containing such acid, and an enamel coat containing such primary salt, covering said priming coat, substantially as set forth.

18. As an article of manufacture, a steel or iron article having a priming coat of a carbonate of an alkali metal, and an enamel coat containing as an ingredient a primary salt capable of decomposing said carbonate, covering said priming coat, substantially as set forth.

19. As an article of manufacture, a steel or iron article having a priming coat of a carbonate of an alkali metal, and an enamel coat containing as an ingredient a primary salt capable of decomposing said carbonate, covering said priming coat, said coats being mottled, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM JANKOWSKY.

Witnesses:

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G. L. BELFRY.