UNITED STATES PATENT OFFICE.

EBEN C. QUINBY AND JOSEPH C. WHITING, OF ST. LOUIS, ASSIGNORS TO METAL MANUFACTURING COMPANY, OF ST. LOUIS, MISSOURI; AND SAID COMPANY ASSIGNOR OF ONE-HALF ITS RIGHT TO LALANCE AND GROSJEAN MANUFACTURING COMPANY, OF NEW YORK CITY, N. Y.

IMPROVEMENT IN PROCESSES OF ENAMELING METAL WARE.

Specification forming part of Letters Patent No. 184,798, dated November 28, 1876; application filed August 30, 1876.

To all whom it may concern:

Be it known that we, EBEN C. QUINBY and JOSEPH C. WHITING, of the city and county of St. Louis, and State of Missouri, have invented certain new and useful Improvements in Enameling Process for Treating Stamped, Pressed, or otherwise shaped Wrought and Sheet Iron; and we hereby declare that the following is a full, clear, and exact description of the same.

By our improved process we are enabled to produce an enameled wrought-iron in which the union of the iron and the enamel is so intimate and tenacious that they may almost be said to be amalgamated; and this we accomplish by dissolving out iron from the surface, so as to expose such parts of the surface as will adhere to the enamel, and annealing so as to fix and toughen the fiber, in order that the enamel will adhere to all parts. This annealing is an essential and important feature of our invention. To non-fibrous—that is to say, cast—iron our invention is not applicable.

Fibrous iron, at a dull red heat, if dissolved in a stream of chlorine, volatilizes, leaving behind a skeleton of the exact shape of the original piece. This residuum has considerable tenacity, nearly resembles dark green bottle-glass, and is an insoluble compound of melted oxide of iron, silica, and alumina. This ferro-silicious matter, thus shown to be intimately inwrought in wrought-iron, and which is the mechanical foundation of its fiber, we make the basis of our enameling process. It is not a capricious dissemination, but it varies in quantity and constituents in different irons. It is therefore essential, in compounding enamels for wrought-iron, to know somewhat of the character and quantity of this ferro-silicious matter in the iron.

Overman, in his work, "Manufacture of Iron," says: "Were it practically possible to make a cinder of potash, soda, and silex, and mix it with any kind of metal,"—that is, any kind of pig-iron—"however bad it may be in our estimation, the bar resulting would be strong, its fibers durable, and it could be welded with ease." Potash, soda, and silex, in one or another of their forms, either separately or in some combination with each other, enter largely into all enamels intended for iron. Consequently, were it practically possible to make iron of the fibrous texture contemplated by Overman, we would have, we think it reasonable to conclude, an article best suited both for shaping and enameling; and some such adjustment, as to fiber, is demanded by that branch of our business which relates to the enameling of pressed, stamped, or otherwise fashioned wrought sheets. As this adjustment has not yet been effected, enameling of wrought-iron is still, in part, empirical. This much, however, is certain: Iron intended for pressing or stamping cannot be made to carry affinities enough to bind, in closest union with itself, a very thick enamel, for, when they are introduced beyond a proportion undetermined as yet, its enameling quality is increased at the expense of its stamping quality.

In order that the combination may be the most thoroughly effected we take care to expand and open the metal as much as possible, in order to present its extraneous matter, (above described as ferro-silicious and interfibrous,) in the most tangible form; and we do this, in part, by heating or annealing the iron. The annealing of iron is not, we know, a new thing. The annealing of cast-iron, preparatory to enameling the same, has been in public use a long time.

From the foregoing it will be seen that all the operations for forming the article which have the effect of straining, compressing, and hardening the sheet-iron are to be formed in the usual way. But, if left in this condition the enamel would not adhere. By the annealing process two effects are produced: First, all unequal strains in different parts of the sheet are neutralized; and, second, the pores of the metal are expanded. By the pickling process the hard and partially-attached scales are separated, and the fibers of the iron brought out. The ferro-silicious matter is also developed in a clean and exposed manner, so that when the enamel is applied it will combine and

firmly amalgamate with it, or incorporate itself thoroughly in the pores of the sheet-iron, and will be unaffected by excessive acids of any description, and will not flake off with use, or be injured by excessive heat. The enamel will then be really part of the entire sheet or article—as the tin in tin-coated iron. The enamel will be as firmly attached over the turned or wired edges as in any part, and the article will be far more flexible, and less liable to have the enamel break, check, or separate than in the articles from which our treatment has been omitted.

We do not claim any special compositions for the enamel, as we may emp oy such as have been heretofore used; nor do we claim, broadly, the separate operations described, as our invention relates only to the manner of applying them so as to produce the results stated. The length of time and strength of pickle will depend upon the character of the iron and thickness of the sheet; but can always be ascertained by inspecting the surface, so as to judge when the interfibrous ferro-silicious matter is fully exposed and the fiber developed.

The annealing may be carried out in any of the usual modes employed by the workers in sheet-iron and wire.

The following is the mode of carrying out the invention: Having been annealed, the article is put into a bath, such as generally used for removing scale from iron, is carefully scoured, and afterward thoroughly washed to remove any acid which may remain from the bath. It is then dipped in a liquid enamel, prepared so as to meet the conditions set forth above, after which it is left to dry slowly. A drying-room is not essential. An ordinary temperature of 65° or 75° will do. Solar heat is as good as any. The result is, an enamel which adheres to the iron with extreme tenacity, bending with it to a degree, and forming so much a part of it that the enameled article may be cut with shears and the enamel hardly injured along the line of the cutting. When made from uncolored glass it is, in color, dark beneath, but its general appearance will depend much upon the thickness of the enamel. As may be seen, however, the reliably coherent and thinnest coat is black. The striæ or spots which appear are developments of this foundation-black through the less-perfectly incorporated or combined uncolored enamel, and they will be more or less, as the enamel is thinner or thicker—or, in other words, as the union between the enamel and the iron is more or less comprehensive. The general arrangement is along the fiber-lines, and is determined by the same ferro-silicious matter which determines or brings out the fibers, and, as we have shown, supplies the bond between the metal and the enamel.

The operations of pickling and annealing should be repeated as many times as mechanical operations are applied to change the texture, hardness, or surface of the article.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The process herein described for producing enameled sheet-iron articles, consisting in forming the article by stamping and shaping in the usual way, and then annealing and pickling prior to applying the enamel, substantially as set forth and described.

2. The method herein described for causing the enamel to adhere upon the turned-over edges of the enameled sheet-iron vessels, consisting in repeating the operation of annealing and pickling after the edge has been turned, and prior to the application of the enamel, substantially as set forth.

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Witnesses:
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