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H. C. MILLIGAN.
PROCESS OF ENAMELING STEELWARE.

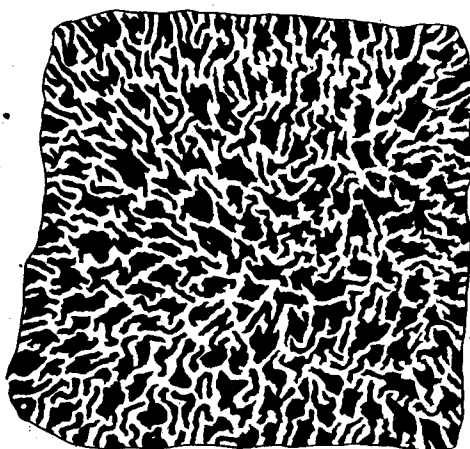
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SPECIMENS.

Fig. 1.



Fig. 2.



Witnesses

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PROCESS OF ENAMELING STEELWARE.

SPECIFICATION forming part of Letters Patent No. 762,547, dated June 14, 1904.

Application filed March 3, 1904. Serial No. 196,398. (Specimens.)

To all whom it may concern:

Be it known that I, HENRY C. MILLIGAN, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Processes of Enameling Steelware; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to enameling ware, and has for its object to coat steel or other analogous homogeneous metallic surfaces with one or more coats of enamel and to produce in the finished product moss-like effects in contradistinction to the ordinary segregated and distinct spots or mottles.

With this end in view my invention consists in the process of enameling hereinafter more fully described and in the novel product resulting from such process.

In the art of producing enameled ware as heretofore and generally practiced it was customary to employ for the metallic base ordinary iron sheets or plates, which were first pickled in an acid-bath and then thoroughly washed in water to remove all traces of acid, (an alkaline was being sometimes used to more effectually remove any traces of acid,) after which the vessel was dipped or coated with liquid enamel and allowed to dry slowly, the moisture of the enamel coating producing oxidized spots upon the surface of the metal which when the enamel was subsequently fused in a muffle-furnace were exposed through such enamel and produced what were commonly known as "spots" or "mottles" of irregular but distinctive characters, such ware being designated in the trade as "mottled ironware" and "graniteware." It has also been customary to produce what is known as "plain thin enamelware" free from spots or mottles, such as described in Letters Patent granted to me July 10, 1888, No. 386,023.

In the progress of the art to which my invention relates it has been desirable to use as the metallic base steel or other bodies more homogeneous than the originally-employed base, consisting of fibrous iron, for the rea-

son that such steel or homogeneous base could be more economically employed; but difficulty in the use of steel was for a long time encountered, owing to the fact that it was supposed that steel being much more dense than iron would not hold the enamel, and consequently various suggestions were made to overcome this difficulty, one of which was that the steel constituting the base should in the process of its manufacture be stretched to render it more porous, and thus secure a more perfect adhesion of the enamel. It was also suggested to overcome the difficulties by introducing certain chemicals in the annealing-pot to so affect the steel as to render it capable of close and permanent cohesion with the enamel.

It has, however, been found from practical experience that the difficulty originally encountered in the use of the steel or other homogeneous metallic base was due to the fact that in the manufacture of the same there was such an amount of impurities remaining in the product that when sheets from the same were drawn out the impurities became exposed, and when such sheets with said impurities were coated with an enamel and subjected to the excessive heat necessary to fuse the enamel said impurities by combustion prevented the enamel from proper cohesion with the metallic base, producing in some instances limited areas of imperfection and frequently rendering the entire area defective. This discovery and the progress in the art of manufacturing steel sheets has led to the production of such sheets free from impurities, or, in other words, of pure steel low in carbon and embodying such qualities and characteristics as to render it equally available with the ordinary and heretofore-used iron sheets for the production of enameled ware by the ordinary and well-known processes of coating and fusing.

Recognizing the conditions in the art, as stated, I will now proceed to describe in detail my novel process for producing enameled ware having a moss-like appearance.

I take the article to be enameled and which is composed of the perfected sheet-steel of commerce and after pickling the same in the manner well known to those skilled in the art

I thoroughly cleanse the surface by washing the same in a preferably alkaline bath. I then thoroughly dry the same, and when dry I then immerse the same in a solution of acid-
5 water in about the proportion of one teaspoonful of sulfuric acid to four quarts of water. I then remove the article from the acid solution and while in a wet condition coat it with liquid enamel composed of the ordinary ingredients
10 and which, as is well known, is intensely alkaline, and after properly drying the same the enamel is fused in a muffle-furnace. The contact of the alkaline-liquid enamel with the wet surface of the metallic base produces a chemical
15 action resulting in a moss-like appearance showing through the enamel. This moss-like appearance is readily distinguishable from the ordinary spots or mottles produced by the hitherto and well known process of making enameled ware.
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The accompanying drawings are designed to illustrate the differences referred to, Figure 1 representing the character of spots or mottles produced by the ordinary processes, and Fig.
25 2 representing the novel moss-like appearance resulting from my improved process.

By reference to Fig. 1 it will be observed that although the spots or mottles vary in size and design they nevertheless have the distinctive characteristic of individuality or segregation from one another, while in Fig. 2
30 the design is intensely irregular as a whole and producing what I have denominated a

"moss-like" appearance of novel and pleasing effect. As this effect is produced by the contact of the liquid alkaline enamel with the minutely-diffused acid on the wet surface of the metallic base, it will be understood that the described moss-like appearance of the finished product will result whether the article
35 is made of one or more coats of enamel, but of course modified according to the number of coats of enamel.

What I claim as new, and desire to secure by Letters Patent, is—
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1. The process herein described, of enameling articles of steel or homogeneous iron, which consists in pickling the same to produce a clean surface; then thoroughly washing the same to remove the pickle; then drying the
50 cleaned article; then immersing it in a weak acid solution and while in a wet condition coating the same with alkaline-liquid enamel; then drying said enamel coating, and finally fusing the same in a muffle.
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2. As a new article of manufacture, a steel or homogeneous iron article having one or more coats of enamel of moss-like appearance, substantially as hereinbefore described.

In testimony whereof I have signed my name
60 to this specification in the presence of two subscribing witnesses.

HENRY C. MILLIGAN.

Witnesses:

J. W. CRAINE,
J. B. SNYDER.