Patented Oct. 27, 1931 1,828,767

UNITED STATES PATENT OFFICE

GRANT S. DIAMOND, OF HAMBURG, NEW YORK, ASSIGNOR TO ELECTRO REFRACTORIES CORPORATION, OF BUFFALO, NEW YORK

PROCESS OF GLAZING REFRACTORY ARTICLES

No Drawing. Application filed October 3, 1928. Serial No. 310,194.

This invention relates to glazing of carbon bonded refractory articles, and more particularly to impregnating of the articles with a glazing solution.

The glazing of articles of this kind is an important feature in their manufacture and the quality of the glaze produced materially affects the life of the articles in service. The glaze, or flux as it is sometimes called, provides a protective film of glass on the surface of the articles, which is molten at furnace temperatures and prevents the oxidation and disintegration of the carbon bond therein by preventing contact between the bond and the furnace gases.

The impregnating with glazing solution was heretofore done in two ways, first, by painting the articles with glazing solution, and second, by dipping the articles into a tank of the solution. The painting of the articles does not provide complete and thorough absorption, since the solution does not penetrate the body very deeply, resulting in a thin, skin deep glaze. Dipping the articles into the solution does not produce entirely uniform results in all articles dipped into a solution.

Glazing processes heretofore used are also defective in that they caused the articles to spall or chip during the impregnating of the same with the glazing solution or during subsequent baking.

The objects of this invention are to provide a method of glazing carbon bonded refractory articles which includes the step of subjecting the articles to a liquid containing the glazing material while the liquid is in motion; also to provide a process of this kind in which the impregnating of the articles with the liquid containing the glazing material is carried on while the articles are at a lower temperature than has heretofore been considered practical; also to carry on a process of this kind by having the liquid carrying the glazing composition at a temperature lower than was heretofore used so that a large precipitation of glazing material takes place in the solution; also to improve processes of glazing in other respects hereinafter specified.

In the manufacture of articles of this kind, the articles are first formed or molded of any suitable mixture including a carbonaceous binding material, such for example, as tar, phenol-resen, dextrin or the like. The articles are then baked under non-oxidizing conditions until the volatile oils are all removed from the binding material, leaving a body with a rigid carbon bond between particles or grains of refractory material. The articles are then ready to be glazed.

In the glazing of articles of this kind as heretofore carried on, the articles were treated with a solution of the glazing material while the articles were at a temperature of about 1300° F., which temperature is that at which the unglazed articles are baked and at which the articles are at a red heat. This temperature is so high as to cause spalling or breaking off of parts of the surfaces of the articles. It was also customary to have the temperature of the solution of glazing material or alkali at about the boiling point of the solution.

I have found that very superior results can be obtained by reducing both the temperature of the articles as well as that of the solution. In carrying out my improved process of impregnating the article with a glazing solution, the articles after leaving the baking oven or kiln at temperatures between 1200° F., to 1300° F., are allowed to cool or chill considerably below this red heat temperature. For example, if the articles are allowed to cool to a temperature of about 500 to 700° F., a very material reduction in spalling results, the best results having been obtained by impregnating the articles while at a temperature of about 600° F.

I have also found that an improved glaze is obtained if the solution of alkali is concentrated or approximately saturated at the boiling point, which for example, is 218° F., in case of a borax solution, and then permitting the solution to cool to a somewhat lower temperature, for example, approximately to a temperature of 175° F., in case of a borax solution.

The chilling of the solution promotes a

larger absorption of glazing material by the articles for three reasons.

First, when the hot articles are treated with a chilled solution the evolution of steam is reduced materially, over the amount evolved from a boiling solution. The volume of steam produced by a hot article in contact with a solution already boiling is sufficient to interfere to some extent in the absorption process, probably allowing an absorption of pure water, and a deposition of dehydrated glaze substance at different spots on the article. Second, the article which is being glazed is chilled to a greater extent when immersed in the cool solution than when immersed in the boiling solution, so that the gases in the pores of the refractory articles are further contracted, producing a stronger pore-vacuum, and consequently quicker and more thorough absorption of the glazing material. In the third place, the chilled solution is turbid with precipitated borax grains which have been thrown out of the solution due to the lower solubility at that temperature, and the grains which are thus carried in suspension in the solution are of very finely divided form and are deposited in the surface pores of the body and build up an accumulation of glazing material in excess of that taken by the articles from a boiling solution, which is very beneficial to the articles and results in a heavier surface glaze. The heavier the surface glaze, the longer oxidation is retarded when the articles are in commercial use.

The advantages of the more thorough absorption of the glazing material by the articles and of the heavy accumulation of glazing material on the surface of the article produces a much more uniform glaze thus increasing the life of the articles. These improvements in the process also increase the manufacturing efficiency since the number of defective articles produced due to unglazed spots and to spalling is very greatly reduced.

I have also found that the process of impregnating a carbon bonded refractory article with a glazing solution can be improved by applying the solution to the articles by means of a continuous stream or streams flowing over the surfaces of the articles which are to be glazed.

I have found that by keeping the stream of solution flowing over the surfaces to be glazed a uniform absorption of the solution throughout the body results, whereas when the article is immersed in a solution, unevenness in the absorption of the solution is apt to result, due probably to the fact that the concentration of the solution is changed due to absorption by the articles, as described above.

The impregnating of the articles with the glazing solution by means of continuous flow may be effected in any suitable or desired manner, for example, the articles may be placed on a rack and a nozzle delivering the solution may direct the same at the articles to cover all surfaces to be glazed. If the articles are in the form of crucibles or retorts, they may be placed on a rack in an inverted position and a nozzle delivering the solution is positioned to direct a jet of solution upwardly into the interior of the article, so that the stream strikes the inverted bottoms of the interior of the aricles and flows down the inner walls thereof, the solution discharged from the articles being collected for further use. The outside of the inverted crucibles may be impregnated by means of a spray, shower or stream of liquid falling upon it. The crucibles or retorts may of course also be impregnated while in upright or normal position by lowering nozzles into the articles to a point near the bottoms thereof, so that the streams of solution will fill the articles and will overflow and run down the outside walls. The solution may be sprayed at the articles by streams directed in other ways at the article.

The advantage of impregnating the article by means of continuously flowing streams or sprays of the solution is that uniform absorption of the solution throughout the article results, which greatly improves the quality and lengthens the life of the article. When these flowing streams are used in connection with a solution containing precipitated glazing material in suspension, the flowing streams have the further advantage of preventing settling of the suspended matter of the solution, so that the suspended matter may be deposited on the articles, instead of settling to the bottom of a container.

After the articles have been impregnated with the glazing solution as described, they are fired to the fluxing temperature of the glazing material, whereupon they are ready for use.

I claim:

1. A process of impregnating porous articles with a glazing solution, including flowing over the surfaces to be glazed while the articles are materially hotter than the solution, a saturated solution of the glazing material containing precipitated glazing material in suspension in the solution.

2. A process of impregnating porous articles with a glazing solution, including making a concentrated solution of a glazing material at the boiling point of the solution, permitting the solution to cool sufficiently to cause precipitation of glazing material in the solution, and flowing the solution containing precipitated glazing material in suspension over the surfaces to be impregnated, while said articles are materially hotter than the solution.

3. A process of impregnating porous ar-

ticles with a glazing solution, including making a concentrated solution of borax in water at the boiling point of the solution, cooling the solution to a temperature of approximately 175° F., and then flowing the solution with precipitated borax in suspension therein over the surfaces to be glazed, while said articles are materially hotter than the solution.

4. A process of impregnating porous articles with a glazing solution, including bringing the temperature of the articles to about 500° F. to 700° F., making a concentrated solution of the glazing material at the boiling point of the solution, permitting the solution to become cooled sufficiently to produce precipitation of glazing material in the solution, and flowing the solution over the surfaces to be impregnated.

5. A process of impregnating carbon bonded refractory articles with a glazing solution, including making a concentrated solution of borax in water at the boiling point of the solution, cooling the solution to a temperature of approximately 175° F., bringing the articles to be glazed to a temperature of approximately 600° F., and then flowing the solution with precipitated borax in suspension therein over the surfaces to be glazed.

6. A process of impregnating porous articles with a glazing solution, including subjecting the articles while hot to a solution of the glazing composition at an elevated temperature but below the boiling point of the solution, said solution being saturated with said glazing material and containing glazing material in suspension when the article is subjected thereto.

7. A process of glazing porous articles, including making a highly concentrated solution of the glazing material at the boiling point of the solution, permitting the solution to cool sufficiently to cause excess dissolved glazing material to be thrown out of solution and carried in suspension in the solution, and impregnating the articles with the liquid glazing solution containing the suspended excess.

8. A process of impregnating baked refractory articles with a glazing solution; including making a concentrated solution of the glazing material, said solution containing additional glazing material in suspension, cooling the articles to a temperature below the baking temperature and above the boiling point of the solution, and subjecting the articles to the solution while the solution is at an elevated temperature but below the boiling point thereof and while the excess material is in suspension.

9. A process of glazing porous baked refractory articles, including making a concentrated solution of borax and water at the boiling point of the solution, cooling the solution to the temperature of approximately 175° to cause excess borax to pass out of solution and to be suspended in the same, and impregnating the articles with said solution while the articles are materially above the boiling point thereof and while said excess is in suspension in the solution.

10. A process of impregnating porous baked refractory articles with a glazing solution, including subjecting the articles while at a temperature of from 500° to 700° F. to a solution of the glazing composition at a temperature of about 175°, said solution being saturated with said glazing material and containing additional glazing material in suspension when the article is subjected thereto.

GRANT S. DIAMOND.