April 2, 1940. C. A. WELLER 2,195,436

CHEMICAL APPARATUS

Filed Dec. 30, 1937

Fig. 1.

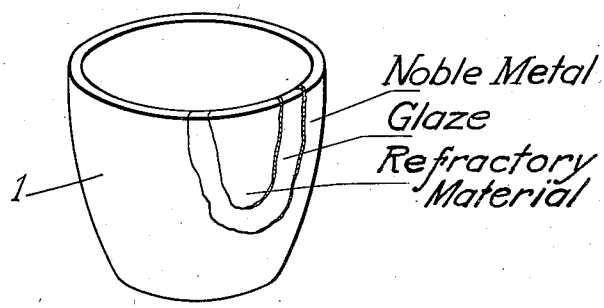


Fig. 2.

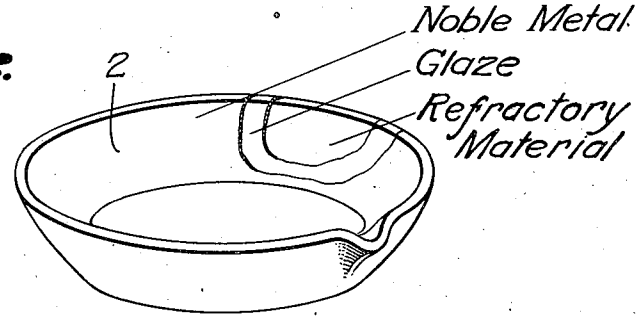


Fig. 3.

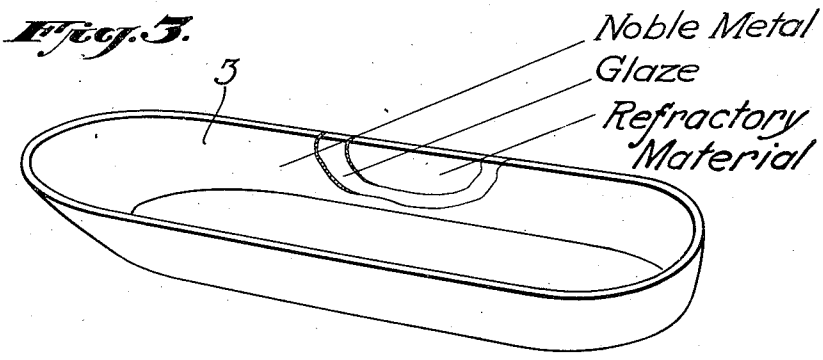
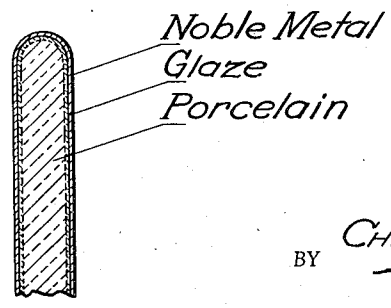


Fig. 4.



INVENTOR.

BY CHARLES A. WELLER.

ATTORNEY.

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CHEMICAL APPARATUS

Charles A. Weller, Bloomfield, N. J.

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7 Claims. (Cl. 263—48)

This invention relates to refractory chemical laboratory ware and more particularly to refractory articles such as crucibles, casseroles, evaporating dishes, ignition boats, and the like articles comprised of glass, porcelain, fused silica and alundum, utilized in chemical and metallurgical work.

One of the objects of this invention is to improve the thermal conductivity, the heat and weight stability of these articles. Another object is to provide a metallized surface on the said articles which will improve the thermal conductivity and the heat and weight stability of the said articles. Still another object of the present invention is to provide chemical laboratory ware having a metallized surface of relatively high stability towards gases and chemicals of all kinds. Other objects and advantages will be apparent as the invention is more fully hereinafter disclosed.

In accordance with the above objects I have found that when such chemical laboratory ware such as a crucible, for example, is surfaced with an adherent metallic coating the thermal conductivity of the crucible is markedly increased, to such an extent that the ignition or firing of materials in the crucible is thereby greatly accelerated and facilitated. Not only is the ignition of such materials facilitated but markedly higher ignition temperatures are obtained with the same heating as compared to un-metalized crucibles, and the temperatures obtainable are comparable to those obtained with solid metal crucibles.

In most chemical and metallurgical work, particularly analytical work, it is highly important that the chemical ware evidenced relatively high heat stability, relatively high weight stability on heating and cooling and relatively high resistance to corrosion or oxidation. Ordinary chemical ware has many limitations as to conditions of use under which these properties will be evident. By the practice of this invention these limitations are substantially eliminated.

My invention consists substantially in surfacing the crucible, evaporating dish, ignition boat or the like article with an adherent film of metal having a thickness adapted to provide for relatively high thermal conductivity throughout the coating, and having the desired physical and chemical properties imparting relatively high resistance to corrosion, oxidation and chemical and physical disintegration of all types and kinds.

For the purposes of the present invention the noble metals are the most suitable surfacing metal, particularly platinum. It is essential in the practice of the present invention that the noble metal coating be firmly bonded to the refractory surface of the article and that the coating have a thickness adapted to evidence high thermal conductivity as well as stability towards the various oxidizing, corroding and chemical and physical disintegrating factors encountered in service. In practice I have found that a coating of about one one-thousandths of an inch thickness in general is sufficient for the purposes of the present invention, although thicker or thinner coatings may be utilized if desired or found suitable.

Before further disclosing the present invention reference should be made to the accompanying drawing, wherein

Fig. 1 illustrates with appropriate indicia, a crucible improved in accordance with the present invention;

Fig. 2 illustrates similarly an evaporating dish improved in accordance with the present invention;

Fig. 3 illustrates similarly an ignition boat improved in accordance with the present invention; and

Fig. 4 illustrates in section the advantageous features of the present invention.

Referring to Fig. 1, the crucible 1, which as above noted may be comprised of porcelain, silica, alundum or similar refractory materials, is surfaced both interiorly and exteriorly with metal, preferably a noble metal such as platinum, the thickness of the coating being of the order of one one-thousandths of an inch.

In Fig. 2, the evaporating dish 2 comprised of similar refractory materials is surfaced at least interiorly with such a metal coating.

In Fig. 3, the ignition boat 3 comprised of similar refractory materials is surfaced exteriorly and interiorly with a metal coating as in the case of crucible 1.

Referring to Fig. 4 most chemical laboratory ware is provided with a natural or artificial glazed surface and in the practice of the present invention that metal coating may be applied directly to the glazed surface of the refractory material substantially as indicated or alternatively to the unglazed or to the sand blasted glazed or sand blasted unglazed surface.

In forming a metal coating upon the refractory surface of the chemical ware it is preferable to first form a relatively thin coat comprised of a noble metal and to build up thereon a series or successions of coats of the same or dissimilar metal as may be desired. The first coating of noble metal is formed by covering the surface with a solution containing a thermally decomposable organic compound of the noble metal, the said solution having relatively high concentration of noble metal as compared to that heretofore employed in the arts, which solution also contains a small proportion of a material, such as sodium fluoride, which is capable of reacting with the refractory surface of the article to

roughen the same to a degree necessary to insure the adherence of the noble metal onto the surface upon thermal decomposition of the noble metal compound. This solution is common in the art except that a lower concentration of noble metal compound than that herein employed is utilized. The solution is applied in a thin even coat to the surface of the article and the article is fired slowly up to temperatures approximating 1000° C. under oxidizing conditions to decompose the noble metal compound and to consolidate the deposited metal onto the surface of the article. Successive coatings of the solution may be applied to the surface with intermediate firing of the article until the thickness of the metal coating resulting is sufficient for the purposes intended.

Alternatively, after the initial coat or coatings of noble metal have been obtained on the refractory surface the balance of the coating may be formed by electro deposition, by metal spray methods, by electrical sputtering methods, or by spraying thereon a thermally decomposable noble metal compound while the crucible is heated to red heat. Subsequent to the building up of the coating of noble metal by either of these alternative methods on the surface of the article the finished product should be heated to the maximum temperature to which the refractory material comprising the article may be heated without sagging to consolidate the plurality of coatings one to the other and to the surface of the article, and to anneal the coating to render the same ductile.

The metallized product of the present invention has many advantages over the un-metallized article. Due to the imperviousness of the metal surface, the refractory material comprising the article is more stable in weight on heating and cooling. The metal sheath on the article has a relatively high heat conductivity as compared to refractory materials in general, and the time of heating the article as well as the amount of heat energy expended to heat the articles will be lower in the case of metallized ware. Where the metallized surface is comprised of platinum many advantages not ordinarily obtained with solid platinum ware will be obtained. For example, the cost of the platinum surfaced ware would be but a fraction of the cost of the same sized article comprised wholly of platinum. The platinum surfaced article would be rigid due to the refractory material forming the base or core, and the presence of the inner refractory core effectually stops or prevents the diffusion of gases through the ware between the metal surfaces upon direct heating of the article. This latter advantage eliminates a defect common to all metal crucibles.

For purposes of the present invention the metal surface of the article should preferably be comprised of a noble metal, particularly platinum. It is apparent, however, that other metals, less noble than platinum but having particularly desirable properties for certain uses, may be employed if desired. For example, nickel, chromium, tantalum, zinc, tin, lead may be utilized as surfacing metals, if desired.

Where it is desired to coat the article with a metal other than a noble metal it is preferable to first form a coating of a noble metal by thermal decomposition as hereinabove described, the thickness of the coating being adapted to provide a satisfactory bond to the refractory surface of the article and preferably also of a thickness adapted to provide sufficient electrical conductivity to permit subsequent deposit of the other metal to the surface by electro-deposition, electrical sputtering or like methods.

In particular, the present invention offers wide use in the manufacture and use of the larger sized dishes, pans and the like for evaporating, crystallizing and the like steps in chemical processes. The metal surfacing of these articles, with a noble metal or with other metals suitable for the particular process, will greatly facilitate the use and application of the same. Large dishes comprised entirely of platinum obviously are too costly for general use but when the said dishes are comprised of porcelain or silica, for example, surfaced with platinum, the article is relatively inexpensive.

Having broadly and specifically disclosed the present invention and given several specific embodiments of the same, it is apparent that the same may be widely varied without departing from the nature and scope of the invention, and all such modifications and adaptations are contemplated as may fall within the scope of the following claims.

What I claim is:

1. An article of manufacture, chemical laboratory ware for high temperature ignition purposes, said ware being comprised of refractory ceramic materials having the surface covered with an adherent noble metal coating.

2. An article of manufacture, chemical laboratory ware for high temperature ignition purposes, said ware being comprised of refractory ceramic materials having an adherent noble metal surface of a thickness rendering the same substantially thermally conductive.

3. An article of manufacture, chemical laboratory ware for high temperature ignition purposes, said ware being comprised of refractory ceramic materials having an adherent noble metal surface approximating $\frac{1}{1000}$ of an inch in thickness.

4. An article of manufacture, chemical laboratory ware for high temperature ignition purposes, said ware being comprised of refractory ceramic materials having the surface covered with an adherent substantially thermally conductive coating of platinum.

5. An article of manufacture, a crucible for high temperature ignition purposes, said crucible being comprised of refractory ceramic material and having an adherent thermally conductive noble metal coating over substantially its entire surface.

6. An article of manufacture, an evaporating dish for high temperature ignition purposes, said evaporating dish being comprised of refractory ceramic material and having an adherent thermally conductive noble metal coating on at least its inside contents-retaining surface.

7. An article of manufacture, an ignition boat for high temperature ignition purposes, said ignition boat being comprised of refractory ceramic material and having an adherent thermally conductive noble metal coating over substantially its entire surface.

CHARLES A. WELLER.