

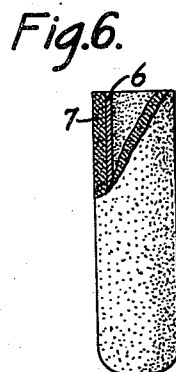
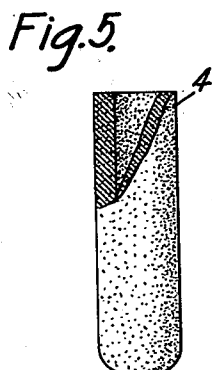
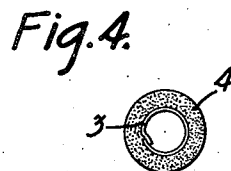
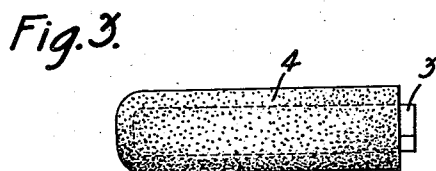
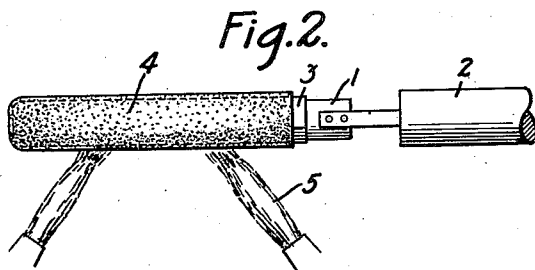
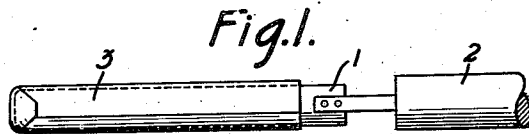
Nov. 8, 1927.

1,648,149

H. T. REEVE

METHOD OF FORMING REFRACTORY CRUCIBLES

Original Filed Oct. 7, 1924



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Patented Nov. 8, 1927.

1,648,149

UNITED STATES PATENT OFFICE.

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METHOD OF FORMING REFRACTORY CRUCIBLES.

Original application filed October 7, 1924, Serial No. 742,112. Divided and this application filed March 24, 1926. Serial No. 96,981.

This invention relates to a method of forming refractory crucibles and has for an object a quick, easy, and inexpensive method of forming crucibles capable of withstanding very high temperatures, such as are used for melting high melting-point metals.

This invention is a division of my copending application, Serial No. 742,112, filed October 7, 1924 and entitled "Refractory crucibles and method of making same."

In accordance with this invention a refractory crucible is formed on a core or form which is provided with a covering or separator of a reducible material such as paper, whereby the core may be removed when the crucible is completed. A highly refractory material, either in the metal or oxide state, is applied in paste form to the separator preferably in a plurality of layers, and thoroughly dried. When the desired thickness of crucible wall is obtained the vessel is removed from the form and fired in a furnace to sinter the crucible and reduce the separator. Similarly, a composite crucible may be formed by building up a suitable crucible lining over the reducible separator, coating this lining with highly refractory material and treating it in the same manner as described above.

The preliminary step by which refractory crucibles of this invention are made, consists of mixing a suitable amount of refractory material, such as silica, alumina, magnesia, fire clay, or like materials with water, alcohol, glycerine, or any other binder to form a paste or pliable mass. While the invention can be performed with any of the above materials, it has been found that chromium oxide, because of its color being dark green, has exceptional heat absorbing capacity and it also can be applied more easily in paste form to any desired core. Furthermore, in view of the fact that every time a melt of metal is made, the crucible must be destroyed to remove the ingot, it follows that the method of making the crucible should be reasonably quick and inexpensive.

The invention may be more easily understood by referring to the following detailed description in connection with the accompanying drawings, in which Fig. 1 illustrates the first step in the method of forming the crucible, Fig. 2 shows the drying stage, Fig. 3 shows the completed crucible with

the form removed, Fig. 4 is an end view of Fig. 3, Fig. 5 shows the crucible ready for use, and Fig. 6 is a composite crucible made in accordance with this invention.

Referring particularly to Fig. 1, a suitable form 1 such as a metal tube or rod is employed having a handle 2 attached to one end for manipulating the form during the processes of making the crucible. A glass tube or rod may also be used as the form for building up the crucible. A reducible wrapper or separator 3, preferably of low ash filter paper, is applied to the form 1 so that the form may be easily removed after the crucible is completed. The paper separator 3 may be perforated, to reduce the time of drying of the refractory material coating, to be hereinafter described. The refractory material may be applied or molded on the separator to form the crucible. Preferably, the paste is made of the required consistency for easy application, by mixing a suitable amount of the refractory material with water or any suitable binder and if desired, may be painted on the separator with a brush. Suitable drying means, such as a Bunsen flame 5, may be applied to the material to remove the moisture. This procedure may be continued until the desired thickness of wall is obtained. The form or core 1 may be removed from the crucible, when the crucible is ready for the firing operation as shown in Figs. 3 and 4. The completed crucible is placed in an electric furnace and fired in any well known manner. During this operation the filter paper or other separator material is charred and the refractory material sintered by the high temperature of the electric furnace. After removal of the crucible from the furnace, the ash residue may be easily removed.

The invention has been described with respect to a crucible of a single refractory wall but may also be utilized to form a composite crucible of the type shown in Fig. 6, in which a highly reactive lining 6 is formed within the crucible.

In the metallurgical art, it is often preferable when melting a metal, to combine a different metal or oxide with the melt, to form an alloy or compound for specific purposes. For instance, in the manufacture of filaments for vacuum tubes or other discharge devices, the filament is preferably coated

with thermionically active material to increase the electron emission and the life of the filament. In accordance with this invention, the thermionically active material, which may be barium and strontium carbonates, is formed into a paste and applied to the paper separator or wrapper 3, to form a lining of any desired thickness. The outer crucible wall 7, should preferably be of a refractory material which is inert to the thermionic material so that it does not combine with the melt. A composite crucible made in accordance with this invention provides an inner lining having the desirable affinity for the metal to be melted and an outer wall of great mechanical strength and inertness to the melting metal.

Similarly, the inner lining may consist of thorium, zirconia, magnesia, alumina, or any combination of these materials to form an inert lining for the metal to be melted. This may be necessary when the crucible material is chromium oxide which has an affinity for certain highly refractory metals.

This method provides flexibility in the size and shape of the crucibles, does not require expensive molds, provides a readily made vessel which can be used immediately and contributes to the manufacture of composite vessels of any desired combination of substances.

What is claimed is:

1. The method of forming a refractory crucible which comprises applying a plurality of layers of highly refractory material to a reducible medium surrounding a core, drying each layer by heat, removing said core, and firing said crucible.

2. The method of forming a refractory crucible which comprises applying a reducible medium to a core, applying successive layers of highly refractory material to said medium, drying each layer, withdrawing

said core, and thereafter reducing said medium.

3. The method of forming a refractory crucible which comprises applying a reducible medium to a core, applying layers of chromium oxide thereon, drying each layer, removing said core, and reducing said medium.

4. The method of forming a refractory crucible which comprises applying a low ash paper to a core, applying successive layers of refractory material paste to said paper, drying each layer, withdrawing said core, and thereafter firing said crucible to remove said paper and sinter said material.

5. The method of forming a composite crucible which comprises applying highly refractory material to a reducible medium surrounding a core, drying said material, applying highly refractory inert material thereto, drying said inert material, removing said core, and firing said crucible.

6. The method of forming a composite refractory crucible which comprises applying a reducible medium to a core, coating said medium with successive layers of reactive material, drying said layers, applying highly refractory inert material to said reactive material, drying said layers, removing said core, reducing said medium, and firing said crucible.

7. The method of forming a composite refractory crucible which comprises brushing a plurality of layers of inert refractory material paste on a paper wrapper, drying each of said layers, applying additional layers of mixtures of said refractory material and chromium oxide, covering said layers with successive coats of chromium oxide, and baking said crucible.

In witness whereof, I hereunto subscribe my name this 23 day of March A. D., 1926.

HOWARD T. REEVE.