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C. EDEN

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ELECTRIC MELTING FURNACE

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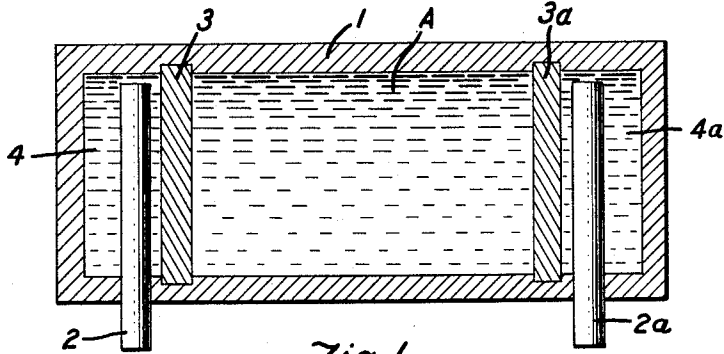


Fig. 1

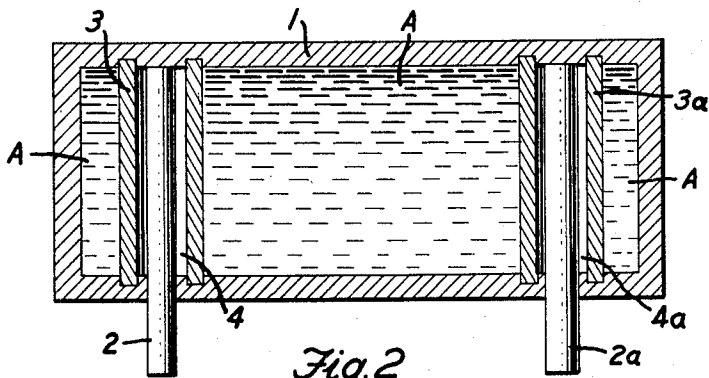


Fig. 2

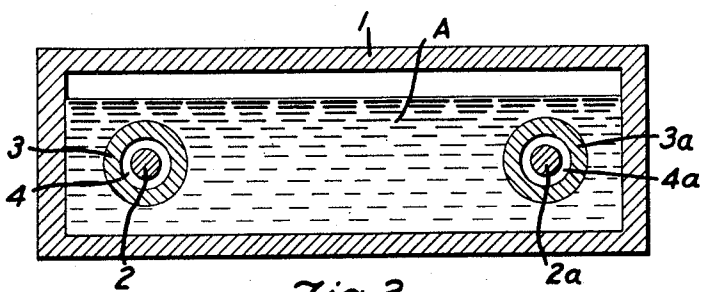


Fig. 3

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ELECTRIC MELTING FURNACE

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8 Claims. (Cl. 13—6)

The present invention relates to an electric melting furnace, particularly for the manufacture and treatment of glass, wherein the material melted or to be melted is heated at least partly by joulean heat.

Prior to this invention various designs of electric melting furnaces have been known in which the electrodes were immersed in the material melted or to be melted. Such furnace designs had the very obnoxious disadvantage that the fused mass itself was polluted by the material of the electrodes, for example, carbon, and that the electrode material was used up very quickly, especially if the fused mass had a high concentration in anions. These disadvantages became apparent especially when the temperatures were raised as highly as usually required in this art.

It is the principal object of the present invention to devise a method as well as an apparatus which overcomes the above-mentioned disadvantages in a very simple and effective manner.

Another object of the invention is to provide an electric melting furnace with means for bodily separating or shielding at least one electrode from the fused mass so as to prevent the pollution of the mass by the electrode material but still permitting an effective operation of such furnace by said electrode.

Another object of the invention is to provide an electric melting furnace with means for protecting at least one electrode thereof from the corrosive action of the fused mass in such furnace and from burning up excessively under such action.

Another object of the invention is to devise a new type of electric melting furnace as well as a new method of operating the same, and of fusing the mass to be treated by indirect means.

A feature for accomplishing these objects resides in the provision of an electric furnace with a partition consisting of one or more metal oxides which form electric conductors or semi-conductors when subjected to higher temperatures, that is, temperatures within the range of those required for fusing the material to be treated. Materials especially suitable for making the partition according to the invention have been found to be compounds of silicic acid with metal oxides as well as stabilized zirconium oxide.

Another feature of the invention resides in providing an electric furnace with one or more electrodes and one or more partitions spaced from said electrodes so as to form an intermediate chamber filled with a material having a different chemical composition than the mass to be fused or treated in the furnace.

Another object and feature of the invention is to surround the electrodes of an electric furnace with a material having a very low concentration in anions so as to reduce the corrosion of the electrode material to a minimum.

Further objects, features, and advantages of the invention will be apparent from the following detailed de-

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scription thereof and the accompanying drawings, in which:

Fig. 1 shows a top view of an electric melting furnace according to the invention, with parts thereof shown in a longitudinal section;

Fig. 2 shows a similar view of a modification of the melting furnace according to the invention; while

Fig. 3 shows a side view, partly in section, of the furnace shown in Fig. 2.

Referring to the drawings, Fig. 1 shows a melting furnace having outside walls 1 within which the electrodes 2 and 2a are mounted in a suitable manner. These electrodes are spaced and shielded from the mass A to be fused or treated by partitions 3 and 3a. Thus, the damaging action of the electrode material upon the mass A and vice versa, of such mass upon the electrode material will be entirely avoided. According to another and preferred embodiment of the invention the chambers 4 and 4a formed by the partitions 3 and 3a, respectively, are filled with a material having a chemical composition different from the mass A to be treated. Such material preferably consists of a substance which has a low concentration in oxygen and therefore limits the corrosion of the electrode material to a minimum.

According to the embodiment of the invention as shown in Figs. 2 and 3, the electrodes 2 and 2a are surrounded by tubular walls 3 and 3a and thus bodily shielded from the fused mass A.

In both embodiments of the invention as illustrated in the drawings, the partitions or walls consist of a material or a mixture of materials which, when subjected to the high temperatures within the range of those occurring in a melting furnace form an electric conductor or semiconductor, so that the electric current passing from one electrode to the other through the mass A will not be interrupted by the partitions.

Materials which have proven to be very suitable for the purposes of the invention are metal oxides which may be used either alone or in a combination of several different oxides. Thus, for example, the partition may consist, or be coated with compounds of silicic acid and metal oxides. Stabilized zirconium oxide has also proved very suitable for this purpose.

While the foregoing description sets forth in detail what I regard as the preferred embodiments of the invention, it is to be understood that numerous changes may be made therein without departing from the spirit and scope of the invention as defined in the appended claims. Thus, for example, although the drawings only show two electrodes in each furnace, it will be obvious to anybody familiar with the art that three or more electrodes and any suitable number of partitions according to this invention may be provided. Also, the invention is by no means limited to the manufacture and treatment of glass, and may be applied to various other fusible materials, for example, substances containing silicate, such as fusible basalt, slags, or the like.

Having thus described my invention, what I claim as new is:

1. In an electric melting furnace for melting glass having at least two electrodes, the improvement which comprises partition means in spaced relationship to at least one of said electrodes forming a chamber isolating said electrode from direct contact with the main portion of a melt in said furnace, said partition means being formed of a different electrically conductive material than the electrode material.

2. Improvement according to claim 1, in which said partition means essentially consists of at least one metal oxide forming an electric semi-conductor when subjected to elevated temperatures.

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3. Improvement according to claim 1, in which said partition means essentially consists of a compound of silicic acid and at least one metal oxide.

4. Improvement according to claim 1, in which said partition means essentially consists of stabilized zirconium oxide.

5. Improvement according to claim 1, in which said chamber formed by the spaced relation of the partition means to the electrode contains an electrically conducting material having a chemical composition different from the melt to be treated in said furnace.

6. Improvement according to claim 5, in which said electrically conductive material in said chamber essentially consists of a substance having a low oxygen concentration.

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7. Improvement according to claim 1, in which said partition means comprises a tubular member surrounding said electrode in spaced relationship thereto.

8. Improvement according to claim 1, in which each electrode has partition means in spaced relationship thereto.

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