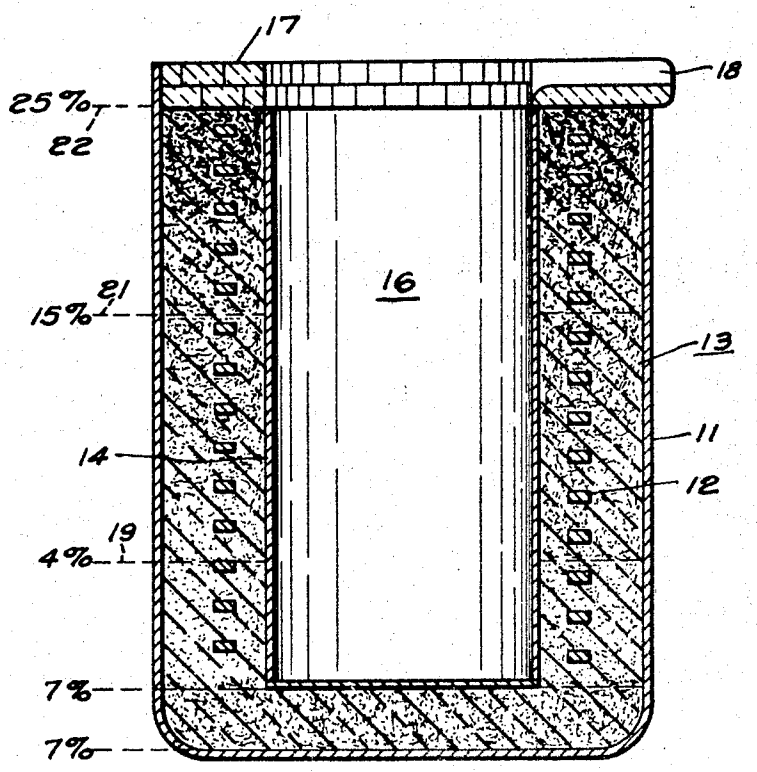
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INDUCTION FURNACE LINING

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UNITED STATES PATENT OFFICE

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INDUCTION-FURNACE LINING

Application filed May 14, 1930, Serial No. 452,206, and in Great Britain May 15, 1929.

Our invention relates to furnaces and more particularly to electric induction furnaces.

An object of our invention is to provide a highly efficient and highly resistant lining of refractory material for an electric induction furnace.

Another object of our invention is to provide a refractory lining which shall embody material giving it different degrees of refractoriness longitudinally of the melting chamber.

In practicing our invention, we provide a refractory lining which may include magnesite, with lime as a bonding material, to which is added varying percentages of a mineralizer, such as borax, iron oxide or glass. The amount of added material is relatively small at that part of the lining subjected to the largest amount of wear and decreases toward the top of the furnace to provide a lining of higher refractoriness at the lower portions of the chamber.

The single figure of the drawing is a view, in vertical section, of a coreless induction furnace embodying our invention.

The linings or crucibles of electric induction furnaces are usually prepared by locating a tubular template within an outer peripheral metal casing, between which is located a heating coil. The space between the template and the casing and around the coil is filled by an initially granular, refractory material which is rammed into place and is then sintered, as by heating the template by energizing the coil, or by melting a charge therein. If the refractory lining is of substantially the same degree of refractoriness from top to bottom, it has been found that the upper portions of the linings are insufficiently sintered and, therefore, have a tendency to crumble, this being particularly noticeable at the upper edge or rim of the lining which is, of course, usually located well above the upper turns of the energizing coil.

Referring to the drawing, we have illustrated a casing 11, which may be of metal, an energizing coil 12 therein and a lining 13 of granular electric-insulating refractory material, the composition of which more particularly constitutes our invention and which will be described hereinafter in detail.

A thin metal template 14 of substantially tubular shape, is located in the casing 11, to cooperate therewith in initially holding the lining during the assembly of the furnace and to define a furnace chamber 16. A cover 17, having a pouring spout 18, may be provided. We have illustrated a specific embodiment of furnace structure in order to illustrate the use of our invention therewith, and desire it to be understood that the details of the casing, heating coil-template and cover are not parts of our invention.

The normal material of the lining 13 may consist of a major portion of magnesite, say on the order of 65 per cent, to which is added a self-hardening bonding material, such as lime. In order to obtain a gradation of the degree of refractoriness, we may add such materials as glass, iron oxide, or borax.

We may add about 6% or 7% of borax to the material which is located at the bottom of the furnace lining and, at a point some 6 inches or so from the bottom, where the erosion in a coreless induction furnace is likely to be the most rapid, indicated by the line marked 19, the lining material may be made more refractory by the addition of a lesser percentage of borax, say on the order of 4%. The percentage of borax may be increased above this point until it reaches about 15% at what may be called the wash line of the charge, indicated by the line 21. The percentage of borax may be on the order of 25% around the rim or top of the lining, at the line 22, and we may add about 5% of dextrine to constitute a bond.

When a lining of this kind is treated in the ordinary manner, after having been tightly rammed into place, by heating a normal charge or metal template therein, the maximum temperature is developed in the zone indicated by the line 19 at which the lining is most refractory, and, as a result, this lining is adequately sintered at this zone. Since the zones indicated by the lines 21 and 22 at which the temperature developed is lower are composed of less refractory or more easily sintered material, these zones are also ade-

quately sintered, and the surface of the lining will, therefore, be such as is best adapted to withstand the wear to which the lining is subjected in the ordinary operation of the furnace.

We believe that the action of the borax or similar material added to the magnesite and lime, is substantially as follows: The borax constitutes an additional flux for the magnesite at the lower range of temperature and then acts as a flux at intermediate temperatures. It vaporizes at the higher temperatures, and the fluxed magnesite is probably recrystallized so that it is of greater refractoriness than before. It may thus be said that the borax acts as a mineralizer for the granular refractory material.

The varying percentages of borax is in accordance with the degree of sintering which is effected by the coil; that is, the degree of refractoriness and of sintering is a maximum near the bottom of the chamber and decreases toward the top, as has been set forth.

Various modifications may be made in the device embodying our invention without departing from the spirit and scope thereof, and we desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

We claim:

1. In an induction furnace, a lining of refractory material defining a material-containing chamber, said lining being most refractory at a level slightly above the bottom of the chamber and decreasing in degree of refractoriness with the approach to the top of said chamber.

2. An electric induction furnace including a lining defining a furnace chamber, said lining comprising a granular refractory material and a relatively small quantity of a material which constitutes a bond at low temperature and a flux at an intermediate temperature and which vaporizes at higher temperatures to increase the refractoriness of the refractory material, the amount of the second mentioned material increasing from the bottom to the top of the lining.

3. An electric induction furnace having a lining defining a material-containing chamber, said lining including a major portion of a granular refractory material, a minor portion of a self-hardening bonding material and a varying but lesser quantity of a material which constitutes a bond for the granular refractory material at lower temperatures and a flux at intermediate temperature and which vaporizes at higher temperatures to increase the refractoriness of the granular refractory material, the amount of said last named material increasing toward the top of the lining.

4. An electric induction furnace having a rammed and sintered lining defining a material-containing chamber, said lining including a major portion of a granular refractory material and a minor portion of material having the characteristics of borax as a mineralizer, the amount of said last named material in said lining varying longitudinally of said chamber and being a maximum at the top thereof.

5. An electric furnace having a rammed and sintered lining defining a material-containing chamber, said lining including a major portion of a granular refractory material and a minor portion of borax to mineralize the granular refractory material, the amount of borax increasing toward the top of the lining.

In testimony whereof, we have hereunto subscribed our names this twenty-third day of April, 1930, and this twenty-eighth day of April, 1930.

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