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METHOD AND APPARATUS FOR BAKING ANODES WITH PREHEATING OF CATHODIC SOLE FOR ELECTROLYTIC FURNACES

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Fig. 1

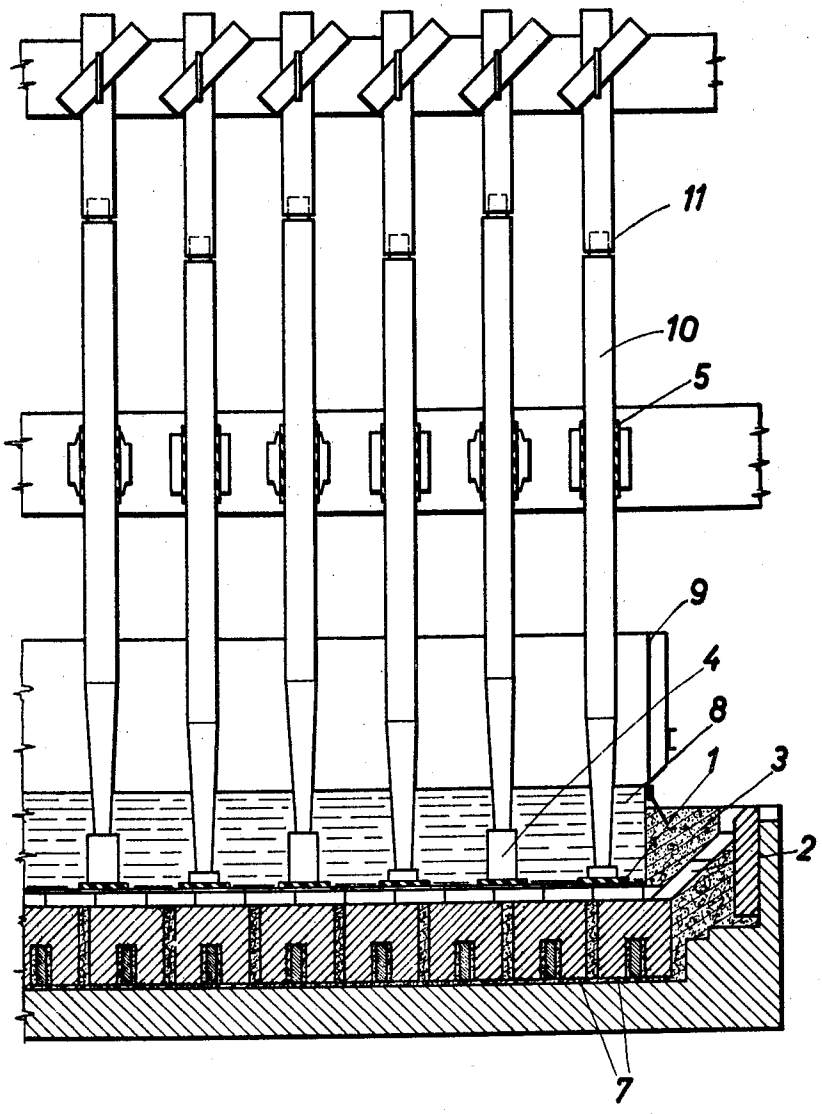

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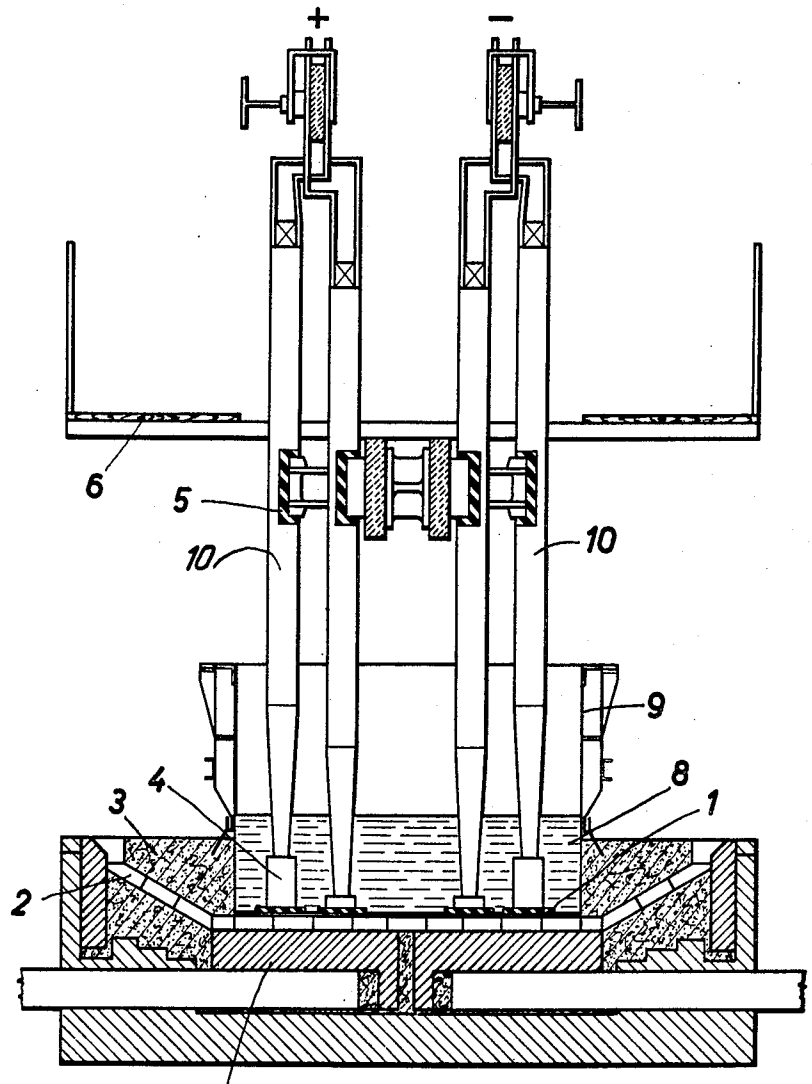
Fig. 2



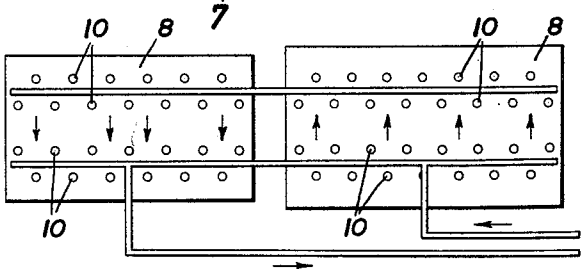


Fig. 3

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METHOD AND APPARATUS FOR BAKING ANODES WITH PREHEATING OF CATHODIC SOLE FOR ELECTROLYTIC FURNACES

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3 Claims. (Cl. 204—67)

The present invention concerns furnaces for aluminum production by fused bath electrolysis of aluminum oxide dissolved in a fluorinated cryolitic bath, and relates particularly to a method and apparatus for anode baking while simultaneously preheating the cathodic sole. The invention is particularly suitable for high amperage electrolytic furnaces, but it may also be applied to other furnace types.

It is therefore an object of the present invention to provide a method and apparatus for preheating the cathodic sole of an electrolytic cell without direct passage of electrical current through the sole, and to avoid thereby localized overheating of the blocks forming the sole.

It is a further object of the invention to provide a method of achieving a relatively high and uniform temperature throughout the cathodic sole of an electrolytic furnace without causing any surface damage of the blocks forming the sole.

It is another object of the invention to simultaneously bake the anode and preheat the bottom of an electrolytic furnace at a minimum cost.

It is a further object of the invention to provide a method and apparatus for baking the anode while simultaneously preheating the cathodic sole of an electrolytic furnace immediately prior to the starting of the electrolytic process itself, thereby precluding the necessity for separately heating up the furnace bottom, the cathodic sole and the anode with a consequent saving of furnace-starting energy.

The usual method of preparing prebaked electrodes of the Soederberg type is described in the McGraw-Hill Encyclopedia of Science and Technology, 1960, vol. I, page 294. Reference may also be had to copending U.S. applications Serial No. 119,465 of Landucci, filed June 26, 1961, and Serial No. 119,464 of Frerotti et al., filed June 26, 1961.

To achieve these ends, the method of the present invention comprises pre-baking of Soederberg-type anodes prior to the electrolytic operation, and is particularly characterized in the fact that the method is carried out by means of either direct or alternating current immediately on the furnace itself, while simultaneously preheating the cathodic sole of the furnace. The anode rests on the vat bottom, and a layer of refractory bricks is interposed between the anode and the vat bottom. Either direct or alternating current is used and enters from a group of two rows of stubs or metallic rods, and goes out from another group of stubs.

The above-mentioned and further objects, advantages and features of the invention will be apparent from the following description of the embodiments shown by way of example on the accompanying drawings in which:

FIG. 1 represents schematically, by way of example of the invention, a longitudinal cross section of a furnace of the indicated type;

FIG. 2 represents a transverse section of the furnace according to FIG. 1;

FIG. 3 shows schematically the electrical arrangement for feeding current to the apparatus.

As shown in FIGS. 1 and 2, the anode, consisting of an anode paste 8 in an anode jacket 9, rests on the bottom of the vat. A layer of refractory bricks 2 is interposed on the vat bottom between element 7 of the cathodic sole and a sheet 1 of asbestos insulation. An anthracite filling 3 or equivalent carbonaceous compound mixed with coal-tar pitch fills the interspaces between the elements 7 and adjacent portions of the sole. A plurality of relatively small cylinders 4 of coal or carbonaceous material are positioned within the anodic paste 8 between tthe asbestos insulation 1 and the current-carrying nipples 10 for transmitting electrical current to the anode. The cylinders 4 are preferably used on alternate nipples 10 so that the joints 11 of the nipples do not fall in the same plane, thus preventing possible fracture along a single plane which might otherwise pass through all the joints 11. A supporting bridge 6 is provided for holding the nipples during the baking operation, and additional asbestos insulation members 5 electrically insulate the bridge 6 from the current-carrying nipples 10.

As shown in FIG. 2, a source of current is connected to the nipples 10. When direct current is used, the two nipples 10 shown at the left of FIG. 2 are connected to the plus side of the direct current source, and the two nipples at the right-hand side of FIG. 2 are connected to the minus side of the same direct current source. When alternating current is used, the respective pairs of nipples at the left and right side of FIG. 2 are connected to the alternating current source in an analogous manner. The anode is thus baked by direct heating from the electric current provided through nipples 10. The bottom, comprising the elements 7, the bricks 2 and the anthracite filling 3 is simultaneously baked by indirect heating from the same current source by conduction and radiation of the heat.

Preferred conditions for carrying out the baking operation according to the invention are shown by way of illustration in the following examples:

	Example I—Anodes of 100 ka.	Example II—Anodes of 128 ka.
Baking duration, days	10	12
Current, amps	8–14,100	8–16,000
Anode voltage, volts	10–15	10–15
Consumed energy, kwh	25,000	30,000
Average temperature:		
Electrode bottom, ° C	700	700
Cathodic sole, ° C	500	500

The following advantages are provided by the method according to the invention for preheating the cathodic sole and prebaking the anode.

According to the invention, preheating of the cathodic sole of the electrolytic cell takes place without direct passage of current through the blocks 7. Consequently, there is no possibility of concentration of current in the block elements 7, and thus there can be no detrimental overheating or concentration of stresses localized in the blocks themselves. The cathodic sole, composed of the blocks 7 and the anthracite filling 3 between them, is uniformly heated to a relatively high temperature, which can be attained with less difficulty than by prior art means of heating, whether directly with energy such as from an electric current, or indirectly by the use of fuel oil and other methods of indirect heating. Furthermore, the method of the present invention does not result in any surface damage to the blocks 7 themselves. The entire operation according to the invention for baking the anode and preheating the bottom takes place at a relatively low cost. Furthermore, the possibility is afforded of starting the electrolytic furnace as soon as the anode baking operation is completed. Thus, the bottom and the anode will both be at optimal temperature, with a consequent con-

siderable saving of the electrical energy required for starting the electrolytic operation. In addition to heating the furnace bottom, consisting of the bricks **2**, the cathodic sole itself is also preheated, as above mentioned, thus providing a further saving in furnace-starting energy.

It will be obvious to those skilled in the art, upon a study of this disclosure, that our invention permits of various modifications and alternations with respect to the individual method steps and components and circuits of the apparatus, and hence can be embodied in equipment other than particularly illustrated and described herein, without departing from the essential features of our invention and within the scope of the claims annexed hereto.

We claim:

1. A method for pre-baking a Soederberg-type anode while simultaneously indirectly preheating a cathodic sole of an electrolytic furnace prior to the electrolytic operation, comprising the steps of suspending an anode jacket in position on said furnace in heat radiating proximity to a cathode sole, filling said jacket with a carbonaceous Soederberg-type anodic paste, and passing an electric current through said paste until said paste is baked into a solid electrode while electrically insulating said cathode sole from said electric current.

2. Apparatus for pre-baking a Soederberg-type anode while simultaneously preheating the cathodic sole of an electrolytic furnace prior to the electrolytic operation, comprising a furnace pot, a plurality of carbonaceous blocks in said pot positioned so as to form the cathodic sole of the furnace, a Soederberg-type carbonaceous filling positioned in the interspaces between said blocks, an

anode jacket adapted to hold an anodic Soederberg-type paste when in operation and positioned in heat radiating proximity to said blocks, means for transmitting an electric current to said anodic paste, and a layer of refractory bricks forming an electrical insulating layer over said blocks so as to electrically insulate the latter from said electric current transmission means and from said paste, whereby said anodic paste is directly heated electrically to bake same into a solid anode while said block elements are simultaneously indirectly preheated only by radiation prior to starting of the electrolytic process.

3. Apparatus according to claim 2, said electric current transmission means comprising a plurality of current-carrying nipples positioned so as to be supported by said layer of bricks while said anodic paste is being electrically baked, said nipples having cylinders of carbonaceous material and of varying length at their lower extremities and having nipple joints lying in a plurality of respective horizontal planes, and asbestos insulation members positioned between said cylinders and said layer of bricks.

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