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G. LANDUCCI

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METHOD AND APPARATUS FOR BAKING AND PREHEATING
BOTTOMS OF ELECTROLYTIC CELLS BY MEANS OF
ALTERNATING OR DIRECT CURRENT
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FIG. 1

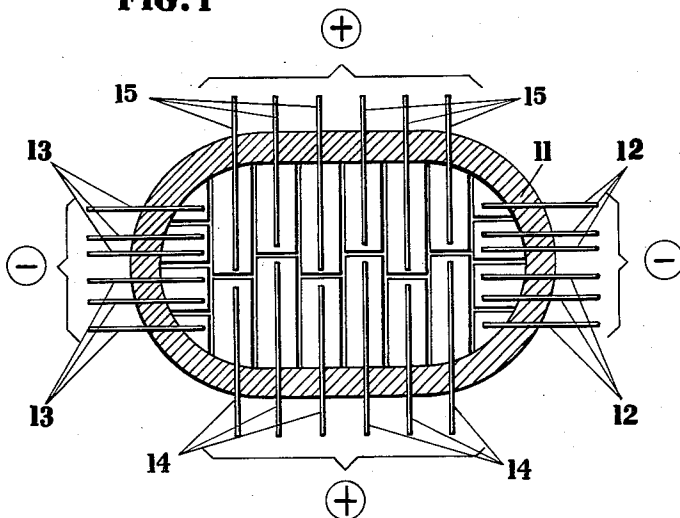
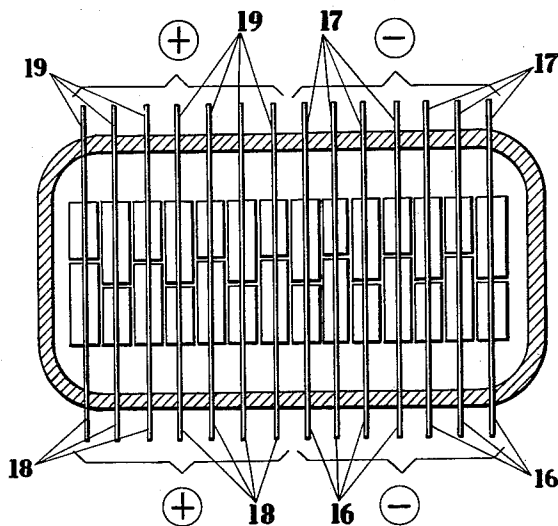


FIG. 2



INVENTOR.
Gualtiero Landucci

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METHOD AND APPARATUS FOR BAKING AND PREHEATING BOTTOMS OF ELECTROLYTIC CELLS BY MEANS OF ALTERNATING OR DIRECT CURRENT

Gualtiero Landucci, Bolzano, Italy, assignor to Montecatini, Società Generale per l'Industria Mineraria e Chimica, Milan, Italy, a corporation of Italy

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1 Claim. (Cl. 204—294)

The present invention relates to a method and apparatus for baking and preheating the bottoms of electrolytic cells by means of alternating or direct electric current, and more particularly to such a method and means for carrying it out without affecting the anode of the electrolytic cells.

For a better understanding of the present invention reference may also be had to copending application Serial No. 119,446 of Frerotti et al., filed June 26, 1961, and Serial No. 119,464 of Frerotti et al., filed June 26, 1961.

Known processes for baking the bottoms of electrolytic cells are subject to a number of drawbacks and disadvantages, due primarily to the formation of abnormal thermal stresses on the sole of the cathode, which result from concentrations of current which may arise, and which have no possibility of being adjusted timely or effectively. These abnormal thermal stresses act upon monolithic structure and the compactness of the blocks of carbonaceous mass forming the cathodic bottom and introduced a number of disadvantages in the prior-art structures thus produced.

It is therefore an object of this invention to provide a method and apparatus which will overcome the above-mentioned drawbacks and disadvantages.

It is a further object of the present invention to provide means for baking and preheating the bottoms of electrolytic cells, without affecting the anode, and which will produce in unstressed condition a monolithic structure and compactness of the bottoms of the electrolytic cells and the surfaces of cathodes used therein.

It is another object of the present invention to provide a method and apparatus for the preheating of the cathodic sole immediately prior to the starting of electrolytic cells.

It is a further object of this invention to provide a process for baking and preheating the bottoms of electrolytic cells without the necessity for having the anode present.

According to the present invention, the anode is not affected by the baking operation, and therefore the process may be carried out without the anode being present. During the baking or preheating operation, the cathodic bottom is coated with a layer of thermal insulation formed of a carbonaceous powder. In the case of a previously baked anode, this carbonaceous powder may be laid on the bottom of the cell, upon an interposed layer of electrical insulation material. According to this latter embodiment, the anode contributes to the thermal insulation, and itself undergoes a preheating, useful in the electrolytic process to follow.

Current for the baking and preheating of the cell bottom is introduced in a suitable manner through some of

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the cathodes and is allowed to go out through the remainder of the bottom cathodes.

The foregoing and other objects, advantages and features of the invention, these features being set forth with particularity in the claims annexed hereto, will be apparent from, and will be mentioned in, the following description in conjunction with the embodiments of the method and device according to the invention illustrated by way of example on the accompanying drawings, in which:

FIG. 1 shows schematically and in plan view a first embodiment of the invention as employed for vats with an oval base section and having cathodes arranged on the round ends thereof as well as along the longitudinal sides;

FIG. 2 is a second embodiment of the invention as employed for vats with a rectangular base section and having cathodes arranged on the longitudinal sides only.

The present invention is applicable not only to Söderberg-type electrodes, but also to pre-baked electrodes. As explained in the McGraw-Hill Encyclopedia of Science and Technology (1960), Volume I, page 294, a Söderberg electrode is one in which one large electrode is located in each pot, and the electrode is formed in place and is baked by heat from the pot as the electrode gradually descends into the pot. The paste charged into the top of the Söderberg-type electrode is a carbon-pitch mixture similar to that used for a pre-baked electrode, but with a somewhat larger proportion of pitch. In pre-baked electrodes, ground coke is mixed hot with enough coal-tar pitch to bond it into a solid block when it is pressed in a mold to form a "green" electrode. This green electrode is then baked slowly at temperatures rising to a maximum of about 1100–1300° C. (2012–2372° F.), and cooled slowly, all out of contact with the air. In a cavity molded in the top of each block, a steel stub is ordinarily embodied by casting molten iron around it; the conducting bar is then bolted to this stub.

As shown in the accompanying FIG. 1, a vat 11 having an oval base section is provided with a plurality of cathode terminals 12, 13 around the rounded sides thereof and cathode terminals 14, 15 along the longitudinal side. The plus and minus signs in each of the figures indicate the positive and negative electrical connections, respectively, when the baking is done by means of direct current. Analogous connections may also be made during baking with alternating current. It is to be understood that the described baking operation is carried out when the cathodes are not yet connected with the normal feeding circuit of the electrolytic furnace. In other words, the electric current used for the baking operation of the present invention is completely distinct from the electrolytic operation itself.

As shown in FIG. 1, the cathode terminals 12 are connected to a negative terminal of a direct-current source, while the cathode terminals 13 are connected to a positive terminal of the same source. The terminals 14 are connected to other portions of the cathode from a negative terminal of a direct-current source of electricity, and terminals 15 of the cathode are connected to a positive connection of the terminals. Thus, according to FIG. 3, the cathodes are arranged along the

longitudinal sides as well as on the round sides of the oval.

FIG. 2 illustrates an arrangement of cathodes on the longitudinal sides only of a vat having a rectangular base section. The terminals 16 and 17 of the cathodes are connected to the negative terminal of a source of direct current, and the terminals 18, 19 are connected to the positive terminal of the direct-current source. As above described in connection with the oval vat of FIG. 1, analogous connections may also be made in the case of baking by means of alternating current.

The following examples are presented by way of illustration of the method for carrying out the invention.

EXAMPLE I

Baking of Bottoms of 32 ka. by Alternating Current: Monophase Transformer 600 kva.

The operation according to this example comprises baking the paste of the fastening mass for the joints between the metal cathodes and the carbon blocks, and the untamped joints of anthracite-containing mass which occur between one block and another. The furnaces are connected in series; namely, a group of negative cathodes of one furnace is connected with the group of positive cathodes of the next furnace. At most, eight furnaces are so connected.

CHARACTERISTIC DATA

(1) Baking duration-----days--	12
(2) Initial current, amperes-----	1,000
(3) Final current, amperes-----	5,000
(4) Volts per furnace-----	8-15
(5) Energy consumption per bottom-----kwh--	7,500
(6) Temperature of cathodic sole-----° C--	650

In the ultimate baking phase, which occurs about the eighth day and following, a layer about 10 cm. thick of anthracite or other small particulate carbonaceous material, such as waste-recovery material, is charged onto the surface of the cathodic sole.

EXAMPLE II

Preheating of Bottoms of 32 ka. by Means of Alternating Current: Monophase Transformer 600 kva. and Rectifier

This method of carrying out the invention is an operation which immediately precedes the starting of the furnaces for the electrolytic operation itself, and is preferably carried out with vats placed in the proper pits of the furnace rooms, but not connected electrically with the normal electrolysis circuit. In other words, the cathodes are not connected with the normal holders of the cathodic current-carrying ring. The bottoms of the cells may be either previously baked (namely the bottom unit, comprising prebaked blocks, may be baked prior to the starting of the furnace; in this case the joints between the blocks are of untamped anthracituous mass and the iron cathode is fixed to the carbonaceous block by a layer of anthracituous mass, see Example I); or they may not have already been baked previously and then baking is not necessary since in that case the fastening between iron cathode and carbonaceous block (block of pre-baked carbon) is effected by pouring cast-iron into the interstices between said iron cathode and said block while the joints between a block and another are of anthracituous mass which in this case is tamped and which does not require baking, that is, in this case the mere preheating suffices).

The vats are then electrically connected with the transformer circuit. The connection of this preheating operation is effected with the furnaces in series with each other in the same manner as for the baking operation, above described.

TYPICAL INDICATIVE DATA (NOT LIMITING)

Preheating duration-----hours--	24-48
Surface temperature of cathode sole-----° C--	200-300
Volts per furnace-----	8-18
Initial current, amperes-----	3,000
Final current, amperes-----	6,000
Energy consumption per bottom-----kwh--	1,500-3,000

The operation according to the invention may also be continued until temperatures are attained in the range of 400°-500° C. at the surface of the cathode sole, of course with a corresponding longer period of time for the duration of the preheating step.

The baking according to Example I, and the preheating according to Example II, as well as the characteristic or typical data listed under each of the examples are applicable for alternating and also for direct-current operation.

The following advantages have been noticed with cathodes made according to the process of the present invention:

A higher thermal efficiency is obtained, baking and preheating of the electrode occur in a shorter period of time, and a remarkable saving in electrical energy is realized. The baking and preheating operations may be carried out completely independent of the anode construction. There is a greater possibility of controlling the passage of current while avoiding local peaks of current density, so that the blocks do not become abnormally stressed by concentration of current. This results in a longer working life of the electrolytic cells. The present invention further affords the possibility of carrying out the baking or preheating operations of the cell bottoms by means of alternating current, and not only by direct current.

It will be obvious to those skilled in the art, upon a study of this disclosure, that the present invention permits of various modifications and alterations with respect to the individual components and steps of the disclosed process, that devices according to the present invention can be modified in various respects and hence may be embodied in apparatus and processes other than particularly illustrated and described herein, without departing from the essential features of the invention and within the scope of the claim annexed hereto.

I claim:

A method of manufacturing a carbonaceous bottom for an electrolytic furnace, comprising the steps of positioning a plurality of carbonaceous blocks adjacent each other in a substantially horizontal staggered checkerwork pattern on the bottom of a furnace, placing a Soederberg-type carbonaceous paste in the joints between the blocks, embedding in said blocks a plurality of current leads extending substantially in a horizontal direction, charging some of said leads positively and other of said leads negatively so that an electric current flows in a substantially horizontal direction through said blocks and through said paste for a period ranging between 2 to 12 days while the surface of said blocks reaches a temperature ranging between 200° and 650° C., and placing a layer of carbonaceous material in particulate form onto the surface of said blocks during the latter portion of said baking period.

References Cited in the file of this patent

UNITED STATES PATENTS

2,378,142	Hurter -----	June 12, 1945
2,728,109	Bonnot -----	Dec. 27, 1955
2,874,103	Syz et al. -----	Feb. 17, 1959

OTHER REFERENCES

Fulda et al.: Tonerde and Aluminum II, Teil 1953, pages 64-66 and 72-73.