Jan. 11, 1944. G. HAGERUP-LARSSEN 2,338,936

ELECTRODE FRAME STRUCTURE

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Fig. 1

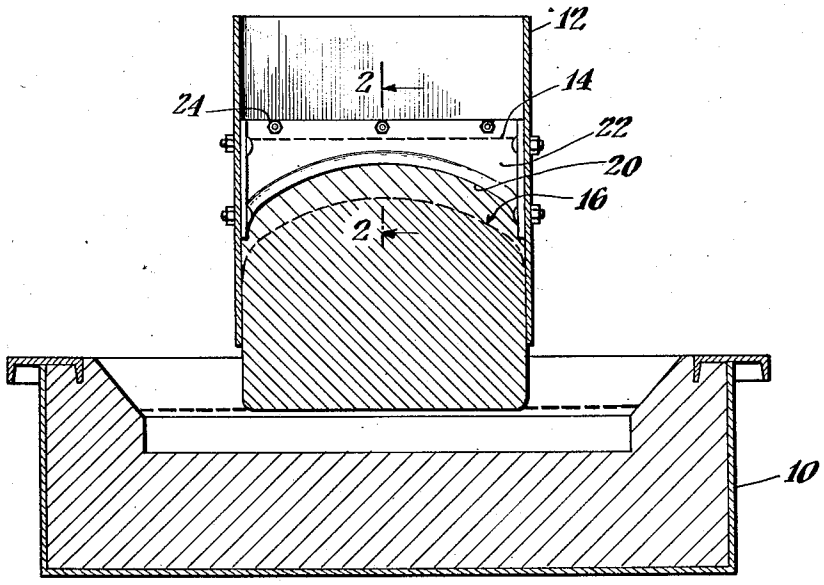
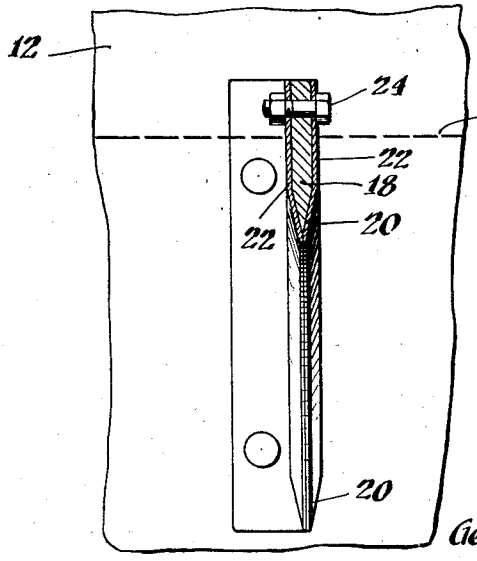


Fig. 2



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ELECTRODE FRAME STRUCTURE

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5 Claims. (Cl. 13—18)

This invention relates to an improvement employed in connection with the Soederberg continuous electrode system, and is particularly intended for use with electrodes of non-cylindrical shape. For example, oblong electrodes of great size are now being employed in connection with the production of aluminum.

In the operation of this system, the raw electrode paste is introduced into the upper part of a casing and moves downwardly toward the heating zone of the furnace. As it approaches the heating zone it becomes partly hardened by the heat of the furnace and may be given additional hardening by passing some of the electric current through it before it is called upon to carry a full load.

Working with non-cylindrical electrodes, it has been found that the electrode paste is sufficiently fluid so that it exerts a substantial hydrostatic pressure tending to distort the casing which encloses the electrode. In some instances this casing may be a movable one which travels with the electrode material and in others it may be a fixed outside casing. If desired, both a movable and a fixed casing may be employed simultaneously. It has heretofore been suggested that the distortion of the electrode be prevented by the use of rigid bars arranged around the exterior of the electrode casing to hold it in place.

I have now discovered that there is a substantial zone through which the electrode moves where the electrode material is exerting hydrostatic pressure tending to distort the casing and has the ability to recoalesce into a unitary body if temporarily separated. Based on this discovery, I have found that the electrode casing can be very simply and efficiently reinforced by the use of internal rods or plates. The electrode paste moves around such reinforcements and coalesces below them to reform a unitary body.

There is one difficulty with this problem. It is highly essential that the cross braces should not extend so far down in the electrode material that they reach the zone where baking has progressed to the point where the paste will not reunite. It has been found that the hardened zone of the electrode extends considerably higher near the middle of the electrode than at the edges. Thus if a straight rod or bar is used for cross bracing, it must be high enough up so that the central portion of the electrode where it has begun to be baked will still be below the cross brace. This means that at the sides a zone of fluidity will extend a substantial distance below the cross braces and may result in distortion.

I have found that this problem can be overcome by using plates for the cross braces, and by studying the characteristics of each individual type of furnace, the line of safety can be determined for the bottom edge of such a plate. This bottom edge will be shaped to follow the approximate line of hardening and of course should be positioned an appreciable distance above the line of hardening in order to insure that the paste will reunite. By making the plates of this shape to follow the contour of the baked portion of the electrode, the reinforcement can be carried down sufficiently far on the sides to maintain the casing in shape without having the reinforcement extend into the baked zone near the center.

While the cross braces may be made of steel, I have found that the electrode paste will slide very easily past faces of smooth aluminum. Instead of making the cross braces of solid aluminum, it is advantageous to make these of steel with removable aluminum plates.

It sometimes happens that operation of the furnace is stopped and the electrode hardens around the cross braces sufficiently so that its flow or movement will be stopped. If the faces of the braces are formed of detachable aluminum plates, they may be released from the cross braces and allowed to go on down into the furnace and new face plates substituted. Since these plates are made of aluminum, they will not have any injurious effect on the metallic bath in the furnace.

It is obvious that if bracing between the sides of the fixed casing is employed and a movable casing is also used, the movable casing will have to be slitted or subdivided into sections so that it can move past the fixed braces.

It is also possible to provide cross bracing between the sides of the movable casing but in such case the cross bracing should be in the form of rods or relatively narrow plates so that no line of cleavage in the baked portion of the electrode will occur.

The invention may readily be understood by reference to the accompanying drawing in which Fig. 1 shows a sectional view through a furnace and electrode embodying my invention. For the purpose of simplicity the electric connectors for the electrode and the supports for the fixed casing are not shown. Fig. 2 shows a detailed sectional view on line 2—2 of Fig. 1 illustrating a manner in which releasable aluminum plates may be attached to the braces.

In this drawing 10 indicates the furnace pot

and 12 is the fixed casing through which the electrode moves, which we may presume is of oblong shape. The broken line 14 indicates the approximate level to which the casing is filled with the electrode paste and the broken line 16 illustrates the curve of the top of the hard-baked part of the electrode. 18 is the metal plate serving as a cross brace, attached to the sides of the casing 12.

As shown in Fig. 2, the cross brace 18 extends above the top level of the electrode mass which is indicated by the line 14. In this case the lower edge of the brace 18 is streamlined as indicated at 20 and the faces of the brace 18 are covered with thin sheets of aluminum indicated by the numeral 22. These may be held in place on the brace 18 in any desired manner as by the bolts 24 which is positioned above the line 14 so that they may readily be released simply by removing these bolts.

While this is a preferred form of my invention, it is to be understood that it will have to be modified to suit the particular conditions that arise in connection with various types of furnace. Also while I have described this invention as principally used with aluminum furnaces, it may of course be used in any case where non-cylindrical continuous electrodes are employed.

What I claim is:

1. In self-baking electrode construction, an electrode of non-circular cross section, such electrode having its lower portion baked hard while its upper portion is sufficiently fluid so that if portions of the electrode are separated, they will re-fuse together, a casing through which the electrode moves which is subject to distortional strains from the hydrostatic pressure of the fluid portion of the electrode and means for strengthening such casing to resist such strains comprising cross braces running through the electrode and positioned close to the zone where the electrode is baked too hard to fuse together but above such zone, so that the braces are always surrounded by a raw electrode paste.

2. A construction as specified in claim 1 in which the cross braces are in form of plates having their lower edges curved approximately in conformity with the top of the baked zone of the electrode.

3. A structure as specified in claim 1, in which the cross braces are formed with detachable faces of aluminum sheeting.

4. In a self-baking electrode construction, a stationary tubular casing extending vertically and adapted to receive at its upper end raw electrode paste which passes by gravity to the lower end of the casing at which time it has been formed into a hard baked electrode, and bridge means extending across the interior of said casing through the electrode paste so that the electrode paste passes down along the bridge means and the bridge means holds the casing in its predetermined shape, said bridge means having its lower edge spaced immediately above the zone in which the electrode paste becomes baked too hard to fuse together.

5. An electrode construction as described in claim 4 wherein said bridge means is arched at its center in conformity with the contour of the upper edge of said zone and wherein the side and bottom surfaces of said bridge means are covered by an integral removable shell which is attached to the bridge means at the upper edge thereof.

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