ANCHORING FOR AN ELECTRICALLY CONDUCTIVE BAR IN A GROOVE IN AN ELECTRODE MADE OUT OF A CARBON BLOCK

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ABSTRACT

Anchoring for a conductive bar in a groove in an electrode block, whereby in the space between the walls of the bar and the groove a cast iron mantle around the bar is provided. In each side wall of the groove at least one recess is provided for the anchoring of at least one projection of the cast iron mantle surrounding the bar.

3 Claims, 5 Drawing Figures
ANCHORING FOR AN ELECTRICALLY CONDUCTIVE BAR IN A GROOVE IN AN ELECTRODE MADE OUT OF A CARBON BLOCK

The invention presented here refers to the anchoring of an electrically conductive bar in a groove in an electrode made out of a carbon block, whereby cast iron is cast into the spaces between the walls of the bar and the groove in order to anchor the bar in place.

The carbon lining, which forms the floor of a cell in a furnace for the electrolysis of a molten charge, was for several decades when the electrolytic cells were still relatively small, predominantly made by crushing a synthetic carbon mass consisting of coke granules and a cokeable bonding agent and spreading this over the conductive ferrous cathode bars which were already arranged in the cell. Before the cell was put into operation this carbon lining of the cell floor had to be baked (sintered).

In the case of larger electrolytic cells, for example those upwards of 40,000 A, the production of the carbon lining from pre-baked synthetic carbon blocks was adopted. Before setting these into the electrolytic cell they are tightly fitted to the cathode bars. After insertion in the cell the spaces between the individual carbon blocks are filled with synthetic carbon ramming mass after which the baking (burning in) takes place.

In many cases in order to avoid the formation of spaces between the pre-baked carbon blocks and between rows of these blocks the surfaces facing each other are stuck together.

The anchoring of the ferrous cathode bars in the pre-baked synthetic carbon blocks can take place in various ways. Earlier, the cathode bars, the whole cross section of which is rectangular, were placed in suitable recesses or grooves in the carbon blocks and rammed with a green synthetic carbon mass. More recently the green synthetic carbon mass has been replaced by pouring in cast iron.

Present day knowledge includes the arrangement in a carbon block of a groove which is dove tail shaped in cross section and in which a bar is set and which with the aid of cast-in cast iron anchors the bar in the carbon block. On fixing the conductive bar in the groove in this way it is however found to be a disadvantage that, the gap between the grey cast iron and the walls of the dove tail groove of the carbon block resulting from the contraction of the grey cast iron and the bar on cooling is enough to produce a slight displacement of the bar set into the groove and enclosed by the cast iron, such a displacement being possible for example as a result of vibration on transport of the carbon block, so that the gap between the cast iron and the walls of the dove tail groove in the carbon block becomes narrow and the block in this case, on reheating to, for example, 700°-750°C after fitting into the reduction cell, is broken by the thermal expansion of the bar.

The object of the invention presented here is to produce such an anchoring for a conductive bar in a groove of a carbon block that the known disadvantages associated with the kind of anchoring described above are avoided and so that the fracture of the carbon block due to the thermal expansion of the bar described previously is not possible.

The object is fulfilled by way of the invention in that in each side wall of the groove there is provided at least one recess which serves to anchor at least one projection of the cast iron jacket surrounding the bar.

In the block and the conductive bar cross section the anchoring runs essentially parallel to the base of the block.

The anchoring can to advantage be further developed in such a way that the upper and lower walls of the recess in the groove in the electrode block are made to run parallel to each other. Further, it is possible to shape the upper and lower walls of the recess such that they are slightly divergent in the direction towards the bars.

The drawing shows an exemplified embodiment of the object of the invention in a simplified manner of representation and shows:

FIG. 1 Carbon blocks with inlaid conductive bar and the cast-filled groove which is in the position for casting with the grooves in the blocks facing upwards.

FIG. 2 Carbon blocks with inlaid conductive bar, lying in the position in preparation for building in to the trough of a furnace for the electrolysis of a molten charge, with the grooves of the blocks facing downwards.

FIG. 3 A section through a perspective illustration of a furnace trough having a lining of carbon blocks combined with the conductive bars.

FIG. 4 A section through an electrode block in the casting position from which can be seen the position of a conductive bar in a groove or anchoring in the block in the cooled condition after the cast iron has been cast into the groove 2 of the block 1 and

FIG. 5 A section through an electrode block in the operating position of the electrode block from which can be seen the position of a conductive bar in a groove or in an anchoring in an electrode block at operating temperature.

The carbon blocks 1 shown in FIGS. 1, 2 and 3 are fitted in a row in a particular number, for example five, with a conductive bar 3, as will be described presently in detail, tightly held and, for example, set into a steel trough 17 of a furnace 18 for the electrolysis of a molten charge, in which furnace in the electrolysis of the molten charge these serve as cathodes being connected to a power supply by way of the conductive bars in a manner not illustrated here. Between the carbon blocks 1 and the steel trough 17 there is provided a layer of fire-proof, heat insulating brickwork. As shown in FIGS. 4 and 5 the electrode block 1 has a groove 2 to accept a conductive bar 3. At least one recess 6, 7 is provided in each of the two side-walls 4, 5 of the groove 2 the said recess 6, 7 being arranged preferably at a height corresponding to the middle of the side-walls. The recesses 6, 7 preferably extend parallel to the length of the groove 2 whereby the upper and lower walls 8, 9 of the recesses 6, 7 can preferably be arranged parallel to each other but can also be arranged divergent in the direction towards the bar 3.

The carbon blocks 1 are laid on the floor aligned in preparation for the introduction of the conductive bar 3 in the groove 2 and with the open side of the grooves 2, which are essentially rectangular in cross section, facing upwards to accept the molten cast iron (see also FIG. 1).

Before inserting the bars 3 in the grooves 2 the bars 3 are heated to a certain temperature, for example 700°C and then laid in position in the groove 2 of the electrode block shown in FIGS. 1 and 4, with the ends
of the bars 3 laid on two blocks not shown to keep the conductive bars at a suitable height with respect to the position of the grooves 2 in the carbon blocks in which there remains between the bars 3 and the walls of the groove 2, a U-shaped gap which allows easy flow of the molten iron which is finally cast into the said gap. On casting the molten iron into the U-shaped gap a cast iron mantle 10 with projections 13, which is bound tightly to the bar 3, forms in the said gap, the projections 13 being so anchored in the groove 2 of the carbon block 1 during and after the contraction of the cast iron mantle and the bar 3 that the cast iron mantle can not move out of the range of the recesses 6, 7.

After cooling, as a result of contraction the bar 3 and the cast iron mantle 10, as shown in FIG. 4, take up less space than when the molten metal was poured. The projections 13 of the cast iron mantle 10 remain however in contact with the recesses 6, 7 of the groove 2 and lie on the lower walls 9 of the recess 6, 7 so that the cast iron mantle 10 which is tightly bound to the bar 3 is anchored to the carbon block 1. Between the cast iron jacket 10 and the walls of the groove 2, and between the side walls 12 and the upper walls 8 of the recess 6, 7, gaps 11 remain when the cast iron mantle is in the cold condition.

The dimensions of the recess 6, 7 and the distance of the same from the bottom 14 of the groove 2 are chosen in accordance with certain specific calculations which take into account the casting conditions and the expansion of the electrode block 1 and the cast iron mantle 10 at average operating conditions.

In the furnace for the electrolysis of a molten charge, for example a charge of aluminium oxide dissolved in molten cryolite, the temperature of the electrolyte is about 950°-960°C and the average temperature of the conductive bar 3 during operation is about 750°C.

With the aid of the anchoring of a conductive bar 3 in a groove 2 which is essentially rectangular in cross section, it is now no longer possible for the bars 3 in the cold condition to move between the side-walls of the groove 2 and wedge there. Also on heating the bars 3 remain in their original position in the groove 2 so that on subsequent expansion due to the heating up no splitting of the electrode block is to be feared.

If the walls 8, 9 of the recess 6, 7 of the groove 2 are made divergent particular care is to be taken that these are only divergent to such a slight extent that the projections 13 of the cast iron mantle 10 in the cold condition can not wedge on the walls 8, 9 of the recesses 6, 7 at a slight sideways movement of the bars 3, whereby on subsequent heating, splitting of the electrode block is avoided at the resultant expansion of the bar 3 and the cast iron mantle 10.

What is claimed is:

1. An anchoring arrangement for a conductor bar in an electrode block, said conductor bar being provided with a cast iron mantle, said electrode block defining a groove operable for receiving said conductor bar and said mantle, at least one lateral projection provided on said mantle and at least one recess defined in a sidewall of said groove into which said projection projects, whereby said cast iron mantle and therefore said conductor bar is anchored in said groove to restrain removal in an upright direction of said conductor bar from said electrode block.

2. Anchoring arrangement according to claim 1, wherein said recess comprises an upper and a lower surface, said surfaces being arranged parallel to one another.

3. Anchoring arrangement according to claim 1 wherein said recess comprises an upper and a lower surface, said surfaces being slightly divergent in the direction of the bar.