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<td>Applicant(s)</td>
<td>Invensil</td>
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ABSTRACT

SYSTEM FOR THE ASSEMBLY OF A SELF-BAKING COMPOSITE ELECTRODE FOR ELECTRIC ARC FURNACES

The subject of the invention is an assembly system for a self-baking, composite electrode for electric arc furnaces, this electrode comprising an outer metal ferrule (1), a central column (2) in pre-baked carbon or graphite made up of a plurality of elements assembled by nipples (4), and carbon paste (3) placed between ferrule (1) and central column (2), and a temporary blocking device (10) for column (2), characterised in that it is equipped with a clamping mechanism (11) which, in co-operation with the temporary blocking device (10) for column (2), permits application of a clamping torque of pre-set value between a new element and the central column (2) to which this new element is to be screwed.

With the system of the invention, it is possible to reduce electrode breakage during furnace operation.
The claims defining the invention are as follows:

1. An assembly system for a composite, self-baking electrode for electric arc furnaces, this electrode comprising an outer metal ferrule, a central column, in pre-baked carbon or graphite made up of a plurality of elements assembled by nipples, and carbon paste placed between the ferrule and the central column, this system comprising a support that is vertically mobile over a length greater than each of the elements and used to suspend the central column, and a temporary blocking device for column, characterised in that it is equipped with a clamping mechanism which, in co-operation with the temporary blocking device for column, permits application of a clamping torque of pre-set value between a new element and the central column to which this new element is to be screwed.

2. The system according to claim 1, characterised in that the central column is fixed to the support by means of a piece comprising means for press-fitting into said support.

3. The system according to claim 1 or claim 2, characterised in that it comprises a temporary device for blocking the downward movement of central column.

4. An assembly system for a composite, self-baking electrode for electric arc furnaces, this electrode comprising an outer metal ferrule, a central column, in pre-baked carbon or graphite made up of a plurality of elements assembled by nipples, and carbon paste placed between the ferrule and the central column, this system comprising a support that is vertically mobile over a length greater than each of the elements and used to suspend the central column, and a temporary blocking device for column, said system being substantially as hereinbefore described with reference to the accompanying drawings.

5. Use of a system according to any one of claims 1 to 4 in an electric arc furnace for the production of metallurgical silicon.

Dated 3 July 2000
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Invention Title:
System for the Assembly of a Self-Baking Composite Electrode for Electric ARC Furnaces

The following statement is a full description of this invention, including the best method of performing it known to me/us:-
SYSTEM FOR THE ASSEMBLY OF A SELF-BAKING COMPOSITE ELECTRODE FOR ELECTRIC ARC FURNACES

Field of the invention

This invention concerns a self-baking electrode, or Söderberg electrode, intended for an electric arc furnace, in particular a furnace for producing metallurgical silicon, comprising a central column made up of a succession of pre-baked electrodes in carbon or graphite, an outer metal ferrule and carbon paste undergoing baking between the central column and the ferrule.

Prior art

The principle of the self-baking electrode has been known since 1917 under a patent filed by Det Norske Aktieleskap for Elektrokemisk Industri (FR 488778) and its inventor C.W. Söderberg gave it his name. The electrode is baked in the electric furnace itself using a carbon paste that is continually supplied inside a ferrule in steel comprising fins to support the electrode. With this technique, the lower part of the ferrule dissolves in the bath of molten metal imparting iron to the bath, which may be a hindrance in particular in the case of silicon.

To avoid contamination by iron, several solutions have been put forward which all consist of mechanically detaching the electrode and the ferrule so that the electrode can be caused to slide without the ferrule. It suffices to use a smooth ferrule without fins, but in this case a mechanical assembly must be provided so that the weight of the electrode can be given other
support. This assembly is generally a piece inserted in the paste during baking, which consumes itself at the same time as the electrode, for example a strip of perforated steel as in patent IT 606568 filed in 1959 by the Edison company, or a column which forms a pre-baked electrode in carbon or graphite, made up of elements assembled together by means of nipples as in patent US 457856 by J.A. Persson filed in 1984. Patent FR 2683421, filed by the Carburos Metalicos company describes various adaptations of this technique. Patent FR 2724219 by Pechiney Electrométallurgie proposes the suspension of the central column from a support that is vertically mobile over a distance that is greater than the length of each of the unit elements forming the central column.

The purpose of the invention is the improve this latter system such as to provide greater safety and increased reliability in the functioning of the electrode, by improving the assembly of elements forming the central column.

Subject matter of the invention

The subject of the invention is a system for the assembly of a self-baking composite electrode for electric arc furnaces, this electrode comprising an outer metal ferrule, a central column in pre-baked carbon or graphite formed of a plurality of elements assembled by nipples, and carbon paste placed between the ferrule and the central column, this system comprising a support that is vertically mobile over a distance that is greater than the length of each of the elements and is used to suspend the central column, and a temporary blocking device for the column,
characterised in that it is equipped with a mechanism which, in co-operation with the temporary blocking device for the column, permits the application of a clamping torque of pre-set value between a new element and the central column to which this new element is to be screwed.

Description of the disclosure

The invention will be described with reference to the single figure which shows an axial section view of an example of embodiment of the composite electrode assembly system.

As described in patent FR 2724219, the electrode properly so-called comprises a cylindrical metal ferrule 1, a central column 2 and, in the space between the ferrule and the central column, carbon paste 3 that is inserted via the top part and bakes gradually as it moves downwards. The central column 2 that is cylindrical and has the same axis as the ferrule, is made up of generally identical elements in pre-baked carbon or graphite, provided at their two ends with threaded conical holes and assembled together by nipples 4, that is to say conical dual-threaded connectors made in the same material and screwed onto the two elements to be assembled. The assembly system comprises a support 5 that is vertically mobile in relation to the ferrule 1 by means of two jacks 6, whose stroke is greater than the length of the elements forming column 2. The upper element of the central column is fixed to the mobile support 5 by means of a metal piece 7 whose end reproduces the thread of nipples 4. When, after the successive sliding movements required to offset the continuous consumption of the
electrode, the jacks 6 arrive at the end of their stroke, column 2 is temporarily blocked using the support of temporary blocking device 10 for the time that is needed to remove the fixation piece 7, to return the jacks 6 back upwards and to add a new element to the top of column 2.

In the system corresponding to patent FR 2724219, this new element was screwed in place manually or using a dynamometric key on the element positioned immediately underneath. If clamping was insufficient, there was a risk that the column would not be properly supported and the assembly might come loose; on the contrary, if clamping was too tight, the thread of the element could deteriorate.

In the improved assembly of the present invention, when it is required to add a new element to the top of the column, piece 7 fitted with a collar 8 is removed, a new element provided at its top end with a new piece 7 is lowered onto the top of the column 2 by means of a winch. When the collar 8 of piece 7 reaches support 5, the new element press-fits into position under its own weight through pivoting pieces 9 and comes to be properly positioned just above column 2. The clamping torque between the new element and column 2 is assured by blocking device 10 and clamping mechanism 11 which permit application of a perfectly defined clamping torque by controlling the oil pressure in the hydraulic jack commanding mechanism 11. The sliding of the electrode is controlled by means of jacks 6, the manoeuvre being conducted with clamping of the ferrule by belt 12 so as to hold ferrule 1 during the sliding movement. Taking into consideration the need to extend the ferrule from time to time, the same manoeuvre is
used for this purpose as previously but in this case by simultaneously sliding ferrule 1 by means of jacks 13 and the electrode by means of jacks 6. The positioning of the electrode in the furnace, controlled by electric adjustment of the furnace, is made in identical fashion to the method described in patent FR 2724219.

With the system of the invention it is possible to make the addition of new elements to column 2 by considerably reducing the risk of breakage of this column and hence the stoppage rate of furnaces which is reduced by 75%, decreasing from 2% to 0.5%. Moreover, this increased safety means that it is possible to reduce the diameter of column 2 by approximately 10% compared with the prior art, which reduces costs, the Söderberg paste being far less costly than pre-baked electrodes.
The claims defining the invention are as follows:

1. An assembly system for a composite, self-baking electrode for electric arc furnaces, this electrode comprising an outer metal ferrule, a central column, in pre-baked carbon or graphite made up of a plurality of elements assembled by nipples, and carbon paste placed between the ferrule and the central column, this system comprising a support that is vertically mobile over a length greater than each of the elements and used to suspend the central column, and a temporary blocking device for column, characterised in that it is equipped with a clamping mechanism which, in co-operation with the temporary blocking device for column, permits application of a clamping torque of pre-set value between a new element and the central column to which this new element is to be screwed.

2. The system according to claim 1, characterised in that the central column is fixed to the support by means of a piece comprising means for press-fitting into said support.

3. The system according to claim 1 or claim 2, characterised in that it comprises a temporary device for blocking the downward movement of central column.

4. An assembly system for a composite, self-baking electrode for electric arc furnaces, this electrode comprising an outer metal ferrule, a central column, in pre-baked carbon or graphite made up of a plurality of elements assembled by nipples, and carbon paste placed between the ferrule and the central column, this system comprising a support that is vertically mobile over a length greater than each of the elements and used to suspend the central column, and a temporary blocking device for column, said system being substantially as hereinbefore described with reference to the accompanying drawings.

5. Use of a system according to any one of claims 1 to 4 in an electric arc furnace for the production of metallurgical silicon.

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