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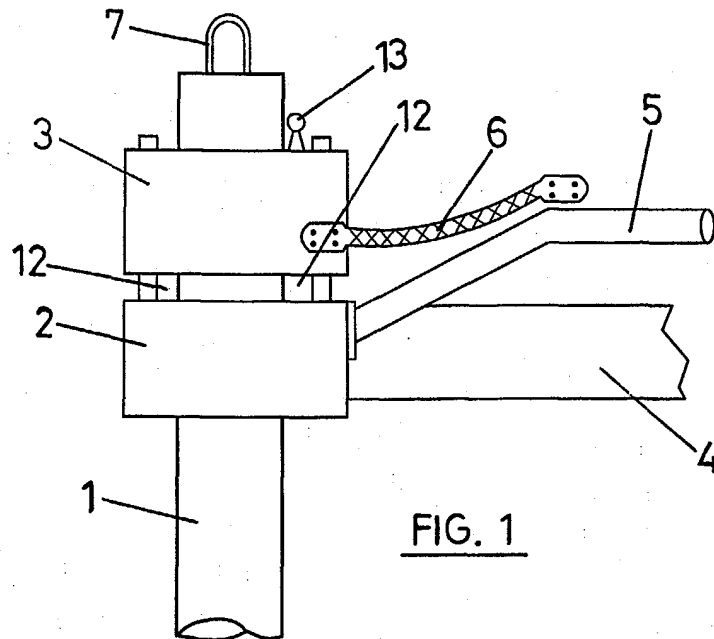
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(54) **Automatic system for elongating electrodes in electric furnaces**

(57) An automatic system for elongating electrodes in electric furnaces, in which involves supporting the electrode (1) by means of two fixing clamps or grips, one fixed (2) and another one movable (3) along a length of the electrode. These clamps grip the electrode (1) at different heights and are of alternative opening and clo-

sure, furthermore being connected to one another by means of hydraulic cylinders (12) with which the upward or downward movement of the movable clamp (3) is caused with regard to the fixed clamp (2) between positions of maximum and minimum separation between them.



Description

[0001] The present invention refers to an automatic system for elongating electrodes in electric furnaces which, by means of a simple mechanism, allows for carrying out the elongation of the electrodes of an electric furnace without needing to interrupt the operation thereof.

[0002] Since many years ago the field of steels, both special and common steels, has experienced very noticeable technical advances and changes largely due to the efforts to produce increasingly purer and more sophisticated steels and, at the same time, trying to increase production for the purpose of lowering costs and to thus be able to obtain a more competitive steel.

[0003] Due to that previously set forth, the current generalized art is the use of large electric furnaces, capable of processing about 140 tons of casting, and with electric outputs of up to 120 megawatts. Castings are obtained with these conditions in less than an hour.

[0004] However, one of the main questions of constant concern in this type of furnaces are the "dead" times. These times are those referred to the preparation of the furnace after each casting which requires the inspection of the walls of the tank and the repair thereof if needed, the inspection of the bottom of the furnace floor, the elongation of electrodes, etc.

[0005] With regard to the elongation of the electrodes of an electric furnace, it must be taken into account that the columns making up said electrodes consist of cylindrical parts coupled to one another by means of a threading process, which grants them lengths of about 10 meters and weights of several tons.

[0006] The electrode is made of graphite and therefore is subject to a natural wear due to sublimation and oxidation. Due to this wear, this is why they must be elongated and even be replaced and changed for new ones.

[0007] The elongation of an electrode in an electric furnace must be done when the furnace is stopped and the operation must be carried out with a crane, by means of which the electrode is held and slid in a downward direction until the desired length. This operation is slow and delicate, and requires a fair amount of time.

[0008] The object of the invention is to eliminate the drawbacks set forth resulting from the time necessary for carrying out the elongation of the electrodes by means of a system which allows for carrying out this elongation in a fairly lesser amount of time and, essentially, without having to stop the operation of the furnace.

[0009] To that end, according to the present invention the electrode or electrodes are held by means of two independent fixing clamps or grips, one of which is fixed whereas the other one is movable along a length of the electrode. These clamps grip the electrode at different heights and are of alternative opening and closure, the movable clamp being able to move with regard to the fixed clamp between positions of maximum and mini-

um separation, in the second of which they are in a practically consecutive position.

[0010] The two clamps holding the electrode are connected to one another by means of hydraulic cylinders which cause the upward or downward movement of the movable clamp with regard to the fixed clamp between said positions of maximum and minimum separation.

[0011] The two clamps can open or close to hold the electrode, the opening and closure thereof and the movement of the movable clamp in either direction occurring in a synchronized manner, such that said movable clamp can sequentially drag the electrode, with regard to the fixed clamp, in the direction of elongation of said electrode.

[0012] To achieve the automatic operation which requires the opening and closure of the clamps as well as the activation of the hydraulic cylinders for moving the movable clamp with regard to the fixed clamp, the two clamps are provided with sensors detecting the opened or closed situation of said clamps, as well as the position of the movable clamp with regard to the fixed clamp, the opening and closure of the grips and the upward and downward movements of the movable grip responding to the signals of said sensors, which can be computer-controlled through a PLC.

[0013] The manner in which the automatic elongation of the electrodes of an electric furnace is achieved by means of the system of the invention will be better understood with the following description, made in reference to the attached drawings in which a non-limiting embodiment is shown:

[0014] In the drawings:

Figure 1 shows a side elevational view of an electrode of an electric furnace supported according to the system of the invention.

Figure 2 shows a similar view to Figure 1, in which the clamps are shown in greater detail, in a normal operation situation, in a position of minimum separation.

Figures 3 to 5 shows different consecutive situations and positions of the clamps during the electrode elongation phase.

[0015] Figure 1 shows an electrode 1 which, according to the system of the invention, is supported or suspended by two clamps, a fixed one which is given reference number 2 and another movable one which is given reference number 3 and which can move along a certain length of the electrode between positions of maximum and minimum separation of the fixed clamp 2.

[0016] The fixed clamp 2 is supported by an arm 4 shaped in a known manner and is electrically fed in a known manner, by means of cooled cables which can access the fixed clamp 2 through a stiff duct 5. The electric connection of the movable clamp 3 is carried out through a flexible duct 6.

[0017] In a normal operation position, the fixed clamp

2 and movable clamp 3 can occupy a position of minimum separation, as shown in Figure 2.

[0018] Each one of the clamps 2 and 3 can be constituted of two grips, a fixed one 8 and another movable one, which can be actuated, for example, by means of a piston 10 or spring 11.

[0019] The movable clamp 3 is connected to the movable clamp 2 by means of hydraulic cylinders 12 by means of the actuation of which the movement of the movable clamp 3 with regard to the fixed clamp is achieved.

[0020] With the described construction, when it is necessary to elongate the electrode 1, the process begins by opening the movable clamp 3, keeping the fixed clamp 2 closed, to support the electrode 1, as shown in Figure 2. Then, the cylinders 12 are activated to cause the lifting of the movable clamp 3 with regard to the fixed clamp 2, as shown in Figure 3. In the next phase, the movable clamp 3 closes and the fixed clamp 2 opens, according to that shown in Figure 4. After this situation, in which the clamps 2 and 3 are in the position of maximum separation, the cylinders 12 are reactivated to cause the withdrawal thereof and whereby the lowering of the clamp 3 until it reaches the position of minimum separation shown in Figure 5. In this movement, the fixed clamp 3 holding the electrode 1 will move it in a downward direction through the fixed clamp 2 which is open, until it reaches the position of Figure 5 in which the clamps are again in the position of minimum separation and in which the closure of the fixed clamp 3 and the opening of the movable clamp 2 will finally be carried out, to again reach the initial position shown in Figure 2.

[0021] The described operation, both the opening and closure of the grips 8 and 9, as well as the movement of the movable clamp 3 with regard to the fixed clamp 2, are carried out automatically. To that end, the movable clamp 3 will be provided with a position detector or sensor with regard to the fixed clamp 2, which can be attained through the run of the hydraulic cylinders 12. Furthermore, the clamps will be provided with sensors indicating the position of the movable grip 9, which can be attained through the actuation pistons 10 or springs 11. Lastly, the movable clamp 3 will be provided with a worn electrode detector 13.

[0022] The corresponding sensors will provide signals which can be computer-controlled by a PLC, all this such that every time it is necessary to elongate the electrode, when an electrode shortening or wear signal is received, the described sequence occurs automatically.

[0023] As can be seen, the system of the invention is based on the synchronized operation of the computer-controlled fixing clamps or grips 2 and 3 of the electrode 1, one of these clamps being movable to carry out movements in an upward and downward direction, while the opening and closure of the grips occurs, in order to finally achieve elongation of the electrode with regard to the fixed clamp in the desired direction.

[0024] The degree of desired elongation is achieved

through the number of necessary consecutive elongation sequences.

5 Claims

1. An automatic system for elongating electrodes in electric furnaces, **characterized in that** it involves supporting the electrode (1) by means of two fixing clamps (2,3) or grips, one fixed (2) and the other one movable (3) along a length of an electrode (1), which grip the electrode at different heights and are of alternative opening and closure, which clamps (2,3) are connected to one another by means of hydraulic cylinders (12) which cause the upward or downward movement of the movable clamp (3) with regard to the fixed clamp (2) between positions of maximum and minimum separation between both; the opening and closure of both clamps (2,3) and the movement of the movable clamp (3) in either direction occurring sequentially, such that when the movable clamp (3) is opened and moves on the electrode (1) from the position of minimum separation with regard to the fixed clamp (2) to the position of maximum separation, said fixed clamp (2) is closed on the electrode (1), whereas when the movable clamp (3) is closed and moves with regard to the fixed clamp (2) to the position of minimum separation, said fixed clamp (2) is opened in order to allow for the movement of the electrode (1) in the direction of elongation thereof.
2. A system according to claim 1, **characterized in that** the clamps (2,3) are provided with sensors detecting the opened or closed situation of said clamps (2,3), as well as the position of the movable clamp (3) with regard to the fixed clamp (2), the opening and closure of the grips (8,9) and the upward and downward movements of the movable grip (9) responding to the signals of said sensors.
3. A system according to claim 1, **characterized in that** the movable grip (9) has a worn electrode detector.

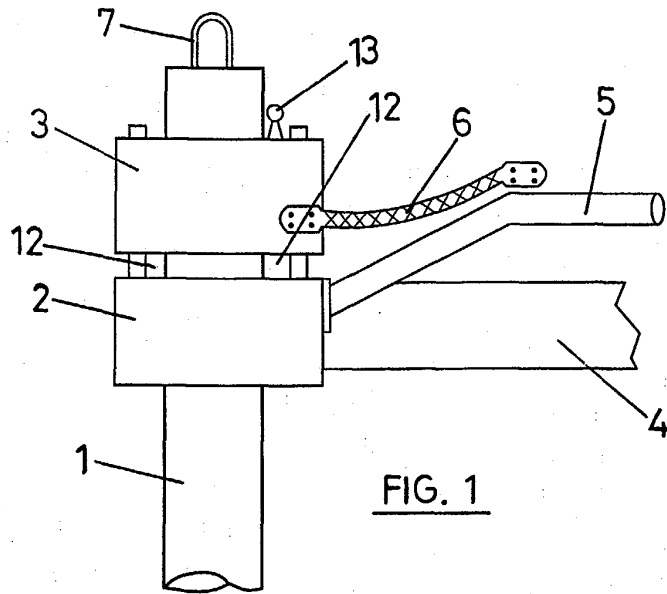


FIG. 1

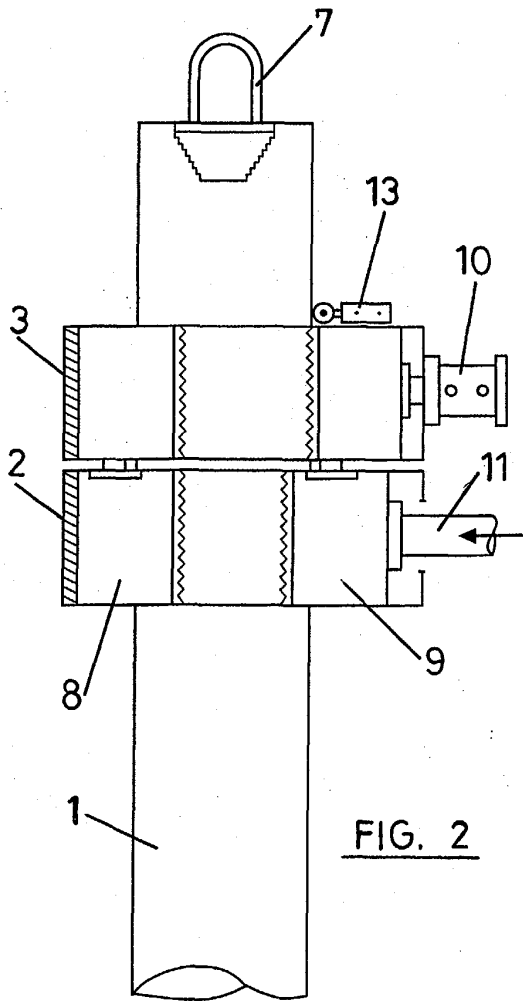


FIG. 2

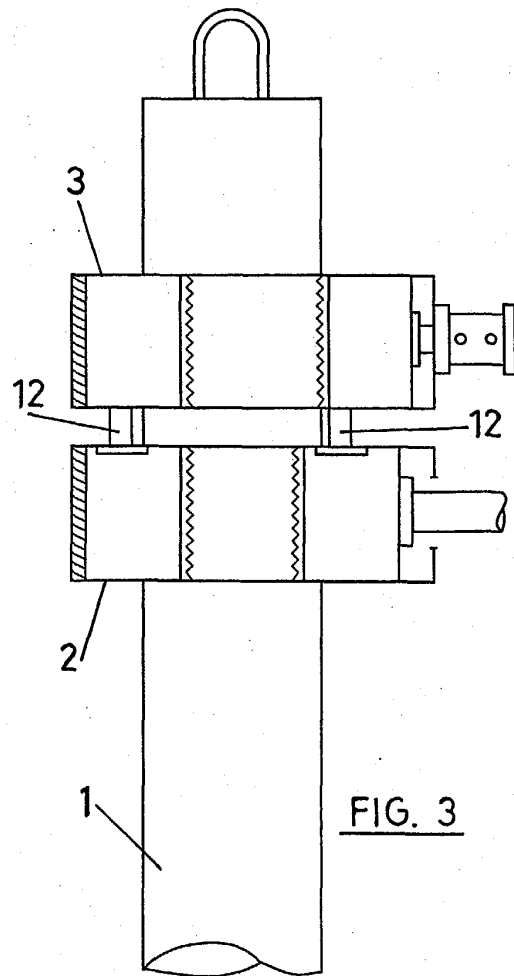
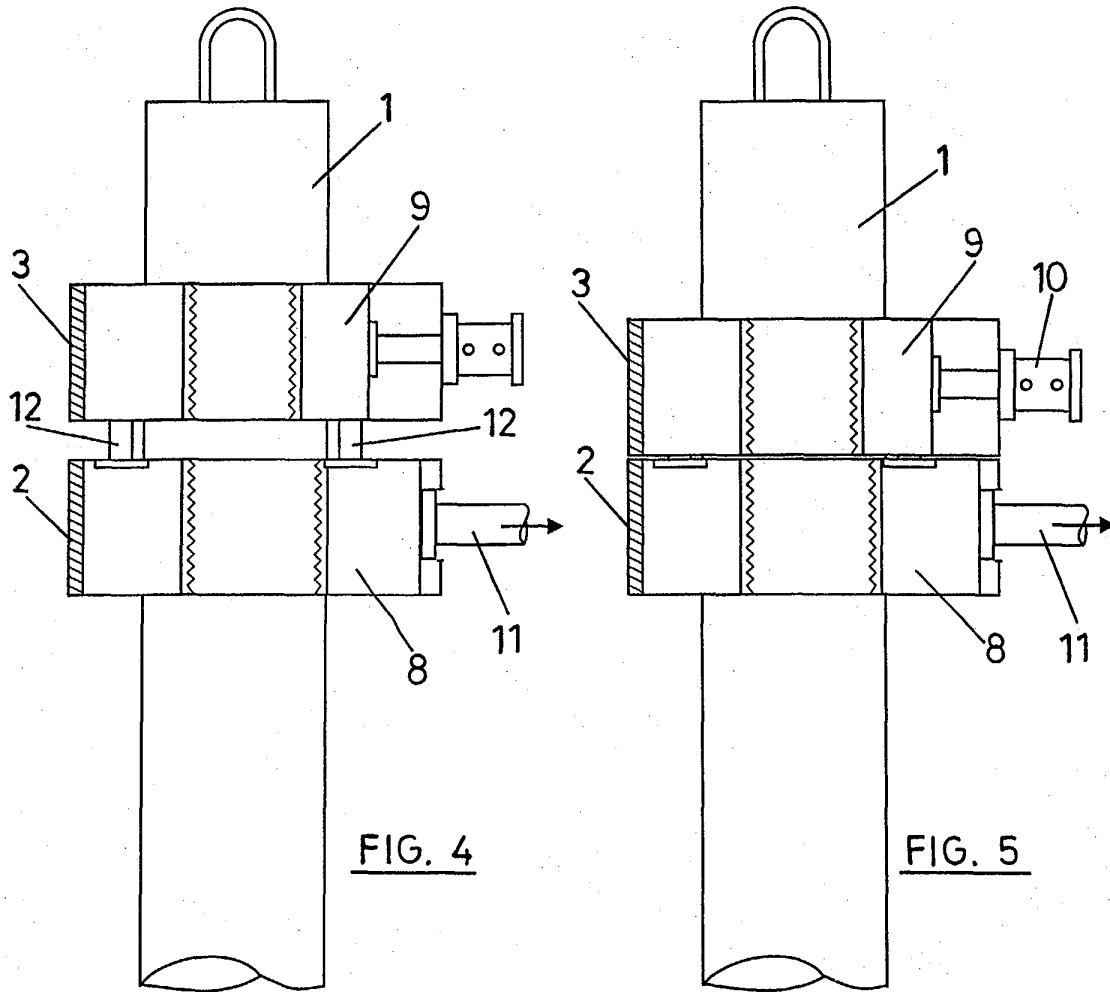


FIG. 3





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 38 0121

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 3 247 305 A (A G ALLEN) 19 April 1966 (1966-04-19) * claims; figures *	1	F27B3/10 H05B7/10
Y	DE 12 54 296 B (INST ELEKTROSWARKI IMENI J. O. PATONA, KIEW) 16 November 1967 (1967-11-16) * page 3, line 76 - line 90; figure 1 *	1	
Y	US 4 646 317 A (K EVENSEN) 24 February 1987 (1987-02-24) * claims; figures *	1	
A	FR 695 216 A (A FRANCHINI) 27 December 1930 (1930-12-27) * claims; figures *		
A	FR 2 136 965 A (V P ZINKOVSKY) 29 December 1972 (1972-12-29) * claims; figures *		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F27B H05B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		30 August 2004	Coulomb, J
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 38 0121

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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30-08-2004

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3247305	A	19-04-1966	GB 988733 A	07-04-1965
DE 1254296	B	16-11-1967	NONE	
US 4646317	A	24-02-1987	NO 824055 A	04-06-1984
			AU 546251 B2	22-08-1985
			AU 2198883 A	07-06-1984
			BR 8306585 A	10-07-1984
			CA 1228388 A1	20-10-1987
			DE 3342900 A1	07-06-1984
			FI 834241 A ,B,	04-06-1984
			SE 8306634 A	04-06-1984
			US 4543656 A	24-09-1985
			ZA 8308522 A	26-06-1985
FR 695216	A	12-12-1930	NONE	
FR 2136965	A	29-12-1972	FR 2136965 A5	29-12-1972