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V. C. HAMISTER
ELECTRODE CONNECTING PIN

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Fig. 1.

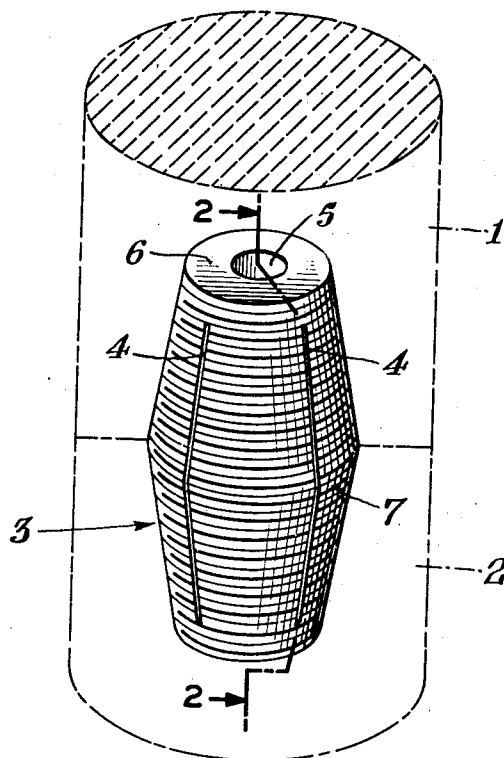


Fig. 2.

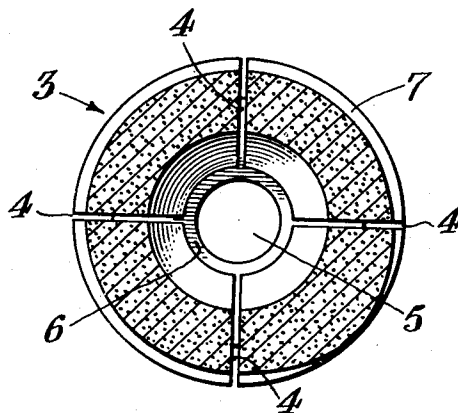
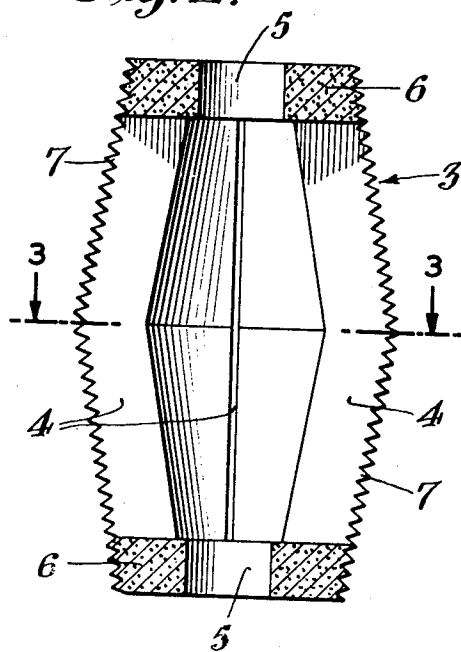


Fig. 3.

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ELECTRODE CONNECTING PIN

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1 Claim. (Cl. 13—18)

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The invention relates to members used in joining carbon electrodes, including graphitized electrodes, particularly for use in electric arc furnaces.

In order to provide a continuous feed of electrode to a furnace, electrodes are drilled and tapped at the end and joined by a threaded nipple or plug of electrode material.

Low resistivity across the interface between joined electrodes is of great importance in modern electric furnace practice due to the extremely high currents employed. This, together with the requirement for strength, has led to the use of solid threaded nipples or plugs as connecting members between electrodes. The use of solid connecting members is not entirely satisfactory and often results in electrode failure or breakage as for example the splitting of electrodes at the socket during or after the connecting operation.

It is a primary object of the present invention to provide a connecting member for sectional electrodes capable of absorbing socket stresses while retaining the low resistivity, high strength and ability to withstand heat shock required of electrodes in modern industrial applications.

In the drawing:

Fig. 1 is a perspective view of one embodiment of the connecting member of the invention shown in position;

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1; and

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2.

Like numerals are used to designate like parts in all views.

Broadly, the invention comprises a connecting member for uniting the abutting ends of electrodes, the connecting member being in the form of a hollow threaded nipple or plug having one or more longitudinal slots intermediate the ends thereof and extending through the walls of said plug.

Referring to the drawing, Fig. 1 shows two tapped ends of electrodes 1, 2 joined by a threaded, hollow, slotted plug member 3. A plurality of longitudinal slots 4, best seen in Figs. 2 and 3, extend through the walls and intermediate the ends of plug 3. The end bore 5 of plug 3 may be of such size as to provide a collar 6 at the ends of slots 4 thus adding to the strength of the plug. The threads 7 may be of conventional design, no alteration in their pitch being required because of the hollow, slotted construction of the plug.

Many comparison tests have been made between conventional solid plugs and the hollow, slotted

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plugs of the invention as electrode connecting members. Data from these tests indicate that the hollow, slotted plug has the ability to absorb socket stresses and that its use as a connecting member between abutting electrodes results in a tight joint with reduced socket strain. The hollow, slotted plug is capable of withstanding severe thermal shock. Tests, in which the electrode joint was surrounded by thermal insulation and heated to 1700° C. by the passage therethrough of large electric currents, and the joint subsequently quickly chilled by removing the insulation, resulted in no breakage at the electrode sockets or of the hollow, slotted connecting plug. Furthermore, electrical resistivity tests indicate that, due to the large area of the abutting interface at the electrode ends, only an extremely minor increase in electrical resistivity at the joint results from the reduced cross sectional area of the hollow, slotted plug.

In order to demonstrate further the advantages of the connecting member of the invention, a series of comparative tests were made in which both solid plugs and hollow, slotted plugs of a size designed for use with 10 inch diameter electrodes were used as the connecting members for 8 inch diameter electrodes. In these tests the socket walls of the 8 inch electrodes were considerably thinner than normal and consequently much more sensitive to socket stresses. The plugs used were of the tapered shape illustrated in Fig. 1 and had a maximum diameter of 8.66 inches at the midpoint which tapered to a minimum diameter of 6.125 inches at the extremities. For purposes of the test twelve transverse strain gauges were placed next to the socket face, one every 60° around the circumference of each electrode.

In the joint assembly operation, torque was applied in 50 foot pound increments and measurements were taken of strain, electrical resistance and travel.

The travel measured on the circumference of the electrode upon the application of a torque force of 750 foot pounds was 1.00 inch for the hollow, slotted plug as against 0.70 inch for the solid plug. The 0.30 inch additional travel obtained by the use of the hollow, slotted plug indicates that the hollow, slotted plug was compressed radially in the middle portion thus tending to conform to the socket shape.

Comparative electrical resistivity measurements made upon joints using solid plugs and hollow, slotted plugs indicate only minor differences at all pressures. At 750 foot pounds the resistance across the joint using the solid plug

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was 0.000031 ohms as compared with 0.000035 ohms for the hollow, slotted plug.

Data showing strain upon the socket wall after the assembly of electrode joints with both solid and hollow, slotted plugs is shown in the table. The torque force applied in joint assembly was 750 foot pounds.

Comparative strain in microinches per inch on outer socket wall between electrode joints employing solid plugs and hollow, slotted plugs

	Solid Plug	Hollow, Slotted Plug	Percent of Solid Plug
Average value of 12 strain gauges located at each 60° around the circumference of electrodes at the electrode joint face.....	466	352	75.5
Maximum value from above gauges.....	781	482	62.0

These data show that not only is a substantial reduction in average strain at the socket face obtained by using the hollow, slotted plug of the invention as the connecting member in electrode joints but also, and more important, the maximum strain was reduced by over one third the value obtained by using the conventional solid plug. With the strain before rupture somewhere near one thousand microinches per inch, the reduction of the maximum strain from 781 to 482 microinches per inch almost doubles the factor of safety. The chances of cracking the socket walls are still further decreased by use of the hollow, slotted plug which exerts no larger outward force than the solid plug and additionally has no solid core to resist the socket walls under thermal stresses.

From these data on travel, resistance and strain it is shown that the hollow, slotted plug when used as a connecting member for electrodes ac-

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complishes the objectives of the invention by providing a strong, tight joint with reduced socket strain and having the ability to absorb socket stresses with no material increase in resistivity.

The invention is not limited to the preferred embodiment shown but embraces all electrode connecting members having the general shape of bisymmetrical truncated cones having the hollow, slotted construction of the invention.

What is claimed is:

A threaded carbonaceous electrode connecting member having the shape of bisymmetrical truncated cones joined at their bases for uniting the abutting ends of tapped carbonaceous electrodes, said member being of hollow construction and having a plurality of longitudinal slots, each intermediate both the ends thereof and extending through the walls of said member, said slots being so disposed within said walls as to provide an annular collar at each end of said member.

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