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2,837,447

METAL-COATED THREADED COUPLINGS FOR ELECTRODES

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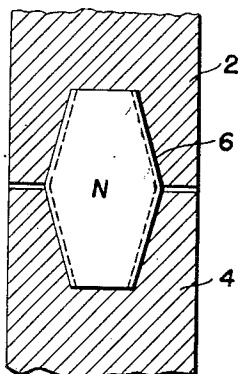


Fig. 1

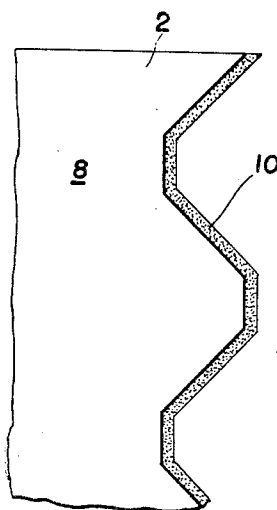


Fig. 2
PRIOR ART

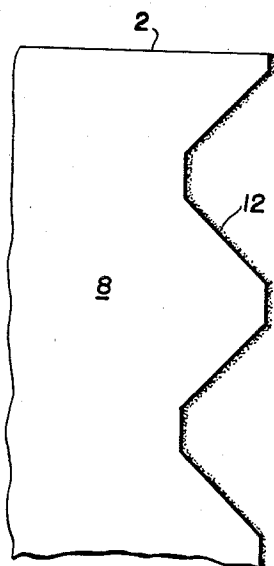


Fig. 3

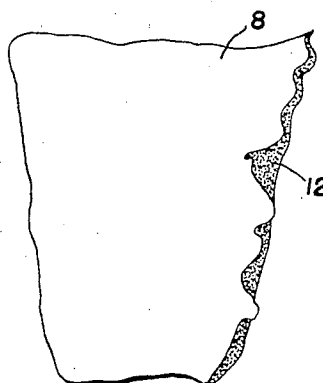


Fig. 4

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METAL-COATED THREADED COUPLINGS FOR ELECTRODES

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1 Claim. (Cl. 117—227)

This invention relates to electrodes. In particular, the invention is directed to metal-coated threaded couplings for continuous electrodes.

In an electrical furnace having self-baking electrodes, it is known to apply sprayed metal coatings to the electrodes. For continuous electrodes composed of a number of individual electrodes, their being metal coated, it is known to connect the electrodes by a sprayed metal band.

The objects of this invention are to produce a strong mechanical and electrically conducting joint between individual carbon electrodes; and to produce a threaded joint which does not become loose upon vibration of the electrodes.

It has been discovered that when the threaded stems of carbon electrodes are spray coated, the electrical conductivity of the sprayed metal is practically negligible, and that a satisfactory conduction of the current through the joint is primarily dependent upon the formation of a mechanically sound and permanent threaded joint. This invention, therefore, is based on the fact that an intimate contact between the threads in the joint, by closely interlocking and engaging the thread surfaces, is of paramount importance, and it is of relatively minor importance as to what metals or metal alloys are applied to the threads as by flame spraying.

In general, the objects of the invention are obtained by coating the threaded stems of the electrodes with a spray coating of uniform thickness not exceeding 50 microns, $\frac{1}{30}$ of a millimeter, and preferably of about 30 microns thick. Exhaustive tests show that with a metal coating of this thickness, vibrations produced by the alternating current will not loosen the threaded joints during the life of the electrodes. It is presumed that this is because the coatings of this thickness are indented and perforated by the roughness of the surfaces of the threads in the carbon electrode when the threaded stem is tightly screwed into an adjacent electrode, or that the roughness of the carbon surface is not materially smoothed out when it is covered with such a thin metal coating.

The means by which the objects of the invention are obtained are described more fully with reference to the accompanying drawings in which:

Figure 1 is a cross-sectional view through two carbon electrodes connected by a threaded joint;

Figure 2 is an enlarged, detailed view of the old art relatively thick metal coatings on the threads;

Figure 3 is a similar view showing the thin coating of the instant invention on the threads; and

Figure 4 is a greatly enlarged view of a surface having the thin metal coating of the instant invention.

In Figure 1, carbon electrodes 2 and 4 are connected together by a threaded joint 6 in order to form a continuous electrode. As further shown in Figures 2 and 3, electrode 2 is provided with a threaded stem 8.

In Figure 2, the threads on the joint member are coated with a relatively thick metal coating 10. Hitherto, it has been assumed that a satisfactory electrical connec-

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tion through the joint definitely required a metal coating, and especially a copper coating, thick enough to smooth over the natural roughness existing on the surface of the threads, the rough inequalities being in the order of 50 to 100 microns. The instant invention deliberately ignores the above notion, and retains these inequalities in the threaded surface even after applying a sprayed metal coating, by allowing the projecting particles of carbon to press into the coating, and forming therein a kind of a granular and perforated surface structure in the sprayed metal coating which will produce an interlocking and intimately contacting threaded engagement with the threaded bore of an adjacent carbon electrode. Such structure is shown in Figures 3 and 4 wherein the sprayed metal coating 12 is less than 50 microns, and preferably 30 microns thick, and therefore does not completely smooth over the rough surface of the threads.

As the invention is based on the fact that the electrical conductivity of the sprayed metal coating does not affect in any way the electrical resistance of the threaded connection, the magnitude of which depends solely upon the intimacy of contact between the engaged threaded surfaces, a further feature of the invention lies in that copper may be replaced by metals of lower electrical conductivity such as aluminum, or steel, this being especially advantageous where the use of copper would cause other concomitant deleterious results as by the contaminating of the molten metal in the furnace as the electrodes burn.

The thin metal coating 12 of 50 microns or less as required by the instant invention cannot always be satisfactorily produced by means of conventional types of metal spray guns. Conventional guns normally operate at a rate of wire advance of between two or three meters a minute, and thus preclude the possibility of forming a flame sprayed coating of the required thinness and uniformity, because the correlative speed at which the threaded surfaces would have to be passed through the flame metal jet would be excessive.

Accordingly, the instant invention utilizes the metal spraying gun as disclosed in the French patent to Schultness No. 1,068,960. This metal spray gun operates with a wire of 2 mm. diameter atomized at a rate of only 30 cm. per minute, and which employs atmospheric air instead of oxygen for the combustion of the fuel gas which is preferably propane. This gun is unique in that it operates with an air-fuel mixture which expels the spray jet, without the use of additional compressed air, merely by the force of the expanding gases in the combustion chamber. It is thus capable of producing metal coatings which are singularly free of oxidation. By using the burning gases issuing from the combustion chamber for the atomization of the melting wire, the gun readily permits the grain size of the metal particles coming from the gun to be reduced to less than 0.05 mm., or 50 microns, and therefore to produce a sprayed metal coating as required by the instant invention without the threaded surfaces having to pass through the jet at a high speed. In other words, the threaded stems are slowly rotated in the metal spray.

In the case of threaded stems of 250 mm. diameter, a rotation of 60 R. P. M. is adequate, and in the case of threaded stems of 400 mm. diameter, 40 R. P. M. is sufficient. These speeds correspond with linear velocities of about 30 to 50 meters a minute.

Having now described the means by which the objects of the invention are obtained, I claim:

A flame-sprayed metallized threaded joint member for an electric arc furnace carbon electrode, comprising a thread surface on said member, and a sprayed metal coating on said surface selected from the class consisting of copper, aluminum, and steel and having a thickness less than 50 microns and the natural roughness of the thread-

ed carbon surface whereby the roughness of the surface is unfilled by said coating.

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