

[54] CONNECTION TYPE CARBON ELECTRODE

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Assistant Examiner—George A. Montanye

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 313/355, 357, 354; 287/2; 285/332.1; 13/18

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ABSTRACT

A connectable carbon electrode having a coaxial projecting portion and a coaxial socket portion for connecting a plurality of the electrodes in succession in which a plurality of elongated indentations are provided on the projecting portion along a predetermined length thereof. This enables the projecting portion to be securely fitted into the inner wall of the socket portion by scrapping off the indentations by the inner wall of the socket portion.

3 Claims, 10 Drawing Figures

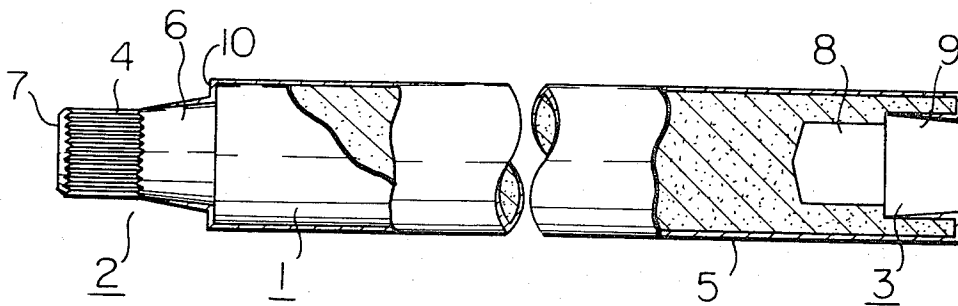


Fig. 1

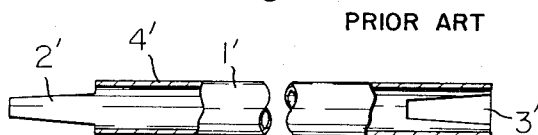


Fig. 2

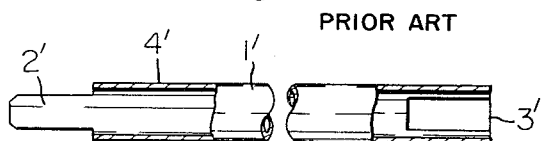


Fig. 3a

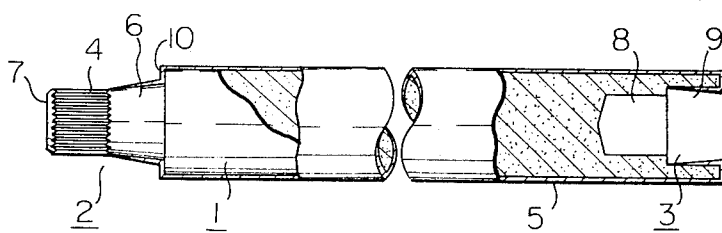


Fig. 3b



Fig. 4

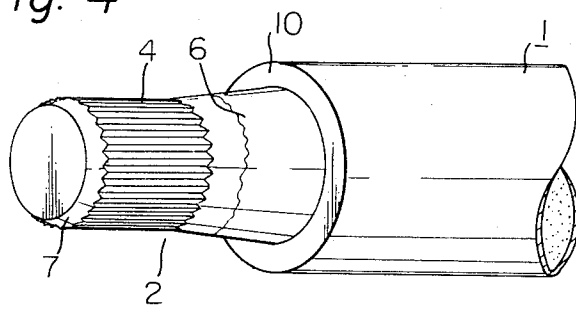


Fig. 5

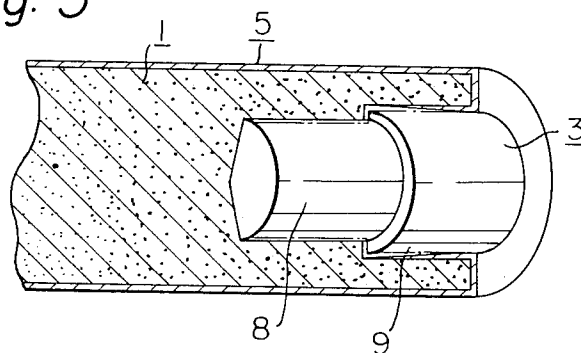


Fig. 6

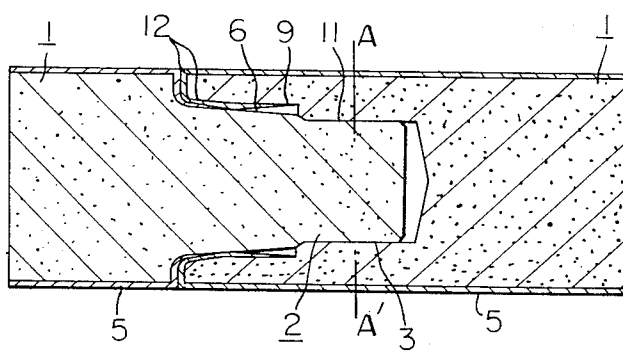


Fig. 7

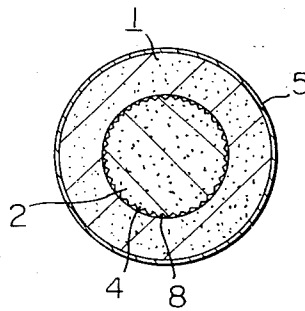


Fig. 8

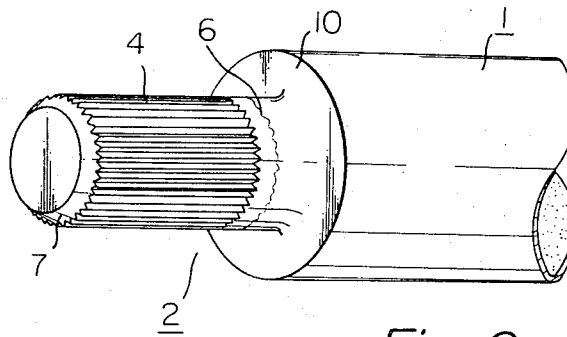
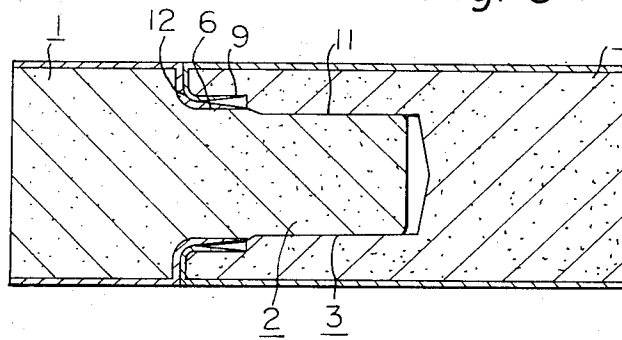


Fig. 9



CONNECTION TYPE CARBON ELECTRODE

The present invention relates to a connectable type carbon electrode and more particularly to a carbon electrode capable of firmly connecting the two electrodes having substantially a coaxial projecting portion and a coaxial socket portion, respectively as well as enabling the electrodes to contact each other in a good conductive condition.

In a carbon electrode which is used in the gouging and blasting work by the arc air method, it is necessary that the electrode have a smaller resistance and that the oxidative wear be reduced in order to obtain stability of the arc condition since a large electric current must pass therethrough. For this reason, a conductive metal such as a copper material is coated on the surface of the carbon electrode. In the work described above, shaving, cutting, perforation, or trimming are performed by arc heat which is produced by splashing the arc current between the carbon electrode and a work piece metal as well as by blowing the melted metal through jet air. Therefore, the length of the carbon electrode is reduced during the job in proportion to the amount of the work done.

Accordingly, it is necessary to change the carbon electrode one by one at the time of consumption of the carbon electrode during the progress of the job. However, when the carbon electrode is changed during the job, the shape of the object to be gouged, for instance, tends to be varied. Also one end portion of the carbon electrode remains unused, so that it is waste. In the conventional carbon electrodes with a coaxial projecting portion and coaxial socket portion such as shown in FIGS. 1 and 2, a conductive metal 4' is coated only on the body 1' of the carbon electrode. However, in this construction, a favorable contact condition can not be obtained between the projecting portion 2' and socket portion 3', so that the contact condition of the two portions is affected by the variations in structural features of each carbon rod. As a result, the contact resistance tends to increase, or becomes large, so that the connecting portion is heated during operation and the coated conductive metal tends to be melted. As a result of this, the base of the carbon is exposed and oxidized, so that it is not possible for the carbon electrode to fully function as an electrode because of collapse and breakage.

An object of the present invention, therefore, is to provide a connectable carbon electrode capable of maintaining a good electrical contact between the coaxial projecting portion of one electrode and the coaxial socket portion of the other electrode.

A further object of the present invention is to provide a connectable type carbon electrode which has a small contact resistance and is not liable to misconnection due to the heat generated in a contacted portion.

A still further object of the present invention is to provide a connectable type carbon electrode in which an conductive metal coating is provided up to indentations of the projecting portion and also slightly to the inner portion of the socket portion.

A still further object of the present invention is to provide a connectable carbon electrode capable of being easily manipulated during work.

These and other objects and advantages of the present invention will be apparent from the following description and accompanying drawings in which:

FIG. 1 shows a connectable carbon electrode according to the prior art;

FIG. 2 shows another carbon electrode according to the prior art;

FIG. 3 a shows an embodiment according to the present invention in which an internal construction is partly shown by a broken window;

FIG. 3 b shows both end views of the electrode of FIG. 3 a;

FIG. 4 shows an enlarged projecting portion of the embodiment of FIG. 3 a;

FIG. 5 shows an enlarged socket portion of the embodiment of FIG. 3(a).

FIG. 6 shows a cross sectional view of the embodiment according to the present invention in a connected condition;

FIG. 7 shows a cross sectional view of FIG. 6 cut by A—A section;

FIG. 8 shows another embodiment according to the present invention in which no taper is provided on the convex portion; and

FIG. 9 shows a cross sectional view of the embodiment of FIG. 8 which is in the socket portion of the another electrode of the same type.

A carbon electrode according to the present invention is made of a mixture of 90 parts by weight of synthetic graphite, 10 parts by weight of carbon black, 40 parts by weight of binder composed of tar and pitch, and the mixture is then kneaded in a high temperature atmosphere and is thrust from a suitable machine and then is cut in a predetermined size. The calcined carbon is then cooked in a reduction atmosphere and is finally graphitized.

In order to electroplate the carbon electrode thus made, copper sulfate 160–200g, and a sulfuric acid of 40–60g are added to one liter of water and the carbon electrode is immersed in the electrolytic bath with the socket portion downward. In this case, the current density will preferable be 3–5A/cm².

The socket portion is immersed to the boundary between a large diameter portion and a small diameter portion thereof, while the projecting portion is immersed in the electrolytic bath up to the indentations.

Referring now to FIGS. 3 through 5, a connectable carbon electrode according to the present invention is shown. The carbon electrode 1 has a coaxial projecting portion 2 and a coaxial socket portion 3, respectively. There is provided on the projecting portion 2 a plurality of elongated indentations 4. Also, the carbon electrode is coated with a conductive metal 5 which is extended to the beginning of the indentations 4 along the tapered portion 6. The other end of the indentation thereof has also a tapered portion 7 forming an inlet which is steeper than that of the portion 6. For instance, the portion 6 has a tapered degree of about 1° to 8° and the portion 7 has a tapered degree of about 45° to 60°. The length of the tapered portion 6 and that of the indented portion are nearly same.

The plurality of the indentations are substantially in the form of elongated grooves and are preferably about 1mm in depth. These elongated indentations are formed by knurling. On the other hand, the socket portion 3 of the carbon electrode 1 is formed in such a way that the projecting portion 2 of the other electrode can be inserted therein. Namely, the socket portion 3 has two sections 8 and 9. The diameter of the section 9 is

larger than that of section 8 and the length of the socket portion consisting of the sections 8 and 9 is slightly longer than that of the projecting portion 2. The diameter of the section 8 is slightly smaller than that of the indented portion, say, by about 0.05-0.5mm, so that when the projecting portion 2 is inserted into the socket portion 3, the portion with the elongated indentations 4, is partly scraped off by the inner wall of the section 8. The diameter of the section 9 is larger than that of the section 8 within 3mm, and it is also larger than the maximum diameter of the tapered portion 6 by about 2mm.

Now, reference is made to FIGS. 6 and 7. When connecting, the projecting portion 2 is forced into the socket portion 3 of the other carbon electrode 1, so that at the time of insertion, the indentations 4 are scraped off by the inner wall of the socket section 8. Accordingly, a good connection and contact is obtained not only at the indented portion area 11, but also at the tapered portions 12 of the projecting portion and socket portion respectively. This means that the contact resistance of the carbon electrodes is very small, so that red-heated condition encountered in the prior art is avoided and the possibility of malconnection and disconnection will also be remarkably reduced. In addition, since the indented portion of the projecting portion is forced to be inserted into the socket portion of the other electrode, no additional support member is required when connecting the two electrodes 1 and 1. FIG. 7 shows a cross sectional view of the portion cut by A-A' section. In FIG. 8, another embodiment of the present invention is shown, wherein the same numerals corresponding to FIG. 3 are used. In the carbon electrode in this embodiment, no tapered portion is provided on the projecting portion, so that the diameter of the indented portion 4 and that of the section 6 are nearly the same.

However, the length of the indented portion is fairly longer than that of the untapered portion 6, so that the length of section 8 is longer than that of section 9, accordingly.

There is no difference with respect to the remaining portions of the electrode.

FIG. 9 shows the two electrodes in a connected condition, wherein the same numerals are used.

Though preferred embodiments of the present invention have been shown and described in the foregoing, it is to be understood that this has been done merely by way of example and not with the object of limiting the

spirit of the present invention.

What is claimed is:

1. A connectable carbon electrode comprising an electrode body of carbon coated on its outer periphery with a thin copper layer, a coaxial projecting portion of carbon material provided on one end of said body and coated on its peripheral surface along a predetermined length with a slightly tapered thin copper layer, which is continuous with the copper layer on the outer periphery of the electrode body, a remaining part of said predetermined length of the projecting portion being provided with elongated indentations of carbon, a coaxial socket portion of carbon material provided inside the other end of said body and having an inner wall surface defining the socket in a substantially similar shape to said projecting portion, said socket being coated with a thin tapered copper layer along a predetermined length of the inner wall, which is continuous with the thin copper layer on the outer periphery of the electrode body and which extends inwardly from the open end of the socket in a first section thereof, the socket having a second section inwardly of said first section and with an inner diameter smaller than the inner diameter of said first section, the inner diameter of said second section being smaller than the outer diameter of the remaining part having said elongated indentations and the inner diameter of said first section is larger than the largest outer diameter of said projecting portion of carbon material, whereby when a projecting portion of a connectable carbon electrode is inserted into a socket portion of a corresponding electrode the remaining part of said projecting portion having the indentations is tightly received in said second section of said socket as the carbon is partially scraped off the remaining part along the walls of said second section during insertion, and said slightly tapered thin copper layer on said projecting portion is wedged into tight engagement with the thin tapered copper layer in said first section of said socket so as to provide a good electrical and a strong mechanical connection between the electrodes.

2. A connectable carbon electrode according to claim 1, wherein said peripheral surface of the predetermined length of said projecting portion is tapered from the electrode body.

3. A connectable carbon electrode according to claim 1, wherein the diameter of the predetermined length of said projecting portion and the diameter of said remaining part are approximately the same.

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