PATENT SPECIFICATION

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COMPLETE SPECIFICATION

High Intensity Positive Carbon Electrodes

We, UNION CARBIDE AND CARBON CORPORATION, of 30 East 42nd Street, New York, State of New York, United States of America, a Corporation organised under the laws of the State of New York, United States of America, (Assignees of CLARENCE EDWIN GREIDER, a Citizen of the United States of America, of 1129, Forest Road, Lakewood, State of Ohio, United States of America), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved positive, high intensity, carbon electrode for use in motion picture projectors and the like, by means of which improved arc stability is achieved through the introduction of a small amount of tungsten to said electrode.

Carbon electrodes are of two general classes, referred to in the art as "low intensity" and "high intensity" carbons. Low intensity positive carbons presently in use vary in diameter from about 9 to 14 mm and the operating amperage is in the nature of 10 to 52 amperes for these respective electrode size variations. The low intensity carbon arc is seldom operated at a current density much over 200 amperes per square inch cross-section of the positive electrode.

In general, a high intensity carbon arc is distinguishable from a low intensity carbon arc in several important respects. The former has a core containing a substantial amount of flame material which becomes highly luminescent under the action of the electron bombardment in the arc stream. The current density in high intensity positive carbons is increased to values which may exceed 1500 amperes per square inch. At this high current density the material of the core is vapourized more rapidly than that of the carbon shell until a deep, cup-like crater is formed in the carbon face. Within this crater vapours of carbon and core materials are excited to a very high temperature and radiating efficiency, producing a brightness several times that possible at the positive crater of the low intensity carbon arc.

In operation, high intensity carbon arcs are of two types. In the older type, the negative carbon is inclined to the positive and the latter is continuously rotated to maintain a symmetrical crater form. This type of high intensity arc generally employs a positive carbon varying from 9 to 16 mm. in diameter, with arc amperages varying from 60 to 170 amperes.

A newer type of high intensity arc is operated without rotation of the positive carbon and with the positive and negative carbons in coaxial alignment. In this arc the positive carbon (usually referred to as a "simplified high intensity" type carbon) has a size range from 6 to 8 mm. in diameter and operates at amperages varying from 30 to 70 amperes.

The operation of a high intensity carbon arc at the lowest current density consistent with the light requirements of a particular motion picture projector installation results in economies with regard to both carbon cost and operating power consumption. With amperages on the borderline of that required for a high intensity effect, however, frequent difficulty arises due to the tendency of the arc to go in and out of high intensity, i.e. to fluctuate between a high intensity and low intensity arc. As the light brilliancy of the high intensity arc is several times that of the low intensity arc the result is a disturbing light fluctuation on the motion picture screen. The exact current density at which this tendency to go in and out of high intensity takes place varies with the different carbons depending on their size, composition and designed operating characteristics. Generally it is in the range of 450 to 600 amperes per square inch. While this

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difficulty might be overcome by changing the carbon size or current load, this is usually not convenient or feasible, because of the standardized projection equipment generally in use in the trade.

Mineralized carbon electrodes have already been proposed in Specification No. 14741/12 composed of two zones formed of carbon paste comprising an inner zone which may contain 1.3% of tungsten computed as tungstic oxide and an outer zone which may contain 1.6% of tungsten computed as tungstic oxide.

According to the present invention a high intensity positive carbon electrode is provided comprising a shell and a core either one or both of which contains, or contain, tungsten in a total amount between 0.1% and 1% by weight computed as tungstic oxide.

The addition, according to the invention, of this small amount of tungsten, computed as tungstic oxide, to the positive carbon greatly reduces the current density at which a carbon arc fluctuates between the high and low intensity effect. While the tungsten may be added to the shell, core or both, it will generally be incorporated in the core mix as the simplest and most convenient way of introducing it into the carbon. The same desirable effects are produced, however, if the tungsten is present in the shell or in both the shell and the core.

The most advantageous amount of tungstic oxide will vary somewhat with different carbon electrode compositions. In general, between 0.1 and 0.5 per cent by weight of the core or shell or both will provide satisfactory results, i.e., 0.1 to 0.5 per cent by weight of the core composition when the tungstic oxide is added to the core or 0.1 to 0.5 per cent by weight of the shell composition when the tungstic oxide is added to the shell or 0.1 to 0.5 per cent by weight of the core composition and of the shell composition when the tungstic oxide is added to both the core and the shell. Amounts in excess of 0.5 per cent increase the burning rate somewhat thus reducing carbon efficiency slightly (i.e. lumen-hours per inch). While under certain circumstances it might be desirable to increase the tungstic oxide to an amount in excess of 0.5 per cent, in spite of the slight decrease in carbon efficiency (lumen-hours per inch), in no case should it exceed 1 per cent, as an amount in excess of this will produce core fusion of the carbon. If less than 0.1 per cent tungstic oxide is employed in the core mixture, the stabilizing effect becomes somewhat erratic.

While tungstic oxide in amounts between 0.5 and 1 per cent may reduce the carbon efficiency somewhat as expressed in lumen-hours per inch, the carbon efficiency as expressed in lumens per ampere is increased by the addition of tungstic oxide throughout the useful range of 0.1 to 1 per cent. In addition, because the inclusion of tungstic oxide in the core material produces a higher arc colour temperature (the light being somewhat bluer), the apparent brilliancy of the light produced is greater than that which the actual lumen measurement indicates.

The invention is applicable to the improvement of all types of high intensity positive carbons, which may vary considerably in the exact shell and core composition. The useful results are especially significant in the "simplified high intensity" carbons employed in the reflector type projection systems. These carbons generally have a shell composition containing a high proportion of coke-base carbon, with a core mix containing carbon and predominating amounts of rare earth fluorides and oxides. In such carbons tungstic oxide in the core in an amount of about .25% by weight thereof, provides a substantial improvement in the ability of the carbon to maintain a stable high intensity arc at an amperage lower than that normally required to insure a constant high intensity effect in the arc.

It will be readily apparent to those skilled in the art, that while the invention has been described with particular reference to improved arc stability in high intensity, positive carbons of present commercial importance it will be equally useful to the trade in the design of more efficient carbons capable of operating at lower current density (i.e. smaller carbon diameter or operating amperage or both) with good arc stability and a high intensity arc.

What we claim is:—

1. A high-intensity positive carbon electrode comprising a shell and a core either one or both of which contains, or contain, tungsten in a total amount between 0.1% and 1% by weight computed as tungstic oxide.

2. A high-intensity positive carbon electrode as claimed in Claim 1, in which the core contains, in addition to said tungsten, a mixture of carbon, and rare earth metal oxides and fluorides.

3. A high-intensity positive carbon electrode as claimed in Claim 2, in which the core consists predominantly of said rare earth metal oxides and fluorides, and between 0.1% and 0.5% by weight of tungstic oxide.

4. A high-intensity positive carbon electrode as claimed in any one of Claims

difficulty might be overcome by changing the carbon size or current load, this is usually not convenient or feasible, because of the standardized projection equipment generally in use in the trade.

Mineralized carbon electrodes have already been proposed in Specification No. 14741/12 composed of two zones formed of carbon paste comprising an inner zone which may contain 1.3% of tungsten computed as tungstic oxide and an outer zone which may contain 1.6% of tungsten computed as tungstic oxide.

According to the present invention a high intensity positive carbon electrode is provided comprising a shell and a core either one or both of which contains, or contain, tungsten in a total amount between 0.1% and 1% by weight computed as tungstic oxide.

The addition, according to the invention, of this small amount of tungsten, computed as tungstic oxide, to the positive carbon greatly reduces the current density at which a carbon arc fluctuates between the high and low intensity effect. While the tungsten may be added to the shell, core or both, it will generally be incorporated in the core mix as the simplest and most convenient way of introducing it into the carbon. The same desirable effects are produced, however, if the tungsten is present in the shell or in both the shell and the core.

The most advantageous amount of tungstic oxide will vary somewhat with different carbon electrode compositions. In general, between 0.1 and 0.5 per cent by weight of the core or shell or both will provide satisfactory results, i.e., 0.1 to 0.5 per cent by weight of the core composition when the tungstic oxide is added to the core or 0.1 to 0.5 per cent by weight of the shell composition when the tungstic oxide is added to the shell or 0.1 to 0.5 per cent by weight of the core composition and of the shell composition when the tungstic oxide is added to both the core and the shell. Amounts in excess of 0.5 per cent increase the burning rate somewhat thus reducing carbon efficiency slightly (i.e. lumen-hours per inch). While under certain circumstances it might be desirable to increase the tungstic oxide to an amount in excess of 0.5 per cent, in spite of the slight decrease in carbon efficiency (lumen-hours per inch), in no case should it exceed 1 per cent, as an amount in excess of this will produce core fusion of the carbon. If less than 0.1 per cent tungstic oxide is employed in the core mixture, the stabilizing effect becomes somewhat erratic.

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2. A high-intensity positive carbon electrode as claimed in Claim 1, in which the core contains, in addition to said tungsten, a mixture of carbon, and rare earth metal oxides and fluorides.

3. A high-intensity positive carbon electrode as claimed in Claim 2, in which the core consists predominantly of said rare earth metal oxides and fluorides, and between 0.1% and 0.5% by weight of tungstic oxide.

4. A high-intensity positive carbon electrode as claimed in any one of Claims

1 to 3, in which a major proportion of the shell is composed of coke-base carbon.

5. A high-intensity positive carbon electrode as claimed in Claim 4 in which the diameter of the electrode is between 6 to 8 mm.

6. A high-intensity positive carbon electrode substantially as described.

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