Feb. 7, 1939. K. M. VAN GESSEL ET AL 2,146,098

CARBONIZED ELECTRODE TUBE

Filed Feb. 20, 1937

Fig. 1

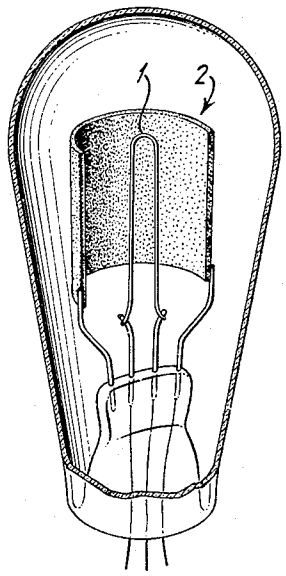
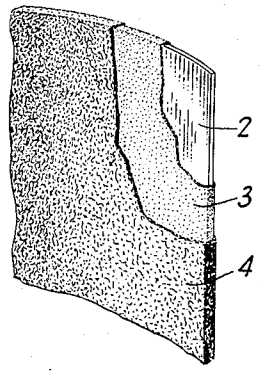


Fig. 2



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Patented Feb. 7, 1939 2,146,098

UNITED STATES PATENT OFFICE

2,146,098

CARBONIZED ELECTRODE TUBE

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Application February 20, 1937, Serial No. 126,740
In Germany February 10, 1936

3 Claims. (Cl. 250—27.5)

This invention relates to an electron discharge device comprising one or more electrodes or other parts with surfaces coated with a carbon layer, and to a method of making an electrode for such a tube.

In order to increase the heat radiation of electrodes for electric discharge tubes, more particularly of anodes, it is known to coat these electrodes on the surface with a black layer such as a carbon layer. Furthermore, it has already been proposed to connect auxiliary bodies, such as cooling ribs to the electrodes and to provide these bodies also with a black layer on the surface. Although such layers may yield good results, they present difficulties in many cases, due to the fact that these electrodes and other bodies may lose part of their coating and black color due to flaking off of the carbon coating and other effects caused by high temperatures during operation, so that the thermal radiation decreases.

Experiments made by the applicants have proved that these difficulties may be caused by the carbon dissolving in the underlying material, particularly during the degasifying operation, and that the drawbacks of the conventional carbonized electrodes can be avoided by this invention.

Discharge tubes made in accordance with the invention comprise one or more electrodes or other bodies which are at least partly coated on the surface with a carbon layer and in which there is provided between the core body and the carbon layer a material layer having such properties that it strongly adheres to the underlying metal and to the carbon and in which the carbon of the layer does not or only partly dissolve. For this purpose we prefer to use layers of silicates, such as sodium silicate, or layers of refractory oxides, such as one or more of the alkaline earths, preferably oxide of magnesium, or oxide of beryllium, oxides of aluminum, or the like. In this way an electrode is obtained which is coated with a firmly adherent carbon layer and which retains its heat radiating properties during use, since there is practically no dissolution of the carbon in the underlying metal layer.

Our invention will better be understood in connection with the accompanying drawing in which Figure 1 shows a rectifier having an anode constructed in accordance with our invention, and Figure 2 is a perspective view partly broken away of part of a cold electrode, such as an anode, made in accordance with our invention.

The rectifier shown in Figure 1 comprises the usual evacuated bulb enclosing a thermionic cathode 1, such as a tungsten or oxide coated filament, surrounded by an anode 2, preferably of nickel and carbonized in accordance with our invention. The anode is coated with a firmly adherent coating of carbon deposited on an intermediate or linking layer of some refractory material which firmly adheres to the metal of the anode and in which the carbon does not dissolve to any substantial extent during operation of the device.

As more clearly shown in Figure 2, the metal body or sheet nickel anode has on its surface a firmly adherent layer of refractory material, preferably an alkaline earth, such as magnesium oxide. On this layer is an adherent coating of carbon 4 which may be applied in accordance with well known methods, but which is preferably deposited by heating the oxide coated electrode in a carbonaceous atmosphere. The linking or binding layer of oxide seems to link or bind the carbon to the metal and to hinder dissolution of the carbon in the metal.

We have obtained good results with electrodes made in accordance with the present invention by a method which comprises coating the nickel electrode 2 with a layer consisting of one or more alkaline earths, preferably magnesium oxide, by applying to the electrode a material which will produce on the electrode a thin, dense, adherent layer of alkaline earth or other oxide when the electrode is treated. One desirable way of obtaining this layer is to spray the electrode with a suspension consisting of finely powdered magnesium oxide suspended in a volatile suspending medium, such as water or alcohol, and then bake the electrode to drive off the suspension medium and leave a firmly adherent layer of magnesium oxide on the surface of the electrode. Magnesium compounds which break down and leave magnesium oxide when heated may be used if desired. The thickness of this layer of refractory oxide is not critical, but the layer is preferably in view of the low resistance made as thin as feasible consistent with complete covering of the electrode surface with a dense, uniform layer of the oxide. The oxide coated nickel electrode is then carbonized by heating it, preferably by the conventional high frequency induction heating coils, in a carbonaceous atmosphere containing a simple hydrocarbon, such as acetylene, methane or the like. In general, the oxide coated nickel electrode responds to carbonizing treatment in much the same way as the oxidized or clean nickel electrodes commonly used, and consequently it may be carbonized by conventional methods, such as, for example, the method disclosed in U. S. patent to Upp, 1,852,865, April 5, 1932.

A cold nickel electrode carbonized in accordance with our invention withstands the temperatures attained during operation of the conventional electron discharge devices better than carbonized nickel electrodes which lack the oxide linking layer and in particular the carbon coating seems to be more adherent and to remain in place much better, particularly during operation than in the conventional carbonized electrodes.

We claim:

1. An electron discharge tube comprising a thermionic cathode and a cooperating cold electrode comprising a metal sheet, a thin refractory adherent layer of magnesium oxide covering the surface of said sheet which faces said cathode and a coating of carbon on and firmly adherent to said refractory layer.

2. An electron discharge tube comprising a thermionic cathode and a cooperating cold electrode comprising a metal sheet, a linking layer consisting of one or more oxides selected from the group consisting of the alkaline earths, beryllium oxide, and aluminum oxide and firmly adherent to said metal sheet, and a coating of carbon on said linking layer.

3. An electrode for an electron discharge device comprising a sheet of nickel having a refractory layer of oxide selected from the group comprising the alkaline earths, beryllium oxide and aluminum oxide and firmly adherent to said nickel sheet, and a coating of carbon on said layer.

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