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H. M. DOWSETT

THERMIONIC DEVICE

Filed Nov. 12, 1920

Fig.1.

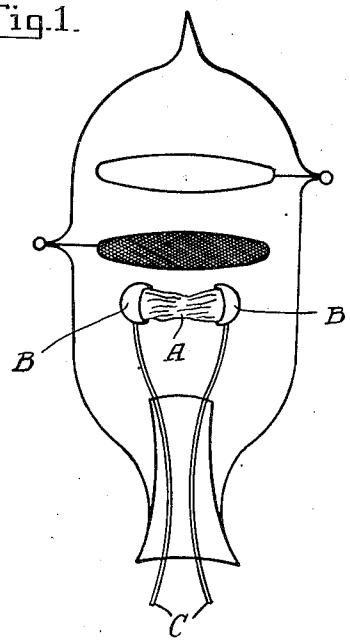
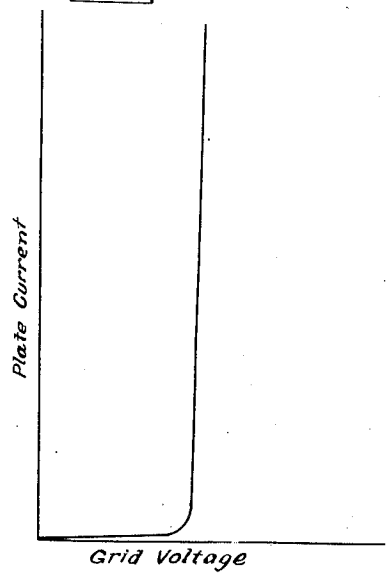


Fig.2.



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UNITED STATES PATENT OFFICE.

HARRY MELVILLE DOWSETT, OF COLCHESTER, ENGLAND, ASSIGNOR TO THE RADIO CORPORATION OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

THERMIONIC DEVICE.

Application filed November 12, 1920, Serial No. 423,711, and in Great Britain November 22, 1919.

This invention relates to thermionic devices such as those used in wireless telegraphy and telephony and commonly called valves.

The cathode of such a valve is usually a good conductor and formed of tungsten, platinum or carbon.

According to this invention I construct a valve cathode of a refractory substance, particularly minerals such as carborundum, which are not good conductors of electricity as compared with the usual materials used for lamp filaments.

I have found that a three electrode valve with a carborundum cathode has a characteristic which differs markedly from that of valves having cathodes formed of the usual conducting substances such as tungsten, or platinum or these metals coated with the oxides of the alkaline earth metals viz., calcium, barium and strontium or the thoriated filaments; that is to say, as the grid voltage is raised from zero, the plate current rises very gradually until a certain critical voltage is reached, whereupon the plate current leaps up to a very high value. A grid voltage-plate current curve of these characteristics such as amplification or rectification is useful for many of the purposes for which valves are utilized.

While at the present time I prefer carborundum as the material of which I construct the cathode, I may use in place thereof any substance and particularly minerals having similar properties such, for instance, as silicon or minerals such as zincite or bornite. The substance must be such that at the working temperature of the cathode it neither fuses nor disintegrates. In the claims minerals and other substances within the scope of the invention will be referred to as refractory substances of low conductivity.

It is essential that when under working conditions, a current is flowing through the crystal, the junctions between the crystal and the two current conducting wires should remain much cooler than the crystal. The junctions therefore require to be well made and to have as low an electrical resistance as possible.

In the case of carborundum this result is obtained by welding on steel tips to the crystal to which the conducting wires themselves are welded, and in the case of other crystals a welding metal is employed which has a melting point as near as possible to that temperature at which the crystal changes either its physical or chemical nature.

For the same reason it is preferable that the crystal should be so shaped that it is thicker at the ends where the conducting connections are made than in the middle where it is required to reach the highest temperature.

My invention is illustrated by the accompanying drawing in which Fig. 1 illustrates a valve construction embodying the invention and Fig. 2 is a curve showing the relation of the grid voltage to the plate current for a soft valve. In Fig. 1 A is the crystal cathode and B the welded-on metal tips by which the crystal is connected to leads C.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that which I claim is:—

1. In a three element vacuum tube, means for increasing the slope of the grid voltage-plate current characteristic over that of tubes having cathodes of known materials and operating under similar conditions, said means comprising a cathode formed of a material having the electron emitting properties of any one of the group of materials consisting of zincite, bornite, and carborundum.

2. In a three element vacuum tube in which the plate current is varied in accordance with variations in the grid voltage, means for rendering a substantially larger change in plate current for a given change in grid voltage than is obtained in other vacuum tubes having cathodes of known materials and operating under similar conditions, said means comprising a cathode formed of a material having the electron emission properties of any one of the group of materials consisting of zincite, bornite and carborundum.

3. A thermionic valve having a cathode formed of a resistor element comprising a substance having the electron emission properties of any one of the group of materials consisting of zincite, bornite, and corborundum, said cathode having an intermediate portion of smaller cross section than its end portions.

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