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ELECTRODE CONSTRUCTION FOR HIGH FREQUENCY ELECTRONIC DEVICES

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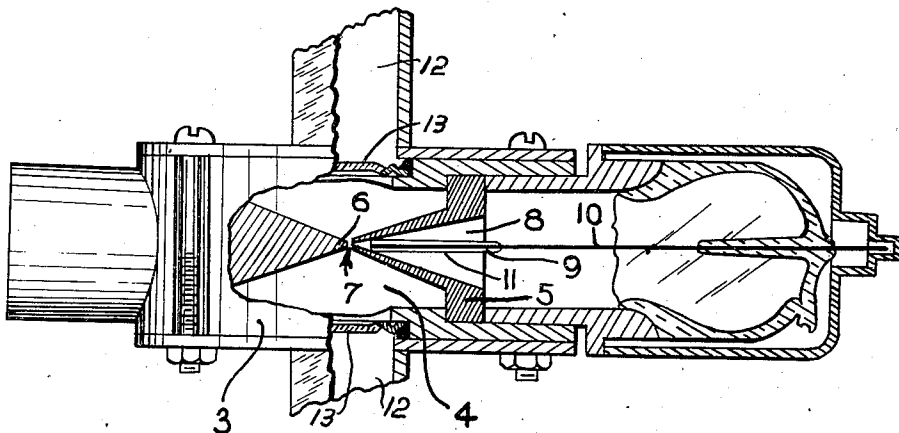


Fig. 1

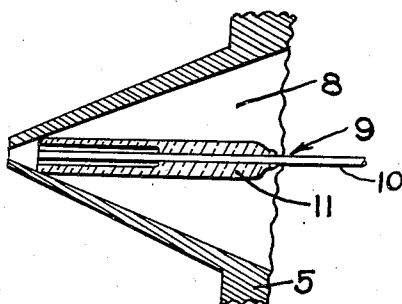


Fig. 2

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ELECTRODE CONSTRUCTION FOR HIGH-FREQUENCY ELECTRONIC DEVICES

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2 Claims. (Cl. 250—27.5)

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This invention relates to electronic devices for generating or controlling high frequency electric currents and particularly to electrode elements therefor.

It is a general object of the invention to provide means for preventing changes in the operating characteristics of such devices under operating conditions.

A further object of the invention is to provide an electrode within an evacuated envelope having a partially enclosing insulating sheath constructed to prevent a bridging over action tending to neutralize its insulation.

Other objects and features will more fully appear from the following description taken in connection with the accompanying drawings and will be particularly pointed out in the claims.

Under certain operating conditions the electrodes within an evacuated electronic device are subjected to a relatively intense field action which has a tendency to sputter or vaporize the elements which results in the deposit of fine particles of metal upon adjacent surfaces. As a result of this phenomenon, certain portions of the tube elements which are separated from others by exposed areas of insulation tend to become partially short circuited.

By way of illustration the invention is incorporated in a high frequency electronic device having an envelope for enclosing its elements. A resonating system is enclosed in the envelope which includes a hollow cone shaped member, constituting one member of the capacity gap of the system.

An electrode leading from outside the envelope extends into the inner or apex end of the hollow cone. The electrode is rod-like in shape and is made of a conducting core sheathed in glass or ceramic material. The sheath engages the walls of the cone and acts as an insulator and mechanical support, for the electrode. The end portion of the electrode is of special construction. The inner wall of the sheath is spaced away from the metallic conducting element thereby producing an air space across which it is impossible to form a continuous path of metallic particles.

To present a better understanding of the invention a particular embodiment thereof will now be described in connection with the accompanying drawings in which:

Figure 1 is a partial longitudinal sectional view showing a preferred form of the invention;

Figure 2 is an enlarged detail view of an elec-

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trode illustrating more clearly the special features of the invention.

The electrode constituting the invention may be employed in various electronic devices. As shown herein the principles of the invention are applied to a high frequency generator or controlling tube for high frequency circuits. Such a tube comprises a metallic body member 3 having an internal evacuated chamber 4 within which a pair of cones 5 and 6 are arranged with their axes in line and their slightly truncated apexes spaced a short distance apart to form a capacity gap 7 which constitutes a part of the resonating system of the tube. The walls of the chamber 4 complete the resonating system. The cone 6 is axially adjustable to provide for changing the frequency of the resonating system. The cone 5 has an axial cone shaped aperture 8 extending completely through the cone and within which the electrode 9 is received. The electrode desirably is generally cylindrical in form and is composed of a central core 10 of electrically conductive metal and an insulating sheath 11 of glass or ceramic material for insulation. The core 10 extends out of the tube for connection to an external circuit not shown.

The main flow of high frequency energy to and through the tube is conducted by the wave guides 12; the energy entering the resonating system through the windows 13.

A more complete description of the operation and construction of the tube to which the invention is applied will be found in my concurrent application filed May 24, 1944, bearing the title "Ultra high frequency electronic tube" and the Serial Number 537,145.

One of the uses of the tube illustrated is as a protective device to prevent excessive electric current from reaching certain types of apparatus such as a crystal detector which are damaged by the application of relatively high volume surges of current. To provide instantaneous operation of such a tube a feeble flow of ions should be maintained at some point in its resonating system at all times. To accomplish this result the electrode 10 is connected to a local source of electrical energy such as a battery. The energy from the battery maintains a low volume flow of ions between the electrode 9 and the adjacent cone 6.

Under operating conditions there is a tendency for a slight sputtering or vaporization of the metal areas adjacent the tip of the electrode. This sputtering phenomenon causes particles of metal to be deposited on all surrounding surface

areas. Before the present invention electrodes of the type described were so constructed that a substantially flat area extended from their metallic core to the perimeter of their insulating sheath upon which an accumulation of metallic particles may form a path of relatively low resistance which partially short-circuits the core to an adjacent metallic element such as the cone 6.

To remedy such a condition the electrode 10 is of special construction. Its sheath 11 may or may not extend throughout its full length but must extend for the full length of its inner end and may closely enclose the core 10 except at its inner tip portion. At its tip portion its sheath 11 engages the walls of the aperture 8 in the cone 5 near its apex. The tip portion of the sheath 11 is spaced from the core 10 to form a chamber 12 surrounding the core. The chamber 12 may be formed in any desired manner either by reducing the thickness of the sheath or by reducing the diameter of the core 10 or both.

Due to the space thus formed between the end face of the sheath and the end face of the core 10 a continuous path of metal particles cannot be formed. The operating characteristics of the tube with respect to the electrode 9 are thus maintained constant throughout its useful life.

What I claim is:

1. In a high frequency tube having an envelope within which is formed a resonating system including a pair of spaced members forming a capacitive gap at least one of the members of which is hollow, an electrode extending outside the envelope and into said hollow member to a point adjacent said gap, an insulating sheath surrounding the conductor, secured thereto at a po-

sition remote from its inner end and spaced therefrom for a substantial distance along and at its inner end, said sheath engaging and being supported by the inner wall of said hollow capacitive gap member.

2. In a high frequency tube having an envelope within which is formed a resonating system including a pair of spaced members forming a capacitive gap at least one of the members of which is hollow, a wire electrode extending outside the envelope and inwardly into the said hollow member to a point adjacent said gap, an insulating sheath surrounding said electrode, secured thereto at its outer end, spaced therefrom for a substantial distance along and at its inner end, the inner extremity of said sheath being flush with the end of said electrode and engaging and being supported by the inner wall of said hollow capacitor gap member.

HENRY J. MCCARTHY.

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