May 7, 1935. F. E. TERMAN 2,000,673

ELECTRON TUBE

Filed Dec. 12, 1929

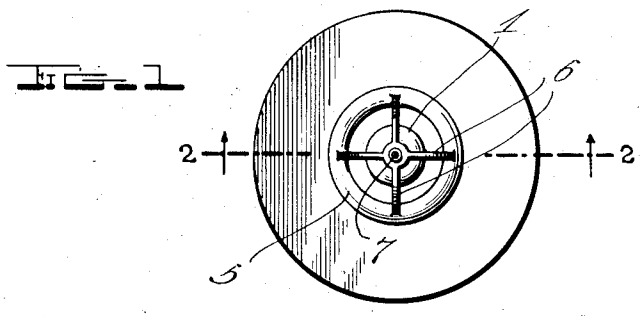


Fig. 1

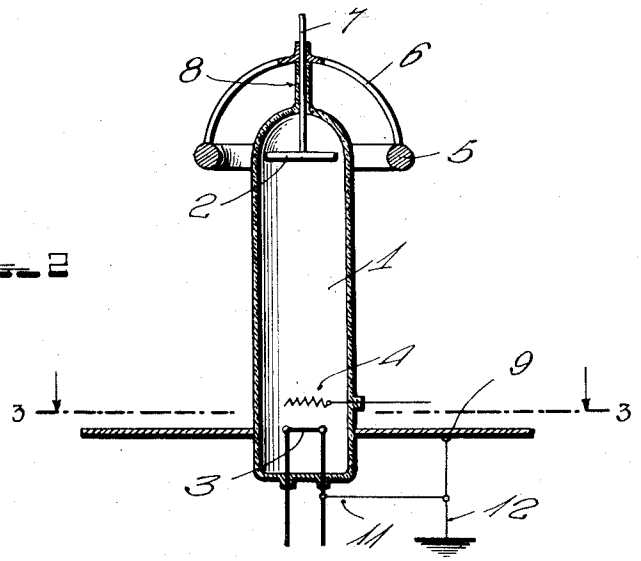


Fig. 2

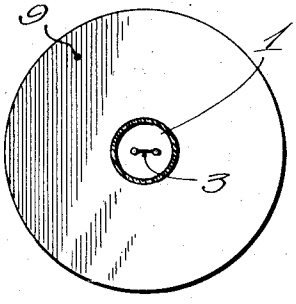
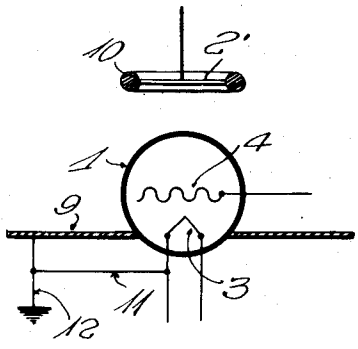


Fig. 3

Fig. 4



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2,000,673

ELECTRON TUBE

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3 Claims. (Cl. 250—27.5)

My invention relates broadly to high power electron tubes, and more particularly to a construction of high voltage tube designed for voltage transformation in power circuits.

One of the objects of my invention is to provide a construction of voltage reducing electron tube device capable of operating for the reduction of voltage from a relatively high potential to a relatively smaller potential.

Another object of my invention is to provide a construction of voltage reducing power tube in which the cathode and grid electrode are disposed adjacent each other at one end of the vessel enclosing the electrodes, with a high voltage plate electrode disposed adjacent the opposite end of the tube, with means located around the enclosing vessel for controlling the electrostatic field in the vicinity of the electrodes and preventing the tendency of sparkover by suppressing local corona.

Still another object of my invention is to provide a construction of voltage reducing power electron tube device in which the tubular vessel enclosing the electrodes has the plate electrode thereof surrounded by a corona shield adjacent one end of the tube and the cathode and grid electrodes surrounded by a ground plate adjacent the opposite end of the tube for controlling the electrostatic field in the vicinity of the electrodes and preventing the danger of sparkover by suppressing local corona effects.

Other and further objects of my invention reside in the construction of a voltage reducing electron tube, device for handling large values of energy, as set forth more fully in the following specification by reference to the accompanying drawing in which:

Figure 1 is a plan view of the electron tube structure of my invention; Fig. 2 is a cross-sectional view through the electron tube structure of my invention on line 2—2 of Fig. 1; Fig. 3 is a lateral cross-sectional view through the electron tube structure of Fig. 2 on line 3—3 thereof; and Fig. 4 shows a modified form of high power voltage reducing electron tube device embodying the principles of my invention.

The electron tube of my invention is designed particularly for coupling power distribution circuits to a power transmission line in a manner whereby the voltage is reduced. The electron tube structure of my invention is designed for utilizing the voltage reducing properties of the electron tube system, where the input circuit connects across the plate and cathode electrodes and the output circuit connects across the grid and cathode electrodes. The voltage reducing properties of the electron tube system in which the electron tube of my invention is employed is explained more fully in my U. S. Patent No. 1,846,043 issued February 23, 1932, where a relatively high potential from the power transmission line is impressed across the plate and cathode for obtaining a relatively smaller voltage across the grid and cathode for distribution to a power distribution circuit. By the use of an electron tube structure and circuit of a very high step-down ratio, say 2000 to 1, low voltage apparatus may be operated directly from 220 kv. lines. The plate is spaced from the cathode and grid electrodes for a distance depending upon the voltage for which the tube is designed to operate. With high direct current voltages the plate electrode may be arranged externally with respect to the enclosed grid and cathode electrodes within the vessel for the electrostatic control of the cathode-grid electron stream within the evacuated vessel.

Referring to the drawing in more detail and in particular to Figs. 1, 2 and 3, reference character 1 designates the enclosing vessel in which the several electrodes of the electron tube are disposed including the plate electrode 2 adjacent one end of the tube and the cathode 3 adjacent the opposite end of the tube, with the grid electrode 4 disposed adjacent the cathode electrode 3. The plate electrode 2 is centered in the end of the evacuated vessel 1 and is surrounded by the corona shield 5 supported by arm 6 from the member 7 connecting with the electrode 2 and seated upon the end extension 8 of the evacuated vessel 1. An electrical connection is thus established between the plate 2 and the externally positioned corona shield 5. The electrostatic shield 5 serves to proper distribute the electro-static field intensities to relieve strain upon the electrodes within the evacuated vessel and may preferably be toroidal, as shown. At the cathode end of the vessel there is provided a plate 9 which serves to control the electrostatic field within the vicinity of the electrodes in the tube. The plate 9 is grounded as represented at 12 and is connected to one side of the cathode 3 as indicated by the connection 11. The stepdown ratio of the inverted electron tube is controlled by the spacing of the grid with respect to the cathode, the distance between the plate and grid electrodes, and the size of the wire forming the grid electrode. When the wires of the grid are relatively large compared with their

spacing and the distance between the plate and grid is great, the stepdown ratio will be high.

In the modified form of electron tube system shown in Fig. 4 the control electrode or plate 2' is outside of the tube and is shielded by means of a ring 10 which encircles its circumference, thereby serving to shield the plate 2'. The grid electrode 4 and cathode 3 are enclosed by the vessel 11 so located with respect to the plate 2' that the electron stream from cathode 3 to grid 4 is subject to control by the external plate 2'.

The grid electrode 4 is biased at positive polarity while plate electrode 2 or 2' is maintained at negative polarity, as set forth in my aforesaid Patent No. 1,846,043.

The high power tube of my invention is so designed that the plate and cathode terminals may be directly connected to a power transmission line of high voltage, while the grid and cathode electrodes may be connected to a power distribution circuit of low voltage at the same time that the electrodes are protected against the effects of the electrostatic field set up around the tube system.

While I have described my invention in certain preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A voltage reducing electron tube comprising an evacuated vessel, a cathode and a grid disposed within said vessel, a plate electrode disposed within said vessel and separated from said cathode and grid, and a conductive member of toroidal shape electrically connected to said plate electrode and surrounding said vessel and mounted adjacent said plate electrode.

2. A voltage reducing electron tube comprising an evacuated vessel, a cathode and a grid disposed within said vessel, a plate electrode disposed within said vessel and separated from said cathode and grid, a conductive member of toroidal shape electrically connected to said plate electrode and surrounding said vessel and mounted adjacent said plate electrode, and a second conductive member outside of said vessel mounted adjacent said cathode and electrically connected to said cathode.

3. A voltage reducing electron tube comprising an evacuated vessel, a cathode and a grid disposed within said vessel, a plate electrode disposed in the proximity of the opposite end of said vessel and remote from said cathode and grid, a conductive member of toroidal shape surrounding said plate electrode, and an auxiliary conductive member outside of said vessel mounted adjacent said cathode and electrically connected to said cathode.

FREDERICK E. TERMAN.