Jan. 23, 1951 J. H. HOSEMANN 2,539,250

DEFLECTION TYPE VACUUM TUBE

Filed Dec. 22, 1948

FIG. 1.

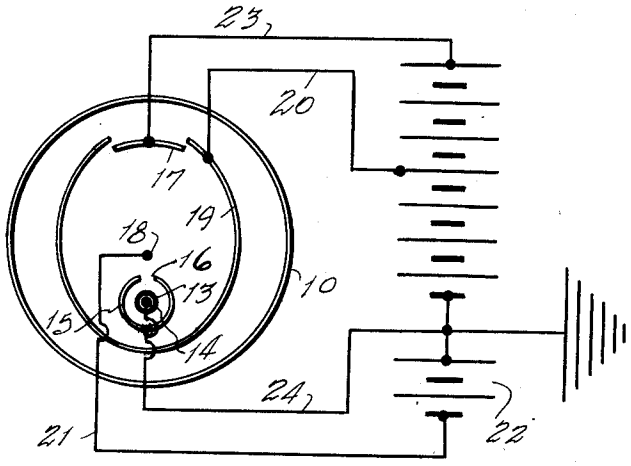
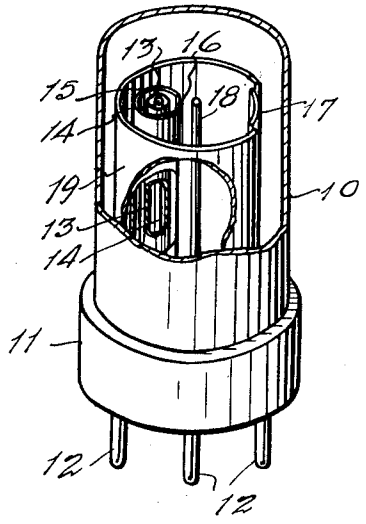


FIG. 2.



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DEFLECTION TYPE VACUUM TUBE

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5 Claims. (Cl. 250—27.5)

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This invention relates to electronic vacuum tubes, and it has particular reference to a deflection type of vacuum tube whose prime object resides in the provision of an association of elements which are more substantial structurally than conventional vacuum tubes and which afford an arrangement whereby interelectrode capacity is greatly reduced by the provision of shorter elements capable of yielding a greater possible ratio of change in voltage output with respect to the change in control voltage, that is, providing greater gain, by proper positioning and operation of the electrodes with respect to each other in the evacuated envelope in which the elements are encased.

Another object of the invention is that of providing a vacuum tube in which the control element or grid is arranged in the path or beam of moving electrons emanating from the cathode to the anode and is thus capable of interrupting or deflecting a portion of the electrons and direct the same to a collector ring arranged about the cathode and grid elements and in this manner substantially reduce the anode current.

Another object of the invention resides in the provision of a vacuum tube of the character described in which the parts are so arranged as to locate the vertical axis of symmetry of the plate in line with the control element and opposite the cathode, so that the control element is arranged between these members and afford means whereby the electrons emanating from the cathode are directed laterally from this element in a relatively thin beam toward the anode and be partially dispersed or diffused by the grid element and absorbed by a collector ring and conducted from the casing.

Broadly, the invention contemplates the provision of a vacuum tube embodying a structural design by which a reduction in anode current can be accomplished without the use of conventional methods of slowing or stopping a portion of the electrons in the cathode area, and to eliminate the use of a cathode condenser normally employed in a self-biased circuit, to maintain a smooth control element voltage.

While the foregoing objects are paramount other and lesser objects will become manifest as the description proceeds, taken in connection with the appended drawings wherein:

Figure 1 diagrammatically illustrates the arrangement of the cathode, and its tubular casing, the grid control element and anode, the collector ring embracing these elements and a circuit, and

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Figure 2 is a perspective view of the elements of the invention, the evacuated casing being shown cut away, illustrating the association of the parts.

The invention is designed primarily for use as a voltage amplifier to be employed in any of the conventional circuits and may also find favor in any of the numerous oscillator circuits which employ the conventional vacuum tubes. It will become apparent that by properly proportioning the geometrical configuration of the elements a greater voltage gain can be obtained in the invention than is possible in the conventional tubes.

The elements are housed within an evacuated casing 10, of conventional design, having a base 11 on which are arranged a plurality of suitably spaced electrodes 12, as shown in Figure 2. A cathode 13 is arranged longitudinally of the casing 10, preferably on one side of the assembly, as in Figure 1, and has a filament 14 arranged coaxially thereof. This assembly is embraced by a tubular conducting sleeve 15 which is electrically connected to the cathode 13 and is formed with a longitudinal slit 16 on one side directed toward the center of the casing 10. The cathode 13 and its filament 14 are positioned concentrically of the sleeve 15 so that the slit 16 is in alignment with these members and the longitudinal axis of the casing 10.

Opposite the cathode 13, as also in alignment with the slit 16, is an anode plate 17 which is arranged in a plane parallel to the cathode 13, and its associated parts, and the plate 17 is arcuate in transverse section, as apparent in Figure 1. A control element, or grid 18 is positioned between the cathode 13 and the anode plate 17 in precise alignment with the slit 16 and spaced from the latter sufficiently to deflect a certain portion of the electrons emanating from the cathode 13 by means of the repelling action of the negative potential on the control grid 18 which consists of a single straight wire.

A collector ring or band 19 is arranged about the entire assembly and extends to each edge of the anode plate 17, as shown in Figure 1, and functions to collect or absorb the excess electrons from the cathode 13 and be conducted from the elements through a conductor 20. A negative increment in control element potential deflects more electrons to the collector ring 19 thus reducing the anode current. A positive increment of control element voltage results in a reduction of the deflection of the electrons and hence a corresponding increase in anode current.

The actual ratio of plate or anode change in

current to the change in control element potential is a function of the geometrical configuration and the potentials of the tube elements. The most important relationships involved are the distances between the slit 16, in the sleeve 15, the control element or grid 18, and the anode 17, the area of the anode 17 also being a factor.

The control grid 18 is connected by a conductor 21 to a source 22 of electrical voltage and the signal source while the anode 17 is connected through a conductor 23. The cathode 13 is connected to a ground conductor 24. Any desired circuit arrangement may be employed, the diagram illustrated in Figure 1 being merely suggestive.

It is apparent, therefore, that the electrons emitted from the cathode 13 must, by reason of the elongated slit 16 in the sleeve 15, be projected in a relatively thin wall. The electrons are attracted to the positively charged anode 17 and, to a lesser extent, the collector ring 19 whose potential is less than that of the anode 17 and greater than the potential of the cathode 13. With an initial negative potential, with respect to the cathode 13, applied to the control element 18 a certain number or portion of electrons are deflected to the collector ring 19.

Obviously, certain changes and modifications may be resorted to, from time to time, by persons skilled in the art without departing from the spirit and intent of the invention or the scope of the appended claims.

What is claimed is:

1. A vacuum tube comprising a cathode, anode plate and control grid element in an evacuated casing, the said cathode being arranged on one side of said casing and having a cylindrical enclosure coaxially thereabout, an eliptical electron collector ring embracing said elements and open on one side to said anode plate, the said cylindrical enclosure having a vertical slit in alignment with said cathode and between the latter and the opening in said collector ring, the said control grid element being mounted before said slit and spaced from said cathode to diffuse electronic discharges therefrom to said anode and collector ring.

2. A deflection type of vacuum tube having a cathode, transversely curved anode plate and a control grid element in an evacuated casing, the said cathode and anode plate being opposingly situated on each side of said casing, a coaxial sleeve embracing said cathode and having a vertical opening on one side in alignment with said cathode, a collector ring surrounding said cathode and grid element and having an opening opposite said cathode for said anode plate, the said grid element being mounted between said vertical opening in said sleeve and said anode plate, whereby part of the electrons emanating from said cathode to said anode plate are intercepted by said grid element and dispersed to said collector ring.

3. A deflection type of vacuum tube comprising a cathode, and an anode plate, a sleeve surrounding said cathode and having a vertical slit on one side in alignment with said cathode therein, a grid element positioned before said slit and spaced from said sleeve, a collector ring embracing said cathode and grid element and partially embracing said anode plate opposite to said cathode, the said grid element being capable of deflecting a portion of the electrons emanating from said cathode to said collector ring from said anode plate.

4. A deflection type of vacuum tube comprising a cathode element in said tube having a sleeve coaxially enveloping the same, the said sleeve formed with a vertical slit along one side, a grid element mounted in said tube in alignment with said slit and said cathode and spaced from said sleeve, an anode plate positioned in said tube in alignment with said grid element and said cathode opposite the latter, and a collector ring embracing all of said elements and extending to the edges of said plate.

5. A deflection type of vacuum tube comprising a cathode having a cylindrical casing coaxially embracing the same, the said casing being formed with a longitudinal slot an anode plate mounted opposite said slot, a grid element between said slot and said anode plate and spaced from said slot to intercept and diffuse electronic discharges therethrough from said cathode, and a collector ring embracing said encased cathode and said grid element and partially enclosing said anode plate.

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