June 20, 1939. A. L. SAMUEL 2,163,156

ELECTRON DISCHARGE DEVICE

Filed July 16, 1937

FIG. 1

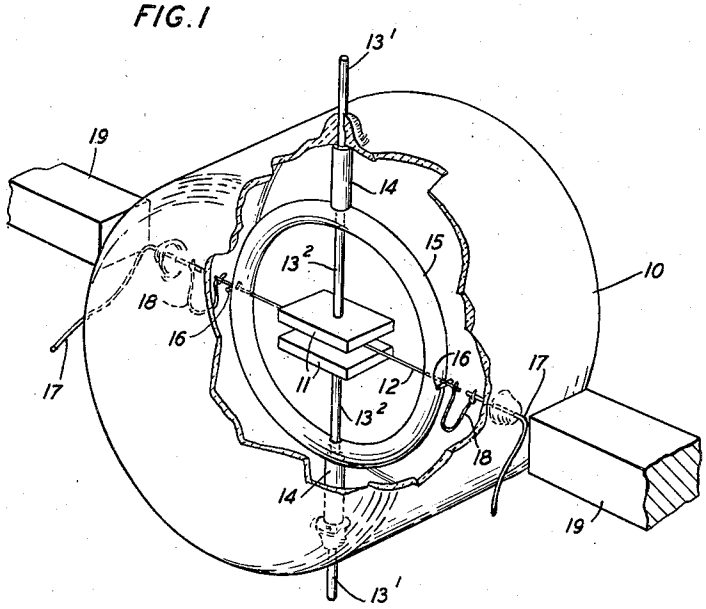

FIG. 2

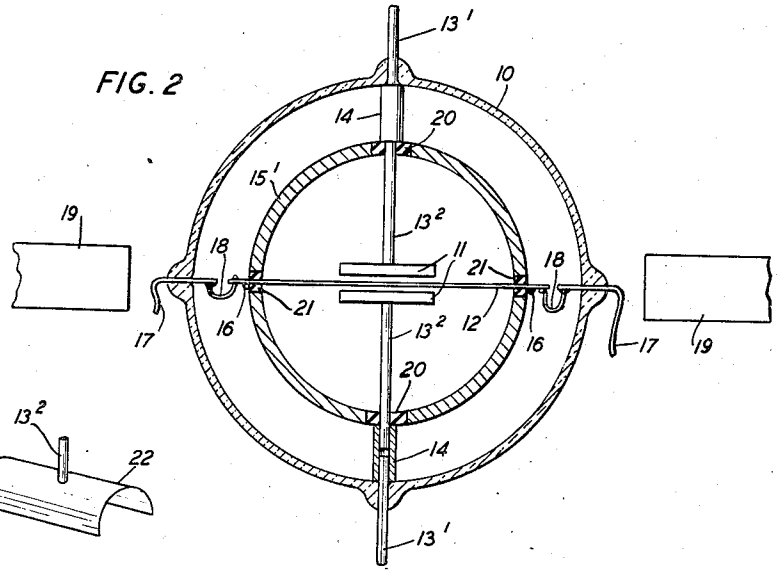

FIG. 3

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ELECTRON DISCHARGE DEVICE

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10 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices especially suitable for the generation and amplification of ultra high frequency impulses.

One object of this invention is to maintain accurately the space relation and relative position of a plurality of electrodes in electron discharge devices.

Another object of this invention is to simplify the construction of electron discharge devices.

In one illustrative embodiment of this invention, an electron discharge device comprises an enclosing vessel housing a pair of anodes, which may be plane and parallel or opposed semi-cylinders, and a cathode, for example, a linear filament, extending between the anodes and parallel thereto. The anodes may be supported by rigid individual leading-in conductors sealed in the walls of the enclosing vessel.

In accordance with one feature of this invention, the cathode is supported and maintained under tension by a resilient or flexible loop or ring member, which may be of insulating material, the ends of the cathode being affixed to diametrically opposite points of the ring member. The ring member may be supported by the leading-in conductors for the anodes and may be slightly compressed, so that an initial tension is applied to the filament. As the cathode contracts and expands during operation of the device, the form of the ring alters accordingly so that the cathode is maintained under a substantially constant tension and its linearity and proper position with respect to the anodes is preserved. Flexible leading-in conductors sealed in the walls of the enclosing vessel may be connected to the ends of the cathode.

The invention and the foregoing and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing, in which:

Fig. 1 is a view in perspective of an electron discharge device constructed in accordance with this invention;

Fig. 2 is a view partly in cross-section of an electron discharge device illustrative of another embodiment of this invention; and

Fig. 3 is a detail view in perspective illustrating another form of anode that may be utilized in the devices shown in Figs. 1 and 2.

Referring now to the drawing, the electron discharge device shown in Fig. 1 comprises an evacuated enclosing vessel 10 housing a pair of anodes 11 and a cathode 12 extending between the anodes. The anodes 11 may be plane parallel plates supported by rigid leading-in conductors 13^1 and 13^2, connected as shown in Fig. 2 by metallic sleeves 14, the conductors 13^1 being sealed in and extending from the vessel 10 at diametrically opposite points.

Encompassing the anodes 11 is a resilient or flexible loop or ring member 15 abutting the sleeves 14 and having apertures in which the supports 13^2 are fitted. The ring member 15 may be of insulating material such as quartz or may be formed of a strip of mica or the like.

The cathode 12 may be a linear filament, for example, of thoriated tungsten, extending parallel to the opposed faces of the anodes 11 and midway therebetween. The cathode extends through diametrically opposite points, 90 degrees removed from the supports 13, in the insulating ring and is held in position by stops 16 secured to the ends of the cathode and bearing against the outer circumference of the ring member 15. Preferably, in the fabrication of the device, the ring member is compressed slightly along the diameter coincident with the cathode so that an initial tension is applied to the cathode. Suitable heating current may be supplied to the cathode through leading-in conductors 17, sealed in the vessel 10 at points 90 degrees removed from the seals for the anode leading-in conductors 13, and flexible connections 18. This arrangement of the various leading-in conductors, it will be seen, minimizes the coupling and interaction between the anode leading-in conductors 13 and those for the cathode 12.

During operation of the device, due to temperature variations the cathode expands and contracts. The form of the flexible ring alters accordingly so that the cathode is maintained under tension. Hence, the linearity of the cathode and the proper spacing of the cathode with respect to the anodes is preserved..

Preferably, in order to allow relatively free expansion and contraction of the ring member 15, a sliding fit is provided between one or both of the supports 13^2 and the ring member. Alternatively, a sliding fit may be provided between one or both of the supports 13^1 and the sleeves 14 and a slight clearance left between the outer ends of the sleeves and the inner wall of the enclosing vessel.

The device shown in Fig. 1 may be utilized to advantage as a magnetron, in which case means are provided for producing a concentrated magnetic field adjacent and parallel to the cathode 12. Such means may include, for example, an ex-

ternal magnet having its poles 19 in juxtaposition to opposite ends of the cathode and in alignment with the cathode 12.

In the embodiment of the invention illustrated in Fig. 2, which is identical in most respects with the embodiment shown in Fig. 1, the ring member 15¹ supporting and tensioning the cathode 12, is formed of a strip of suitable metaal. The ring member is supported by the leading-in conductors 13 for the anodes and is insulated therefrom by insulating bushings 20 carried by the ring member 15¹ and fitted on the leading-in conductors. The ring member has affixed thereto other insulating bushings 21 through which the cathode 12 extends.

Although in the embodiments of the invention shown in Figs. 1 and 2, the anodes 11 are plane and parallel, they may be of other forms. For example, as indicated in Fig. 3, the anodes may be semi-cylinders 22, mounted in opposed relation and coaxial with one another and the cathode 12. Also, although the cathode 12 has been shown as a wire or filament, it may be of other construction. For example, it may be a relatively wide ribbon having its larger faces parallel to the anodes 11. Such a cathode is particularly suitable for devices of the parallel plane electrode diode type.

It will be understood, of course, that the embodiments shown and described are but illustrative of the invention and that various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. An electron discharge device comprising a cathode, an electrode in cooperative relation with said cathode, a single flexible member having spaced portions affixed to opposite ends of said cathode and spacing said cathode with respect to said electrode, and leading-in conductors electrically separate from said member and connected to said ends.

2. An electron discharge device comprising a filamentary cathode, and means supporting said cathode comprising a flexible loop member, said cathode having its ends affixed to spaced points of said loop member.

3. An electron discharge device comprising a linear filamentary cathode, and means supporting said cathode comprising a flexible circular member, said cathode having its ends affixed to diametrically opposite points of said circular member.

4. An electron discharge device comprising a pair of spaced electrodes, supports for said electrodes, a cathode between said electrodes, and a flexible member mounted on said supports and connected to opposite ends of said cathode.

5. An electron discharge device comprising a pair of spaced anodes, a linear filamentary cathode extending between said anodes, supports for said anodes, and a flexible ring member mounted on said supports, said cathode having its ends connected to diametrically opposite points of said ring member.

6. An electron discharge device comprising a pair of cooperatively disposed electrodes, and a flexible member connected to opposite ends of one of said electrodes and engaging the other of said electrodes.

7. An electron discharge device comprising a pair of anodes, supports for said anodes, a flexible insulating ring mounted on said supports, and a cathode extending between said anodes and secured at its ends to said insulating ring.

8. An electron discharge device comprising an enclosing vessel, a pair of juxtaposed anodes, leading-in conductors for said anodes extending from diametrically opposite points of said vessel, a flexible ring carried by said conductors and encircling said anodes, a cathode extending between said anodes and having its ends secured to diametrically opposite points of said ring, and flexible leading-in conductors connected to the ends of said cathode.

9. An electron discharge device comprising an anode, a support for said anode, a flexible metallic member positioned by said support and insulated therefrom, and a filamentary cathode in cooperative relation to said anode, said cathode having its ends connected to said flexible member and insulated therefrom.

10. An electron discharge device comprising a pair of anodes, supports for said anodes, a flexible metallic ring carried by said supports and insulated therefrom, and a filamentary cathode extending between said anodes having its ends connected to diametrically opposite points on said ring and insulated therefrom.

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